CRITICAL LANDS STATUS REPORT

The North Flathead Valley & The Flathead River Corridor

Flathead Basin, Montana

Flathead Lakers

June 12, 2002

Contents

Acknowledgements

Many people have contributed to this report in numerous ways. Thanks are due to the representatives of agencies and organizations who attended past Critical Lands workshops (see Appendix A, p.51) for their participation in the Critical Lands Project. Special thanks are due to Gael Bissell, Habitat Conservationist/Wildlife Biologist with the MT Department of Fish, Wildlife & Parks (FWP); Susan How, Executive Director of the Flathead Land Trust; Jack Stanford, Director of the Flathead Lake Biological Station; Bonnie Ellis, Senior Researcher at the Flathead Lake Biological Station; Brian Marotz, Fisheries Biologist with FWP; Amy Waller, wildlife biologist and private landowner; and Dan Casey, Coordinator of the Northern Rockies Bird Conservation Region with the American Bird Conservancy for their generous time in providing information to include in this report.

Several people were instrumental in providing guidance to the project, and shaping and editing this report. Special thanks are due to Robin Steinkraus, Flathead Lakers' Executive Director; Phil Lehner, Flathead Lakers' board member; Sid Rundell, Flathead Lakers' President; Barry Flamm, Flathead Lakers' Past President; Bill Swaney, Environmental Science Instructor at the Salish & Kootenai College; and Marilyn Wood, The Nature Conservancy's NW Project Manager.

The Flathead Lake Biological Station produced the Critical Lands Maps under the guidance of Jack Stanford and the leadership of Diane Whited, Geographic Information Systems and Landscape Planner. Brandon Jackson, a graduate student at the University of Montana, provided summer field data to this project on osprey and eagle nests. Natural Resources Information Service, Natural Heritage Program, the Department of Fish, Wildlife and Parks, the Flathead National Forest and the Bureau of Mines and Geology provided map layers and data used in the production of the Critical Lands maps.

This report was made possible thanks to Flathead Lakers members who provided funds for the Critical Lands Project, and River Network for support through a Watershed Assistance Grant.

The Flathead Lakers are solely responsible for any errors or omissions in this report.

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EXECUTIVE SUMMARY

This report evaluating the status of lands critical to maintaining and improving water quality in the Flathead Basin is a product of the Critical Lands Project. The Critical Lands Project is a collaborative effort led by the Flathead Lakers and involving representatives from federal, state, tribal and local agencies and organizations (Appendix A, p.51). *Project goals* are:

1) to identify, protect and restore lands critical to the quality of Flathead Lake and its tributaries,
2) to build trust, communication and cooperation among various agencies and organizations committed to protecting critical lands, and
3) to inform the public about the importance of conserving and restoring lands critical to the quality of Flathead Lake to gain grassroots support.

Project participants initially identified *critical areas* and associated threats and concerns (Flathead Lakers, 1999) throughout the Flathead Basin, including wetlands valley-wide, major tributaries and drainages to Flathead Lake, undeveloped lake shoreline, and North Flathead Valley agricultural lands. Participants also developed *criteria* for evaluating critical lands, and decided to give primary emphasis to lands that are critical for protecting water quality or that contribute to water pollution, and secondary emphasis on significant areas for wildlife habitat. The criteria also help evaluate for threats, ecological defensibility and durability, cultural, recreational and aesthetic values, and the feasibility for a conservation project (Appendix B, p.52). An evaluation process, which included a *weighting and ranking system* based on these criteria, was used to identify areas with overlapping significant values (Appendix C, p.53). The weighting system gives the most weight to areas significant for water quality.

A series of Geographic Information System (GIS) maps were produced to help identify, evaluate and illustrate critical lands and resources in the North Flathead Valley, and to evaluate threats to critical areas, such as housing and road density pressures and shallow groundwater areas (Figs.1, 2, 3). The maps also help highlight areas where there are opportunities for protection or restoration of critical areas, such as good riparian corridors, large open space and good connectivity in the landscape.

Based on recommendations of participants, the project is focusing initial conservation and restoration efforts on the *Flathead Valley north of Flathead Lake*, specifically on wetlands, riparian corridors and floodplain areas. Research indicates that the mainstem of the Flathead River contributes the highest nutrient loads to Flathead Lake (Table 2, p.13) and that urban and agricultural lands in the North Flathead Valley contribute the highest nutrient loads to Flathead Lake. Ashley Creek and the Stillwater, Whitefish and Flathead rivers contribute the most nutrients to Flathead Lake on an acre-per acre basis (Table 3, p.13). The North Flathead Valley is also the most densely populated area in the basin and is one of the fastest growing areas in Montana.

This report discusses critical lands in the North Flathead Valley, including *riparian corridors, floodplain areas, wetlands and sloughs, prime agricultural soils and farmland and lakeshore,* as well as associated threats and concerns. Some of the *major threats* associated with critical areas discussed in this report include: Non-point source pollution, water level fluctuations, loss of riparian or shoreline vegetation, floodplain alterations, non-native species introductions, and loss of soils and farmland. Specific concerns, needs and opportunities associated with lands along the Flathead River corridor are further discussed in the Critical Lands profiles (pgs. 25 - 47).

The evaluation of critical lands along the Flathead River indicates they rank as follows (Table 1, p.12; Fig.4 & 5, p.16):

1. Flathead River Islands
2. Foy's Bend; Fennon Slough
3. Weaver Slough
4. Upper Braided Area, Flathead River; Egan Slough; McWenneger Slough
5. Church Slough (profile not included)
6. Columbia Falls, CFAC Land
7. Flathead River/Brosten Pond stretch (profile not included)

The evaluation of critical lands focused on ecologically significant areas that were given high priority by workshop participants. Thus, most critical areas presented in this report ranked relatively

high. The actual ranking may not be as important as opportunities for conservation in specific areas (see Critical Lands profiles for specific information, pgs. 25 - 47).

The Flathead Basin has large forested (approx. 73%) and protected (35%) areas. The ecosystem services provided by large *undisturbed forest areas* are critical to maintaining water quality and wildlife habitat in the Flathead Basin. Recharge areas found in protected areas are largely responsible for the relatively clean water in the rivers and lakes of the basin.

This report identifies existing *conservation efforts* to protect or restore critical lands throughout the Flathead Basin (Table 4, p.19; Fig.6) and provides preliminary conservation recommendations based on the critical lands evaluations.

The report also includes recommendations for preliminary conservation strategies based on the evaluation of critical areas:

- Discourage inappropriate development and removal of riparian vegetation along rivers, streams, wetlands and on shallow groundwater areas.
- Protect *intact riparian forests*, including cottonwood forests, along the Flathead River and tributaries. Focus initial Critical Lands Project conservation efforts on high priority areas, including *Flathead River Islands, Flathead River sloughs, Foy's Bend, upper braided area of the Flathead River*. Coordinate with the Flathead Basin Commission and local watershed groups to evaluate potential critical areas along the *Stillwater* and *Whitefish* rivers and *Ashley* Creek and develop protection and restoration strategies based on both watershed assessment studies and Critical Lands Project criteria.
- Protect wetlands contiguous to river corridors, in the floodplain and on shallow groundwater areas.
- Adopt forestry *stream management zone-type regulations* and *best management practices* for farming, housing development and other land uses.
- Assess restoration needs and *revegetate streambanks* where needed (Fig.1).
- Promote good stewardship practices on the *shallow alluvial aquifer* to minimize water quality impacts**.** Assess feasibility of extending sewer districts to connect new development and evaluate alternative septic systems that may be appropriate for shallow groundwater areas.
- Reduce water quality impacts from *stormwater runoff, septic systems,* and other pollutant sources.
- Use *conservation easements* to protect priority critical areas where feasible.
- Continue to develop and support *partnerships* for watershed protection and restoration.
- Inform the public about the importance of protecting and restoring critical lands in the Flathead Basin.

Previous recommendations by workshop participants that should be further explored include (Flathead Lakers, 2001):

- Explore *linkages* between the economy and ecologically significant areas. Publicize the value of riparian areas.
- Evaluate Missoula County's new *riparian regulations*.
- Ensure that *key groups* (local key decision-makers, including public officials, students, real estate, agricultural and industrial organizations) are informed about critical areas that need protection or restoration.

The Flathead Lakers plan to bring Critical Lands Project partners together in Spring, 2002 for a third workshop to collaboratively develop strategies for protection and/or restoration of specific high priority critical areas along the Flathead Valley river corridors, and define opportunities for action to guide implementation of conservation efforts.

I. Introduction

A. The Flathead Basin

The Flathead Basin is located in northwest Montana and the southeastern corner of British Columbia. It constitutes the northeastern-most drainage of the Columbia River. Water flows from headwaters in Glacier National Park, the Bob Marshall Wilderness and Canada into Flathead Lake, the largest natural freshwater lake west of the Mississippi River. Altogether, the Flathead Watershed drains six million acres of scenic landscapes.

The Flathead Basin encompasses the drainages of the North, Middle, and South Forks of the Flathead River, Stillwater and Swan rivers, Flathead Lake, and the Lower Flathead drainage. These drainages correspond to 4th Code U.S.G.S Hydrologic Units (HUC): 17010206, 17010207, 17010209, 17010210, 17010211, 17010208, 17010212.

Large low elevation valleys were scoured by several glaciers in the Pleistocene era leaving a trail of alluvial (gravel, sand, silt and clay) and outwash (boulders, gravel and sand mixture) deposits and glacial till. Many lakes, wetlands and floodplains occur on outwash planes, kettle formations and moraines formed by the glaciers (Alt and Hyndman, 1986 in Greenlee, 1998).

The streams and rivers in the Flathead Basin have generally excellent water quality, typical of water bodies with low primary productivity (EPA, 1983). The basin is home to more than 300 species of aquatic insects, including 105 kinds of stoneflies comprising one-fourth of all stoneflies in North America (EPA, 1983). The basin is inhabited by several species listed as threatened or endangered by the federal Endangered Species Act, including bald eagles, bull trout, grizzly bears, peregrine falcon, gray wolf and lynx. Bald eagles and ospreys nest along the Flathead River and Flathead Lake shores. The Flathead River between Kalispell and Flathead Lake is believed to have one of the highest densities of osprey nests in Montana (EPA, 1983). Bull trout are dependent on Flathead Lake's tributaries for recruitment. Grizzly bears reside in the large forested expanses found along the Continental Divide, including Glacier National Park, the Bob Marshall Wilderness and the Flathead National Forest.

Flathead Lake serves as a barometer of the health of the Flathead Watershed. Changes are taking place on lands upstream and surrounding the lake. Rapid growth and inappropriate development in critical areas are occurring in ways that jeopardize things we value such as clean water, wildlife habitat, healthy ecosystems and quality of life.

Research shows that water quality in Flathead Lake has been steadily declining since 1977, manifested by increased algal growth and decreased water clarity (FLBS 1997, Ellis et al. 2000). Flathead Lake was listed as an impaired water body by Montana Department of Environmental Quality (MT DEQ 303d List) in 1996 and 2000. Consequently, Total Maximum Daily Loads (TMDL) were determined for Flathead Lake to help manage nutrient loads to the lake (DEQ, 2001). Further watershed assessments are proposed by the Flathead Basin Commission to identify specific nutrient sources and nutrient reduction strategies.

The 1996 and 2000 303(d) List, a compilation by the Montana Department of Environmental Quality (DEQ) of impaired and threatened waterbodies in need of water quality restoration,[1] identified the probable causes of impairment to Flathead Lake as: nutrients, siltation, suspended solids, flow alteration, organic enrichment/low dissolved oxygen, algal growth, PCB's, metals, mercury, and noxious aquatic plants. The main sources of pollution include runoff from urban sprawl, poor agricultural and timber harvest practices, old and poorly maintained septic systems, and air pollution (Montana DEQ Website, 2000; DEQ, 2001).

Other water bodies listed in the Montana 1996 & 2000 303(d) Lists[2] include several rivers, streams and lakes in the Swan and Stillwater drainages and other Flathead headwaters, including the drainages of the three forks of the Flathead River, and the mainstem of the Flathead River (Montana DEQ Website, 1996). TMDL studies must also be conducted for these areas

[1] Section 303(d) of the federal Clean Water Act requires states to identify state waters where water quality is impaired or threatened and submit a list to the U.S. Environmental Protection Agency (EPA) every two years.

[2] The U.S. District Court stipulated that Montana must complete water quality studies for all waterbodies the 1996 303(d) List, including waterbodies later dropped in the 2000 303(d) List.

to determine the degree of impairment and to guide water quality restoration efforts.

Lands critical to water quality often serve as the "kidneys" of the rivers and lakes. In a natural state they provide a buffer that filters out nutrients and other pollutants before they reach the water. These areas also contribute to quality of life by providing wildlife habitat and sustaining terrestrial and aquatic species, by enhancing scenic qualities and recreational opportunities, and by providing a the connection between upland areas and streams, rivers or lakes.

B. THE CRITICAL LANDS PROJECT

The Flathead Lakers initiated the Critical Lands Project in response to the decline in the water quality of Flathead Lake. The goals of the Critical Lands Project are to: 1) identify, protect and restore lands and waters critical to the quality of Flathead Lake and its tributaries, 2) build trust, communication and cooperation among various agencies and organizations committed to protecting critical lands, and 3) inform the public about the importance of conserving and restoring lands critical to the quality of Flathead Lake to gain grassroots support.

The project was launched in November, 1999 with a workshop attended by resource professionals from tribal, state, federal, and county resource and land management agencies, research scientists, and representatives of other conservation organizations (Appendix A, p.51). During this workshop, participants developed and agreed on criteria for defining critical lands, identified initial priority areas, and developed strategies for cooperation and action.

The criteria include ecological significance, urgency of existing or potential threats, ecological defensibility and durability, community and landowner support for protection, aesthetic/ scenic/ cultural/ historical values, and protection or restoration feasibility (Appendix B, p.52).

In the 1999 workshop, participants identified the following priority areas for conservation:

- wetlands valley-wide
- the Flathead River corridor above Flathead Lake
- undeveloped lake shoreline,
- North Flathead Valley agricultural lands
- the North Fork drainage
- Dayton, Ashley, Stoner and Ronan creeks
- Flathead Lake south and north shores
- other major tributaries and drainages to Flathead Lake: Stillwater, Whitefish, Swan rivers and the three forks of the Flathead River

Other areas listed as critical include specific lands such as PacifiCorps lands associated with Bigfork Dam along the Swan River, Somers area, Big Arm, property next to the Owen Sowerwine Natural Area, Brenneman's Slough, Columbia Falls Aluminum Company lands, and Wild Horse Island (Flathead Lakers, 1999).

In May 2001, during a second workshop, participants agreed to place primary emphasis on areas that are critical for protecting water quality[1] or that contribute to water pollution. Secondary emphasis was placed on significant areas for wildlife habitat.[2] Additional cultural and social values, such as farmland, open space, recreation and aesthetics, provide further justification for protecting an area. Thus, critical lands include areas that provide important water quality functions[1], important wildlife habitat, scenic views, farmland, open space and significant recreational opportunities. Further, conservation efforts in those areas are ecologically defensible, receive community support and are technically and economically doable.

Workshop participants agreed that wetlands, river corridors and floodplains are among the most productive and diverse habitats as well as the most important areas for maintaining water quality in the Flathead Basin.

Additional specific areas listed as critical during the second workshop include the floodplains and the shallow alluvial aquifer in the Kalispell area, the Nyack, North Fork and Middle Fork of the Flathead River, the Swan River, the Jocko River, and Post, Crow, Mission and Ducharme creeks.

At the second workshop, the group decided to focus initial conservation and restoration efforts on the North Flathead Valley, north of Flathead Lake, specifically on wetlands, riparian corridors and floodplain areas, including the shallow alluvial aquifer. The North Flathead Valley extends from the north shore of Flathead Lake to Whitefish and Columbia Falls (Fig.1).

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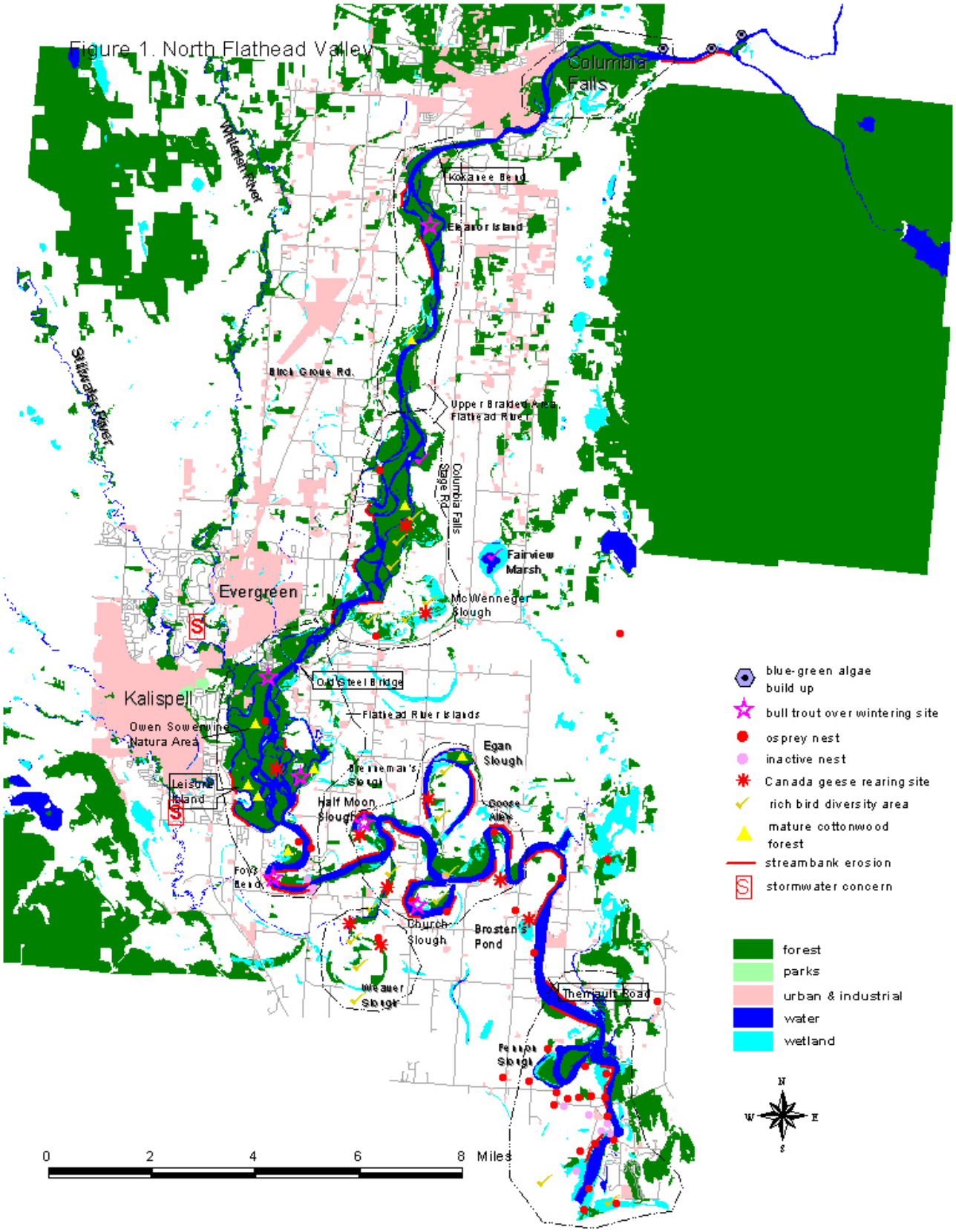
[1] **Areas significant for water quality**: Areas which provide important hydrological functions, such as the uptake and assimilation of nutrients and other pollutants. (*For more detail see: Flathead Lakers, 2001. Critical Lands Workshop Report, Chart A. Identifying Significant Areas for Water Quality*).

[2] **Ecologically significant areas**: Areas that provide important ecological services, such as functional habitat for rare, threatened, endangered or sensitive species; important breeding or birthing areas, including those areas required to reproduce or propagate a species (include mating, birth, nesting, spawning); migration corridors, or other areas of special concern.

Figure 1. North Flathead Valley



Research indicates that the lands in the North Flathead Valley contribute the highest nutrient loads to Flathead Lake (Stanford et al., 1997). The North Flathead Valley is also the most densely populated area in the basin, and is one of the fastest growing areas in Montana (FBC, 2000).

Some of the major concerns and stresses associated with critical areas in the Flathead Valley include (Flathead Lakers, 1999; information compiled using the Critical Lands Evaluation Forms):

- fast growth and haphazard development and associated impacts
- non-point source pollution
- removal of riparian vegetation
- water level fluctuations and wave action leading to bank collapse
- floodplain alterations
- exotic species introductions
- loss of large tract agriculture to development

Despite the initial focus by the Critical Lands Project on the North Flathead Valley, protection of headwaters and wildland areas is also vital for the overall health of the watershed. Many agencies and organizations focus their conservation efforts in those areas.

Lands along the Whitefish and Stillwater rivers, and Ashley Creek are also of paramount importance for protecting or improving water quality, as indicated by the TMDL report (Department of Environmental Quality, 2001). This Status Report discusses general critical lands and resources in the North Flathead Valley. The evaluation of specific areas focused mainly on lands along the Flathead River corridor and associated floodplain areas. This main focus along the Flathead River was based on two factors. First, the Flathead River delivers the greatest nutrient loads to Flathead Lake. Second, this river has the most intact riparian corridors, wetlands and sloughs, important areas both for maintaining water quality and wildlife habitat.

The Flathead Basin Commission, a non-regulatory organization formed by the Montana Legislature in 1983 to monitor and protect water quality in the Flathead Basin, will conduct additional water quality assessment studies for several sub-watersheds, including the drainages of the Whitefish and Stillwater[1] rivers and Ashley Creek.[2] These studies will help guide protection and restoration efforts needed to improve water quality.

The ecosystem services provided by undisturbed forest areas are critical to maintaining water quality and wildlife habitat in the Flathead Basin. Approximately 73% of the basin is forested (DEQ, 2001). Thirty-five percent of those lands are in wilderness or other protected status (e.g. Glacier National Park). The Flathead National Forest (FNF) administers the largest amount of public lands in the basin, approximately 60% of forested lands in the North, Middle and South Forks of the Flathead, and the Swan and Stillwater drainages. Recharge areas found in Glacier National Park, the Bob Marshall Wilderness and other undisturbed forested lands are largely responsible for the relatively clean water in the rivers and lakes of the basin. Without these protected areas, Flathead Lake could be in worse shape.

[1] A Department of the Environmental Quality grant will fund a watershed assessment study of the Stillwater River drainage starting in 2002.

[2] A riparian/wetland assessment was recently completed for the Ashley Creek upper drainage.

II. Methods

The Flathead Lakers evaluated recommended critical areas along the Flathead River corridor and associated floodplain using the criteria developed by workshop participants in 1999 and 2001 (Appendix A & B, p.51, 52). A Critical Lands Evaluation Form (Appendix C, p.53) was developed based on the criteria, and a weighting system was used to help rank and prioritize critical lands. Resource managers and research professionals were interviewed and project reports and research documents were reviewed to collect information about specific areas.

A. Identification of Critical Lands

The Flathead River corridor was divided into seven ecological units[3] based on a suggestion by Gael Bissell, Habitat Conservationist and Wildlife Biologist with the Montana Department of Fish, Wildlife and Parks (FWP). Some areas along the

[3] **Ecological unit**: An ecological unit is an area that has some common ecological characteristic, such as a plant community, habitat types or wildlife species. For the Flathead River corridor, the delineated ecological units represent areas with common habitat characteristics and wildlife use.

Flathead River were evaluated at the ecological unit level. Other areas, such as Egan Slough, were evaluated individually and assessed in relation to the ecological unit of which they are a part. The ecological land units provided a smaller scale at which to evaluate the riparian corridor and wetlands along the Flathead River than the originally suggested priority areas.

Despite the subdivision of the Flathead River into ecological units for evaluation, the integrity of the entire Flathead River system depends on stream connectivity, functional riparian corridors[1], wetlands and floodplains throughout the entire Flathead River system (G. Bissell, pers. comm. 2001).

Ecological units and critical areas within those units were evaluated using the Critical Lands Evaluation Form. The main categories in the Critical Lands Evaluation Form are:

- Areas significant for water quality: sinks[2] & sources[3]
- Functional habitat for rare, threatened, endangered or sensitive species
- Urgency of existing and potential threats
- Ecological defensibility and durability
- Cultural, recreational and aesthetic values
- Feasibility assessment.[4]

The Critical Lands Profiles (pgs. 25 to 47) summarize the areas evaluated.

Areas for which there was not sufficient information (e.g. Echo Lake, Stillwater and Whitefish rivers) to adequately answer the questions, were not evaluated using the Critical Lands Evaluation Form. However, some of these areas (e.g. the shallow alluvial aquifer) are still discussed in the report (see Critical Lands and Resources, p.8).

B. PRIORITIZATION OF CRITICAL LANDS

A weighting and ranking system is included in the Critical Lands Evaluation Form. The ranking system helps highlight areas with overlapping significant values and/or immediate threats. Questions are designed to generally provide a Yes or No answer, where NO = 0 and YES can receive a score between 1 and 3, three being the highest value. The scores per category were added to produce what this report refers to as '**raw scores**' (ranging between 0 and 21). These raw scores were further placed in an ordinal scale, between 1 and 3, three again being the highest value. These **ordinal scores** were multiplied by a weight factor, between 1 and 4, providing the **weighted scores** for each category (Appendix C, p.54). Thus, raw scores are lower than the weighted scores.

The information gathered by the Critical Lands Evaluation Form is not always quantifiable. Therefore, this evaluation does not completely remove subjectivity. However, the scores reflect a degree of concern or significance based on the knowledge of resource managers and scientists in the region.

Sinks and sources, which indicate whether water quality is a major concern, received the highest weight. Thus, the total weighted scores highlight areas where water quality concerns rank high. Figures 4 and 5 (p.16) illustrate the raw and weighted scores.

Individual agencies and organizations can use the raw scores to identify areas of interest, such as areas where ecological functions and connectivity rank high but threats are low.

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[1] Riparian corridors extend along riverbanks where ground water and surface water mix. Functional riparian corridors provide various ecological services such as nutrient retention, flood containment, ecosystem productivity and biodiversity. The functionality of riparian corridors varies depending on local conditions and natural processes, which influence the integrity and productivity of the stream ecosystem (Edwards, 1998).

[2] **Sinks**: "Sinks are areas with the capacity to uptake and assimilate nutrients and other pollutants. These areas are not 'dumping grounds' for pollutants but are ecologically functional areas. Desired functions range from filtering and storage of nutrients to slowing down water flows to regulating water temperatures. Examples of sinks are: high quality wetlands, shoreline and riparian vegetation, sloughs, and floodplains" (Flathead Lakers, 2001).

[3] **Sources**: "Sources are areas that contribute excess nutrients and other pollutants. Point source pollution comes from a known identifiable source. Non-point source pollution refers to nutrients, pathogens, sediments, toxic compounds, etc. picked up from the ground or the atmosphere by snowmelt and rainwater and carried to surface waters or groundwater. Examples of sources are: runoff from pavement and rooftops, farm irrigation drainage, livestock waste, leachates from landfills, stormwater, dust from gravel roads, seepage from failing septic systems, leaking pipes, channels and dams, etc." (Flathead Lakers, 2001).

[4] The feasibility assessment is based on a landowner's willingness to protect/restore the resource, the capacity of potential project partners to implement conservation strategies, probability of success and costs. Contacting specific landowners directly will be necessary in most instances to further determine if they have interest in pursuing a conservation project on their land. No cost analyses have been conducted at this stage.

C. Mapping of critical lands in Flathead River Corridors

The Flathead Lake Biological Station of the University of Montana produced a series of Geographic Information System (GIS) maps for the Critical Lands Project to help identify, evaluate and illustrate critical lands and resources in the North Flathead Valley, and to evaluate threats to critical areas. The mapping was limited mostly to the Flathead River and associated floodplain since it is in the initial priority area and the scale of available data allows for detailed analysis of land cover, housing and road density, and groundwater resources.

The maps were produced using ArcInfo Geographic Information System (GIS). GIS data layers were compiled from the statewide database (NRIS) and Flathead County GIS maps. Aerial photos from 1990 and 1997 (USFS) were used to evaluate land use change. Two scales of data were compiled: 1) approx. 1:100,000, used to provide a general overview of land use and infrastructure in the North Flathead Valley and 2) approx. 1:24,000, used to compile a detailed map of the riparian corridor along the Flathead River and other wetland habitats. The mapping included:

- General land use and land type classification for 1990 and 1997
- Land use change: this map shows new housing developments between 1990 and 1997 visible in the aerial photos
- Depth to Water Table (Montana Bureau of Mines and Geology well data)
- Road Density
- Housing Density
- Flood Emergency Management Agency (FEMA) 100 and 500-year floodplain boundaries
- Vulnerable Groundwater Areas: the Housing Density Map was combined with the Water Table Depth Map in non-sewered areas to highlight vulnerable groundwater areas
- Protected Areas and Conservation Easements
- Eagle & Osprey Nests (active and inactive nest locations are based on field data collected by a team led by Jackson, a graduate student at the University of Montana, during the summer of 2001).

The maps provide an overall picture of land use changes and development in relation to critical lands such as riparian corridors, wetlands, the floodplain and shallow groundwater areas. They help highlight areas where there are opportunities for protection of critical areas (e.g. good riparian cover and connectivity, shallow groundwater areas, low housing and road density; Fig.2A-2I). They also identify areas where restoration of critical areas may be needed (e.g. absence of riparian cover in an ecologically significant area) or where extra protection measures may be needed (e.g. high housing density on shallow groundwater areas; Fig.3A-3H).

The maps rely on available information and mapping layers and they are limited to the accuracy of the source data (Appendix D, p.55). The bald eagle and osprey nest locations identified by Jackson are limited to what the researchers could see from the river and accessible roads. Their locations were mapped using a Geographic Positioning System (GPS) accurate within 100 feet.

An additional map (Fig.1) is included to show areas named in this report and to indicate wildlife values identified by natural resource managers (bull trout winter sites, rich bird diversity areas, Canada geese rearing sites, osprey nests, mature cottonwood forests) and 'problem areas' (riverbanks lacking riparian vegetation or with erosion problems, stormwater concerns). Resource managers have identified other bald eagle and osprey nests that will be confirmed by Jackson during the summer of 2002.

Figure 2. Critical Lands Maps (see Appendix E, page 57)

Figure 3. Vulnerable Groundwater Areas Map (see Appendix F, page 61)

III. Critical Lands

Riparian corridors, floodplains and wetlands have numerous ecological, economic and social benefits. These lands provide important water quality functions and provide vital food, habitat and movement corridors for wildlife, as well as significant recreational opportunities.

A. Critical Lands and Resources

1. Riparian corridors

At the 2001 Critical Lands Workshop, participants concurred with Jack Stanford, Director of the Flathead Lake Biological Station, that riparian areas, including floodplains, are among the most ecologically valuable lands. These areas are important for filtration and deposition of sediments, slowing water flow (flood containment) and providing soil stability, as well as for their high plant and animal diversity. The lands identified by the Critical Lands Project provide some of the best remaining wildlife habitat along the Flathead River (G. Bissell, pers. comm. 2001).

The riparian corridors in the Flathead River Islands, the Upper Braided Area and Columbia Falls Aluminum Company (CFAC) lands are the largest and most contiguous, providing both important water quality and wildlife protection (Fig.1). The riparian vegetation in the sloughs and Foy's Bend provide significant wildlife values and protect water quality.

Riparian corridor, wetlands and sloughs support nesting habitat for bald eagles, osprey, Canada geese, waterfowl, upland game birds, great blue herons and double-crested cormorants. During migration, 70% of migratory bird species use riparian habitat (D. Casey, pers. comm. 2001). The Flathead River corridor provides some of the best habitat in Montana for white-tailed deer, beaver, river otter, muskrats, and mink (G. Bissell, pers. comm. 2001).

Bull trout, a threatened species, and westslope cutthroat trout, a species of concern (Carlson, J., 2001),[1] use the Flathead, Stillwater and Whitefish rivers for migration and spawning. FWP has identified several wetlands and sloughs along the Flathead River with good riparian cover where bull and westslope cutthroat trout winter (specific areas listed under Wetlands and Sloughs, p.10).

Osprey require relatively good water clarity for fishing. Therefore, osprey nests can be used as relative indicators of water quality (B. Jackson, pers. comm. 2001). Jackson recorded approximately 27 active osprey nests along the Flathead River and associated wetlands, another two on nearby Swim and Rose creeks, and at least six more on the lake's north shore (Fig.1). Jackson also recorded seven active bald eagle nests on the river and six on Flathead Lake's north shore. Resource managers identified a few additional nests between the Flathead River Islands and Columbia Falls.

These ecologically significant areas also have high scenic qualities and provide outstanding recreational opportunities for boaters, floaters, hunters, fishermen and wildlife watchers. River corridors are also culturally and socially significant to native people, who camped, hunted and fished along the rivers and lakes.

Cottonwood trees are good indicators of healthy riparian areas and floodplains (J. Stanford, 2001). Resource managers in the area indicate that there are approximately seven remaining mature cottonwood stands on the Flathead River (G. Bissell and D. Casey, pers. comm. 2001; Fig.1). These are found in Leisure Island, Foy's Bend, and Brenneman's Slough. Another three mature cottonwood stands are found in the Owen Sowerwine Natural Area (OSNA) and near Flathead National Forest lands north of the Presentine Fishing Access Site and Columbia Falls Stage Road (Fig.1).

Natural floods create gravel bars and sandbars where young cottonwood trees can seed. Cottonwood trees have been observed to regenerate along the Flathead River north of the Flathead River Islands. However, on the southern section of the river, very little regeneration is observed (G. Bissell, pers. comm. 2001). Kerr Dam operations cause

[1] Species of concern include plant and animal species at-risk or potentially at-risk due to rarity, restricted distribution, habitat loss, and/or other factors. Several agencies maintain their own lists. In November of 2000, FWP and Montana NHP combined their lists, also indicating the status assigned by other agencies (USFWS, FS, BLM).

artificial flooding of the Flathead River south of Foy's Bend leading to the inundation of depositional areas where cottonwood trees would normally regenerate. Furthermore, Hungry Horse Dam has reduced high flows that would normally have created more extensive islands and bars needed for regeneration (G. Bissell, written comm. 2002).

Most of the riparian corridors along the Flathead River ranked high in terms of significance for water quality (Table 1, p.12).

2. Floodplain areas

Groundwater near the surface indicates the extent and width of riparian corridors and floodplain areas (J. Stanford, 2001). A Depth to Water Table Map (Fig.2E) was produced for this project using well data provided by the Montana Bureau of Mines and Geology (MBMG). This map shows water table depth (5 ft. intervals) in the North Flathead Valley.

Noble and Stanford (1986) identified two unconfined aquifers in the Flathead Valley which are hydrologically independent of one another: the shallow alluvial gravel aquifer and the deltaic sand aquifer. Both are recharged primarily by snowmelt and rainfall infiltration.

The Flathead and Whitefish rivers hydrologically bound the *shallow alluvial aquifer* to the east and west, and Badrock Canyon and the confluence of the Flathead and Whitefish rivers confine it to the north and south. There is significant groundwater-surface water interaction between the aquifer and the Flathead River (Noble and Stanford, 1986). Consequently, pollution, including dissolved nutrient loads, entering the alluvial aquifer is flushed into the Flathead River system.[1]

Nutrient concentrations in the shallow alluvial aquifer were found to be highest in the urbanized areas. Fecal coliform bacteria were found to be widespread indicating both human (from septic systems) and animal pollution (Noble and Stanford, 1986).

Noble and Stanford (1986) determined that groundwater movement between the aquifer and the Flathead River is faster north of Kalispell than it is to the south of Kalispell. To the south, the river is wide and deep and has effectively created a channel in the deltaic sand and silts which characterize the valley south of Kalispell. Further, this riparian corridor is lacustrine and narrower, and the fine-grained deltaic sediments are less permeable, restricting water movement. Thus, water exchange between the groundwater and the river is slower to the south, and nutrients in the groundwater are less likely to be immediately flushed into the river and the lake (J. Stanford, 2001).

The *deltaic sand aquifer* is hydrologically bounded by the north shore of Flathead Lake on the south, the Flathead River on the north and east and Highway 93 on the west. There is little groundwater-surface water exchange. Water for domestic, municipal and agricultural use is drawn from this deep aquifer. It is believed that the deltaic aquifer does not contribute to nutrient loads of the river and the lake (Noble and Stanford, 1986).

Due to these findings, the Evergreen area was connected to the Kalispell sewage treatment plant in 1994. However, if housing development continues to extend along the riverbanks and north of Evergreen and Kalispell on the alluvial aquifer, further preventive measures are needed to effectively collect runoff and sewage to prevent pollution of the aquifer. A groundwater monitoring study proposed by the Flathead Basin Commission could provide recommendations on ways to decrease the nutrient load in groundwater entering Flathead Lake (FBC, 2001).

The Depth to Water Table Map was overlaid with the Housing Density Map to produce the Vulnerable Groundwater Areas maps (Fig.3A-3I) which highlight shallow groundwater areas where 1) housing density is high (potential problem areas), and where 2) housing density is low (> 40 acres per units) and preventive measures are needed to avoid land use impacts on groundwater quality (see Major Concerns and Stresses, p.12, for a discussion of vulnerable groundwater areas and development).

3. Wetlands and Sloughs

Wetlands are areas inundated or saturated by surface or groundwater for most or part of the year. They support a high diversity of plants adapted to saturated soils. Wetlands are considered high biodiversity areas since they provide habitat for numerous amphibians, insects, fish, shorebirds, waterfowl, and mammals dependent on water. Wetlands are also critical for the uptake and long-term storage of nutrients in the wetland vegetation.

[1] Groundwater flows into the Flathead River about mid-November, while surface water supplements groundwater in the shallow alluvial aquifer in May and June when Flathead Lake is being brought to full pool (Noble and Stanford, 1986).

Loss of wetlands can be responsible for the change from perennial to intermittent flows in streams.

The Flathead River Watershed supports "…one of the greatest and most diverse concentrations of wetlands in the Rocky Mountains, including peatlands, oxbow ponds, springs and seeps, complexes of pothole ponds, vernal pools and beaver ponds" (p.2, Greenlee, 1998).

Wetlands and sloughs in the Flathead Valley (Fig.1) host a number of threatened and endangered species, including bald eagles and bull and westslope cutthroat trout. A vast number of migratory and neo-tropical birds use the wetlands in the Flathead Valley.

Several wetlands and sloughs along the Flathead River provide important winter habitat for bull and westslope cutthroat trout (B. Marotz, pers. comm. 2001). Riparian forests on the river banks and associated wetlands provide large woody debris which creates pools and riffles for fish spawning, keeps the water cool, and supports insect, mollusk and crustacean species which are important food sources for fish (Connecticut River Joint Commission 2000; Brooks et al. 1997).

Recorded bull trout winter sites include (Fig.1): Church Slough, Half Moon Slough, Foy's Bend, Eleanor Island, and two locations in the Flathead River Islands (near Old Steel Bridge and south of Brenneman's Slough) (B. Marotz, pers. comm. 2001).

Several wetlands along the Flathead River have higher than usual bird diversity (Fig.1). These include Weaver, Egan, Church, McWenneger and Shaws Sloughs, and Fairview Marsh. Another area with high bird diversity is the riparian corridor extending north of McWenneger Slough on the east side of the Flathead River, adjacent to Flathead National Forest lands (D. Casey, pers. comm. 2001).

Most of the wetlands and sloughs along the Flathead River scored high for ecological significance for water quality and for wildlife habitat. All the evaluated wetlands are within the FEMA floodplain boundaries and are likely to provide important floodplain functions for the river. Weaver Slough, together with the Flathead River Islands, had the highest scores for Ecological Significance and Ecological Defensibility & Durability (Table 1, p.12).

4. Prime agricultural soils and farmland

In the 1999 Critical Lands Workshop, participants listed development of Flathead Valley agricultural lands as a major concern. Prime agricultural soils and farmland may not be critical for protection of water quality or wildlife habitat. Yet, they frequently are adjacent to critical lands and can provide a buffer from more dense development and its impacts, such as increased impervious. Farmland can also provide valuable open space, beneficial to wildlife, scenery and recreation. Farmland between Weaver Slough and Blasdel and Flathead Lake Waterfowl Production Areas to the south provides important open space and habitat continuity for wildlife.

The Flathead Valley contains some of the finest agricultural soils in Montana, comparable to the soils in the Midwestern bread basket. Flathead County soils are eligible for funds from the U.S. Department of Agriculture (USDA) Farmland Protection Grant, which only supports projects in areas with prime agricultural soils (S. How, pers. comm. 2001).

Most soils in Flathead County were formed in surficial glacial deposits during the Pleistocene period, followed by volcanic ash deposits from the Cascade Mountain Range. Erosive action of the rivers further modified valley bottom soils to form alluvial deposits (Flathead County, 1994). The most productive agricultural soils in the valley are found along the slower mainstem of the Flathead River, where sediment deposition and plant litter formed deep organic soils (EPA, 1983).

5. Lakeshore

In the 1999 Critical Lands Workshop, participants listed remaining undeveloped shoreline on Flathead Lake as a critical area, the main concerns being increasing density of shoreline development.

There are few large areas of undeveloped shoreline remaining on Flathead Lake, except for a few protected areas and the south shore, which has several large farms. Most of the north shore is protected by the U.S. Fish and Wildlife Service (USFWS). The Flathead Lake Waterfowl Production Area (WPA), provides excellent nesting habitat for osprey and bald eagles (Fig.1). To the north, the Flathead Lake WPA is surrounded by large agricultural land parcels. A more in-depth evaluation of critical lands on lakeshore areas is needed.

Table 1. Ranking of critical lands

FLATHEAD RIVER CORRIDOR	Water Quality		Wildlife Habitat	Threats	Defensibility & Durability	Cultural, recreational & aesthetic values	Total Scores††	FEASIBILITY *	RANK**
	Sinks	Sources							
Flathead River Islands	12 (11) †	12 (5)	9 (12)	6 (16)	6 (12)	3 (7)	**48 (63)**	4	**1**
Foy's Bend	12 (9)	12 (6)	9 (9)	6 (15)	6 (12)	3 (8)	**48 (59)**	5	**2**
Fennon Slough	12 (8)	12 (6)	9 (11)	6 (14)	6 (11)	3 (9)	**48 (59)**	4	**2**
Weaver Slough	12 (8)	8 (4)	9 (12)	6 (17)	6 (13)	3 (8)	**44 (62)**	5	**3**
Upper Braided Area	12 (8)	8 (3)	9 (11)	6 (13)	6 (11)	3 (7)	**44 (53)**	4	**4**
Egan S.	12 (8)	8 (2)	9 (8)	6 (16)	6 (12)	3 (8)	**44 (54)**	4	**4**
McWenneger Slough	12 (9)	4 (1)	9 (9)	6 (16)	6 (10)	3 (8)	**40 (54)**	5	**4**
Church Slough	12 (8)	4 (1)	9 (7)	6 (16)	6 (9)	3 (9)	**40 (50)**	N/A	**5**
Columbia Falls, CFAC land	12 (8)	8 (2)	6 (5)	6 (12)	6 (11)	2 (6)	**40 (44)**	N/A	**6**
Flathead R./ Brosten's Pond	8 (4)	8 (3)	3 (3)	6 (17)	4 (5)	3 (8)	**32 (40)**	2	**7**
Other areas evaluated									
Dayton Creek	12 (6)	12 (9)	6 (5)	6 (17)	6 (13)	3 (9)	**45 (59)**	5	**2**
Post Creek	12 (9)	8 (2)	9 (9)	6 (15)	6 (12)	3 (8)	**44 (55)**	4	**4**
FL. Lake south shoreline	12 (9)	8 (4)	6 (4)	6 (20)	6 (9)	3 (9)	**41 (55)**	2	**4**

† Weighted scores are indicated first followed by the raw scores in parentheses. Raw scores are higher than the weighted scores since they were put in an ordinal scale (of 1 to 3) and then multiplied by a weight factor (of 1 to 4; see Methods, p.5).

†† Weighted scores favor lands critical for water quality. Raw scores weight all categories equally.

* Feasibility is based on existing information about landowners' willingness to protect the natural resource, the capacity of Critical Lands Project partners to implement conservation strategies, the probability of success and costs. Feasibility will change based on changing interests of landowners and agencies, funding availability, land costs, etc. and as more information is obtained.

Feasibility score: 5 (high); 4 (medium-high); 3 (medium); 2 (medium-low); 1 (low).

** Rank is determined by the total weighted score. When weighted scores are the same, then the higher raw score determines which critical land ranks higher.

B. Major Concerns and Stresses

Some of the major concerns and stresses associated with critical lands in the North Flathead Valley which can lead to degraded water quality in rivers, streams and lakes, and can impact plant and animal communities include (Flathead Lakers, 1999 and Critical Lands Evaluation Forms, 2001):

- Non-point source pollution
- Loss of riparian vegetation along rivers streams, wetlands and lake shoreline
- Water level fluctuations
- Floodplain alterations
- Non-native species introductions
- Loss of farmland and soil disturbance

1. Non-point source pollution: Fine sediments and nutrients (in particular phosphorus and nitrogen) from logging activities, burning and slash, road building, farming, livestock, inappropriate residential development, lawn fertilizers, faulty septic systems and near-shore construction end up in streams and lakes via runoff or groundwater contamination. High levels of phosphorus and nitrogen in the water cause algae blooms. Increased algae in the water impact the aquatic life in the lake and water users.

The *Flathead River* delivers the greatest nutrient loads to Flathead Lake, followed second by the *Stillwater and Whitefish rivers*, and third by the

Swan River, Ashley Creek and Stoner Creek and other shoreline tributaries (Table 2).

Table 2. Summary of nutrient loads to Flathead Lake*

Drainage	BioTP load %	TN load %	NO2/3 load %
Main-stem Flathead	**60.28**	**69.90**	**75.13**
Stillwater/Whitefish	8.93	7.84	6.65
Swan	4.97	7.10	4.25
Ashley Creek	4.29	4.34	3.05
Stoner Creek	0.11	0.07	0.02
Other shoreline creeks	1.10	0.75	0.61
Shoreline septic	2.59	NA	3.86
Precipitation	16.11	8.60	5.55
Point Sources	1.62	1.39	0.88

*Adapted from DEQ, 2001. Original sources: Stanford and Ellis, 2001 and Makepeace and Mladenich, 1996).

The *Ashley Creek drainage* delivers the greatest nutrient loads per unit area, with the exception of nitrate/nitrite inputs. The mainstem Flathead River delivers the greatest nitrate/nitrite loads (Table 3).

Table 3. Mean areal (metric tons/km^2/year) nutrient loads to Flathead Lake*

Drainage	BioTP load	TN load	$NO_{2/3}$load
Ashley Creek	**0.012**	**0.127**	0.043
Stillwater/Whitefish	0.010	0.091	0.037
Main-stem Flathead	0.007	0.089	**0.046**
Swan	0.004	0.058	0.016
Stoner Creek	0.003	0.018	0.002

*Adapted from DEQ, 2001. Original source: Stanford and Ellis, 2001).

Research indicates that the most *developed areas*, especially urban and agricultural land, contribute the greatest nutrient loads to the lake on an acre-per-acre basis (Stanford et al., 2001 in DEQ, 2001). Water quality deteriorates significantly as the Stillwater and Whitefish rivers and Ashley Creek flow through the most developed areas in the North Flathead Valley (Stanford et al., 1997). Flathead County's population grew by 25.8% in the last decade, twice the rate for the state of Montana (Census Bureau website), and most of the housing development has been occurring outside incorporated cities and towns (FBC, 2000).

Impervious surfaces, such as roads, parking lots and rooftops, prevent the slow filtration of nutrients and other contaminants from runoff into the ground. Impervious surface coverage is correlated with increasing stream degradation (Arnold and Gibbons, 1996).

The impact of impervious surface on water quality also depends on the type of surface, the type of contaminants rain and snowmelt pick up from those surfaces, and the surrounding landscape (Arnold and Gibbons, 1996). Lands around a house may effectively filtrate some of the runoff washing from the rooftop and driveway. However, runoff on the shallow alluvial aquifer is likely to rapidly drain into the groundwater.

Housing and Road Density maps (Fig.2G & 2H) illustrate to some extent the distribution of impervious coverage in the North Flathead Valley. *Road and housing density* within 1.5 miles of the Upper Braided Area of the Flathead River is low (more than 40 acres per unit and less than 1 mile of road per sq. mile). Road and housing density rapidly increases to the west of the river. Housing density to the east and south of the Flathead River, on the valleys' best agricultural lands, is also low. However, road density is patchy. Low-density road areas indicate large open space areas with possible good connectivity and low short-term threat of development.

Housing density on the shallow alluvial aquifer is still relatively low (5 to 40 acres per unit) with a few 2-5 acre developments north of Evergreen in the proximity of the Flathead River and around Columbia Falls.

Runoff from impervious surfaces in the cities and along roads is frequently collected by storm sewer systems. These channel untreated runoff into streams. A study by the Flathead Lake Biological Station in the North Flathead Valley indicated that *stormwater* has an impact on water quality (Stanford et al., 1997). The study found that suspended solids, total iron, zinc, $NO_{2/3}$, pH and total aluminum exceeded EPA benchmark values for stormwater. Stormwater may be a special concern in Ashley Creek, south of Kalispell, and at the confluence of the Whitefish and Flathead rivers, south of Evergreen.

Septic systems have an average effective life span between 15-20 years (Stanford et al., 1997). After that, phosphorus may leach into the groundwater system. In shallow groundwater areas, septic systems may leach phosphorus into the groundwater regardless of their age (EPA, 1983). In 1998, the Flathead County Health Department estimated that more than 50% of all individual septic systems in Flathead County were over 20 years old (Draft Flathead Stewardship Index, Flathead Conservation Roundtable, 2002).

Another concern with septic systems is that they do not remove nitrogen (B. Ellis, pers. comm. 2001).

Nitrogen has also been found to promote algae growth and consequent water quality deterioration (discussed in Stanford et. al, 1997).

2. Water level fluctuations: Water level fluctuations controlled by Kerr Dam operations are responsible for bank erosion both on Flathead Lake shoreline and Flathead River banks. Bank erosion and collapse are extensive along the Flathead River south of Foy's Bend (C. Hanson, pers. comm. 2001) and the north shore of Flathead Lake (Lorang et al., 1993). Hundreds of acres have been lost to the river, caused by fluctuations in the lake level resulting from Kerr Dam operations (C. Hanson, pers. comm. 2001). Elevated lake levels create an artificial flood stage in the river upstream to Foy's Bend.

The duration and range of water level fluctuation are responsible for the extent of shoreline erosion (Lorang et al., 1993). The timing for lowering the water also impacts near-shoreline fisheries habitat fish in Flathead Lake, by dewatering spawning areas for salmonids in winter. Shoreline erosion also causes the redistribution of fine sediments and consequent degradation of deep spawning habitat (Ducharme, 2000).

Bank erosion on Flathead River banks is further aggravated by wave action caused by motorboats and jet skis. Several landowners along the Flathead River have expressed a need to reduce wave action (C. Hanson & A. Waller, pers. comm. 2001). Resource managers from FWP and the Flathead Conservation District have also expressed the need for wave action education (C. Hanson & G. Bissell, pers. comm. 2001).

Different bank stabilization techniques have been attempted, such as rip-rap, with varying success. While this technique may stop bank collapse, it frequently creates additional problems, such as reducing the riparian zone, increasing water speed, and moving the erosion problem downstream.

3. Loss of riparian or shoreline vegetation: The removal of the vegetation cover along rivers, streams and lakes removes natural nutrient filters and sinks and leads to warmer water temperatures in the summer and colder temperatures in the winter. These water temperature changes disrupt fish spawning activities and diminish the food base for many wildlife species that feed on aquatic organisms.

The floodplain along the mainstem of the Flathead River retains only 22% of its natural vegetation (EPA, 1983). However, there are still functional expanses of continuous riparian vegetation along the river which provide excellent wildlife habitat and floodplain functions. The riparian cover along the Stillwater and Whitefish rivers and Ashley Creek is greatly reduced and patchy, especially in the lower drainages (Fig.2A, 1990 Land Cover). Of these three, the Whitefish River is the only one that still has some continuous vegetation cover along its banks.

Some regulations are aimed at protecting riparian corridors. Commercial logging cannot occur within 50 feet from any stream or other water body, called the streamside management zone (Logan and Clinch, 1991). However, riparian corridors do not have the same degree of protection for other land use activities such as housing development and livestock grazing (J. Stanford, pers. comm. 2001). The MT Stream Protection Act and the MT Natural Streambed and Land Preservation Act require a permit for construction projects in or near a stream (Montana Association of Conservation Districts, 1997), and the Flathead Conservation District recommends a 20 feet set-back from the stream (C. Hanson, pers. comm. 2001).

Sections of the Flathead River in the North Flathead Valley where riparian vegetation is absent and bank erosion is frequently a problem were identified using the 1997 U.S. Forest Service aerial photos and confirmed by resource managers (Fig.1). Several of these areas would benefit from revegetation of the riparian corridor. Revegetation of the riverbank south of Foy's Bend may be complicated by water level fluctuations regulated by Kerr Dam.

4. Floodplain alterations: Channelization and bank armoring increase sedimentation and stream velocities, and lead to loss of storage and recharge capacity, loss of riparian vegetation and pools, and degraded wildlife habitat.

The Vulnerable Groundwater Areas maps (Fig.3A) indicate that there are several dense housing developments around Kalispell and Evergreen on top of a very shallow water table which is outside the Kalispell sewer district. Most prominent are a few densely populated areas (more than one unit per acre) south of Kalispell and along Ashley Creek (west of Airport road and east of Sunnyside road, and west of Meridian road and 2nd Street).

The New Structural Developments Map (Fig.2I) shows new housing developments that occurred between 1990 and 1997, and that are visible on the 1997 aerial photographs (scale: 1:15,800). Most development occurred along highways 2 and 93, around Kalispell and Columbia Falls. Highway 2 crosses the shallow alluvial aquifer in several areas where the water table is less than 15 feet deep.

5. Non-native species introductions: Weeds, exotic fish and aquatic organisms threaten the diversity and abundance of native fish and plant species. They are also responsible for economic losses in agriculture.

Exotic plant and animal introductions in critical lands and waters in the Flathead Valley have been identified as a problem (Greenlee, 1998). Non-native aquatic species introduced in basin waters can cause the decline or collapse of native species, change the food web dynamics in the system, hamper swimming, boating, and fishing, clog irrigation intake pipes and invade fish spawning beds. They may also be extremely difficult to remove. Some non-native introductions include *Mysis* shrimp, northern pike, walleye, bass, and carp, among others.

The extent of the problem in critical areas in the North Flathead Valley is unknown. However, certain weeds have been identified as a problem, in particular in the Flathead River Islands, and in Egan and McWennegar sloughs. Specific concerns are discussed in the Profiles of Critical Lands in the Flathead River Corridor (pgs. 25 to 47).

Prevention of new non-native species introductions in the Flathead Basin is vital. The economic costs and ecological impacts caused by exotic species have been recorded in other regions, including Eurasian watermilfoil (Myriophyllum spicatum) and Zebra mussels (*Dreissena* sp.).

6. Loss of farmland and soil disturbance: From 1992 to 1997 farmland in Flathead County decreased 22%, average size of farm decreased 29% and average lot/tract size decreased from 9.06 acres in 1987-1996 to 5.09 acres in 1999 (S. How, written comm., 1/14/02) [1].

When farmers subdivide a portion of their farm, riparian lands are apt to go first because they are not only the least productive for farming but also have the highest development value (S. How, pers. comm. 2001).

Soil disturbance in the Flathead Valley can be a direct threat to water quality. Some alluvial soils have a very permeable, sandy and gravelly matrix. Water moves rapidly through the soils, which do not effectively filter sediments and contaminants. Further, the groundwater table is close to the surface in many areas. Thus, contaminants from faulty septic systems and spilled toxic fluids can rapidly pollute the groundwater (Flathead County Montana, proposed Master Plan Update White Paper Report "Ecosystem Management," 1994).

Areas with steep slopes (25-30% or greater) are unsuitable for development or present extensive engineering limitations. Development on steep slopes can result in water quality degradation from erosion, and can create safety hazards.

C. CRITICAL LANDS RANKING

The evaluation of critical lands focused on areas that were given high priority by workshop participants because of the numerous benefits they provide. Thus, it is not surprising that most critical areas presented in this report ranked relatively high (Table 1, p.12; Fig.4, p.16). The riparian corridors, especially those of the Flathead River, provide multiple significant ecological and social values, such as water quality, wildlife habitat, and recreational opportunities.

Critical land along the Flathead River ranked as follows (Table 1, p.12; Fig.4 & 5, p.16):

1. Flathead River Islands
2. Foy's Bend; Fennon Slough
3. Weaver Slough
4. Upper Braided Area, Flathead River; Egan Slough; McWenneger Slough
5. Church Slough (profile not included)
6. Columbia Falls, CFAC Land
7. Flathead River/Brosten Pond stretch (profile not included)

[1] An illustration of farmland subdivision in Flathead County between 1980 and 1998 is shown in *Striking the Roots of Sprawl: A Look at Economic and Government Policies that Feed Sprawl* (Citizens for a Better Flathead, 2000).

Figure 4. Weighted Scores (Total and by Category) & Total Raw Scores[1]

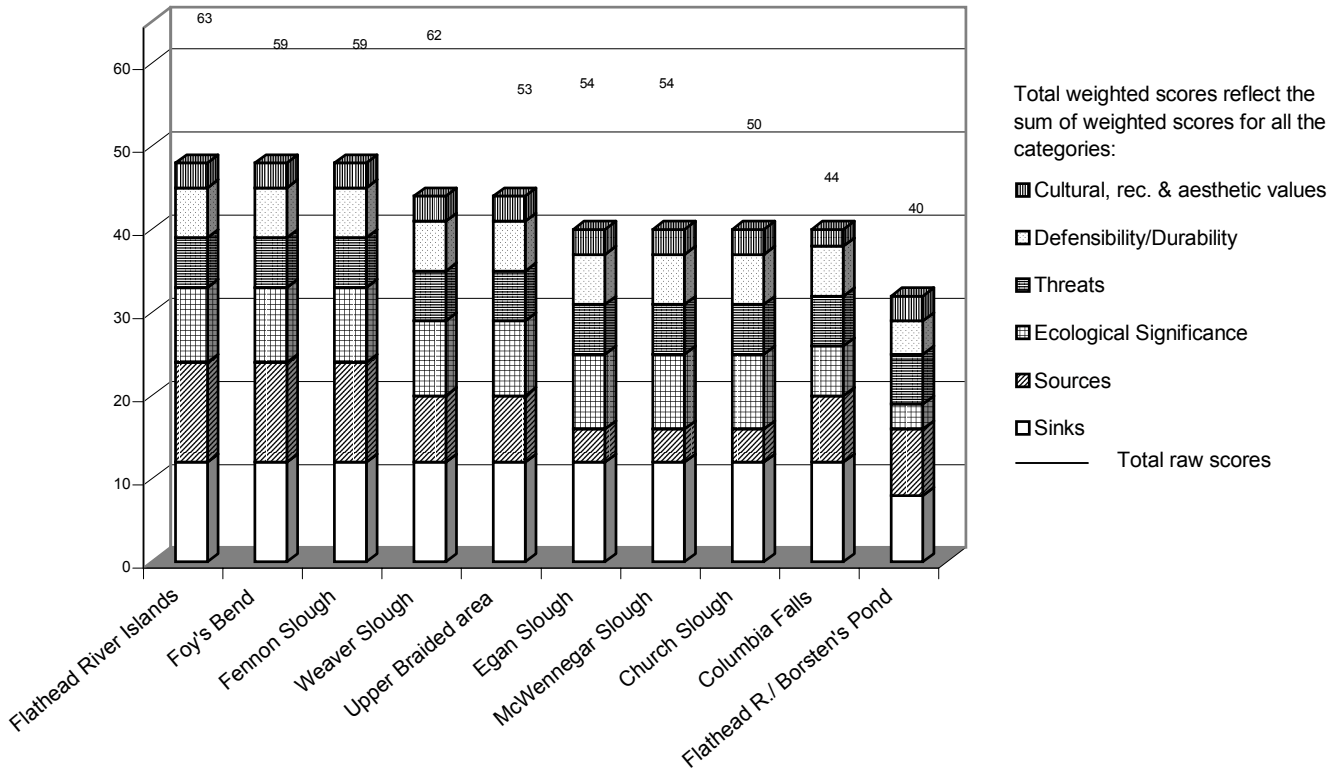
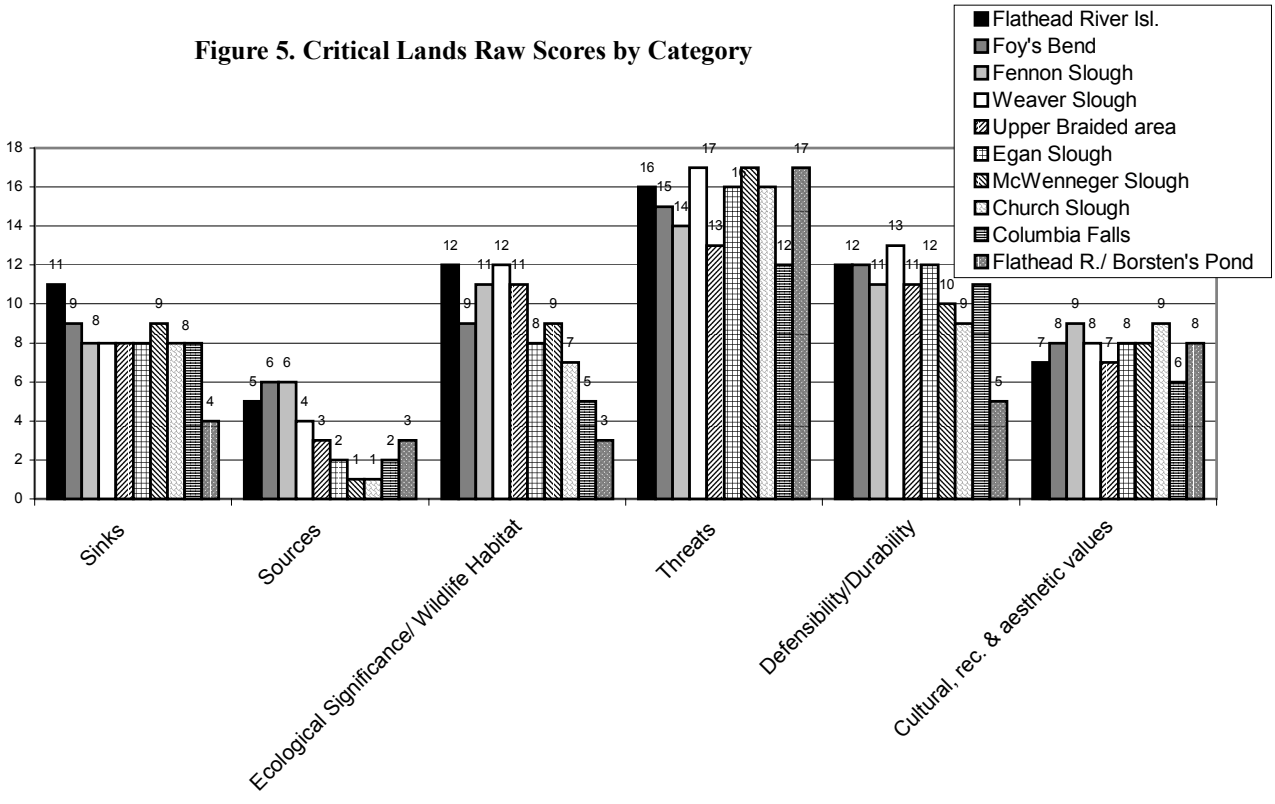


Figure 5. Critical Lands Raw Scores by Category



[1] See the Methods section (p.5) for an explanation on the difference between weighted and raw scores.

Importance for water quality received the highest weight. Thus, the total weighted scores highlight areas where water quality concerns rank high.

Most areas along the river with relatively large native vegetation cover have significant wildlife values. The *Flathead River Islands and Weaver Slough ranked highest for Ecological Significance* for wildlife habitat, followed closely by most other evaluated sections of the river, except for Columbia Falls/CFAC lands and the Flathead River section including Brosten's Pond[1] (Fig.5, p.16).

Existing and potential threats received positive scores, thus areas with high threats received higher scores. However, when scores were weighted, threats had a lower weight factor than water quality and wildlife habitat. Thus, water quality and wildlife habitat values lead the ranking, not the threats. Threats were measured according to environmental fragility, degree of protection (or lack of), existing and potential threats, and need for restoration. However, a low threat might indicate an opportunity for conservation. *Columbia Falls/CFAC lands, the Upper Braided Area of the Flathead River and Fennon Slough had the lowest threat scores* (Fig.5, p.16).

Wetlands and riparian vegetation along the western side of the *Upper Braided Area provides important filtering functions* for nutrients and other pollutants moving from the shallow alluvial aquifer to the Flathead River. However, this natural buffer may not be sufficient with increasing development pressures north of Evergreen.

Presently, open space and connectivity exist along the Upper Braided Area of the Flathead River (north-south), except on the southwest side where development pressures are high (Fig.2G & 2H). Thus, protection of large open areas along the river may still be viable.

D. ONGOING CONSERVATION EFFORTS

1. Conservation Efforts in the Flathead Basin

An initial strategy suggested by 1999 workshop participants for protecting and restoring critical areas was to support existing conservation projects with a high probability of success, such as those initiated in Weaver Slough, Ashley Lake, and Dayton, Ashley, Haskill and Stoner creeks. These areas all have watershed groups or community-driven projects with strong support from agencies or conservation organizations.

Conservation efforts in critical lands and waters are listed in Table 4 (p.19) and located in Figure 6.

Water bodies in need of restoration were identified by DEQ in the 1996 *Montana 303(d) List*. Conservation efforts are presently focused mainly on monitoring and assessment to determine sources of pollution and restoration needs. The *Flathead Lake Biological Station* continues to conduct *water quality research and monitoring* in Flathead Lake and major tributaries with limited funding. The information is central to understanding long-term changes in water quality in Flathead Lake and nutrient load contributions by the tributaries.

The *Flathead Basin Commission* is proposing short-term *watershed assessments* to identify specific sources of pollution in the priority river drainages identified by the Flathead Lake Biological Station research and the TMDL (DEQ, 2001) report. Watershed assessment studies have been initiated for Ashley Creek and the Swan River. A study for the Stillwater River will be initiated in 2002, and studies for the *Whitefish, and Flathead River* drainages are proposed for the near future.

The *Flathead Conservation District* is involved in two community-based watershed assessment projects in the Stillwater drainage, the *Haskill Basin* and the *Swift Creek projects*. The latter is in collaboration with the Whitefish Sewer and Water District.

The *Confederated Salish and Kootenai Tribes* (CSKT) are conducting short-term *watershed assessments* on a drainage-by-drainage basis, starting with the Mission and Little Bitterroot drainages. The goal of these studies is to quickly identify pollution sources and restoration needs. The Tribes also have numerous *restoration projects* in various priority river and stream drainages on the Flathead Indian Reservation (Table 4, p.19). However, many projects valley-wide are done on an opportunity basis, when a landowner expresses interest. Restoration of riparian corridors often targets the recovery of native fish and includes cattle fencing, channel reconstruction, dam removal and road crossing upgrades.

[1] Despite the ranking for this section of the river, *Brosten's Pond* itself has a high concentration of migratory waterfowl (Casey and Wood, 1987) and two active osprey nests (Fig.1).

The CSKT regulate physical alteration of aquatic lands, wetlands and Reservation waters through the Aquatic Lands Conservation Ordinance (ALCO) (CSKT, 1999, 24). This ordinance also enables the Tribes to conduct wetland mitigation projects. Several wetland projects have been initiated with the Department of Transportation for the proposed expansion of Highway 93.

Flathead, Ashley, Jette, Echo, Mary Ronan, Blanchard and Little Bitterroot lakes are examples of *lakes with local associations* formed by property owners to address water quality issues (FBC, 2000). The *Volunteer Monitoring Program* coordinated by the *Flathead Basin Commission* collects water quality data in 29 lakes and several streams throughout the Flathead Basin with the assistance of local volunteers.

Several years of communication between landowners, Natural Resources Conservation Services (NRCS), the CSKT and the Lake County Conservation District have led to several recent restoration projects in the *Dayton Creek* drainage, one of the most polluted tributaries to Flathead Lake. Some of these efforts include livestock fencing along streams and removal of dikes to improve fish passage.

The *Flathead Basin Commission* is implementing *buffer strip* demonstration projects to restore native riparian vegetation. The Flathead Lakers are producing materials to educate lakeshore property owners about the benefits of buffer strips.

The *Flathead Conservation District* is conducting a *bank stabilization* demonstration project along the Flathead River, north of Fennon Slough, which compares several bank protection techniques.

Other restoration efforts are led by *NRCS* through the *Wetland Restoration Program, Conservation Reserve Program, Wildlife Habitat Incentive Program, and the Environmental Quality Incentives Program.*

In the *Swan Valley*, the *Swan Ecosystem Center* conducts various programs to educate the public about the Swan ecosystem and promote sustainable forest stewardship and responsible recreation. The center and *Friends of the Wild Swan* help gather water quality data on lakes and streams for the Flathead Basin Commission and the Flathead National Forest (FNF), combining these efforts with their school education programs. In collaboration with FNF, FWP, the Department of Natural Resources Conservation (DNRC) and Plum Creek Timber Company, the Swan Ecosystem Center has compiled numerous maps that illustrate land use and conservation values.

A verbal agreement between *Plum Creek* and *USFWS* indicates that Plum Creek would give priority to public land acquisition (e.g. FNF), followed by conservation buyers, in grizzly bear core areas (linkage zones) if they are sold by Plum Creek (Dahl, pers. comm. 2002).

Conservation easements can play a significant role in conservation efforts in the Flathead Basin. Conservation easements can protect wetlands, riparian corridors, lakeshore, and farmland, and help protect water quality, wildlife habitat and/or farmland. *The Nature Conservancy* focuses on protection of biologically diverse areas, the *Montana Land Reliance* focuses on lands in the proximity of water bodies, and the *Flathead Land Trust* focuses on valuable farmland including associated riparian corridors and wetlands.

There are approximately 24,500 acres in conservation easements in the Flathead Basin,[1] 2,200 of which are in the North Flathead Valley[2] (Fig.2D, Public Lands and Conservation Easements Map; NHP, 2002).

2. Guideline Studies and Reports

Several studies and projects provide information about the Flathead Basin and can help guide conservation efforts in the Flathead Basin. They include:

- *Yellowstone to Yukon (*Y2Y) Conservation Initiative is a network of over 300 U.S. and Canadian institutions, organizations, foundations and individuals seeking to *identify and protect priority landscapes for conservation* within the Y2Y region, including wildlife core areas, movement corridors for wide-ranging mammals like grizzly bears and wolves, and transition areas that contain increasing levels of human activity.

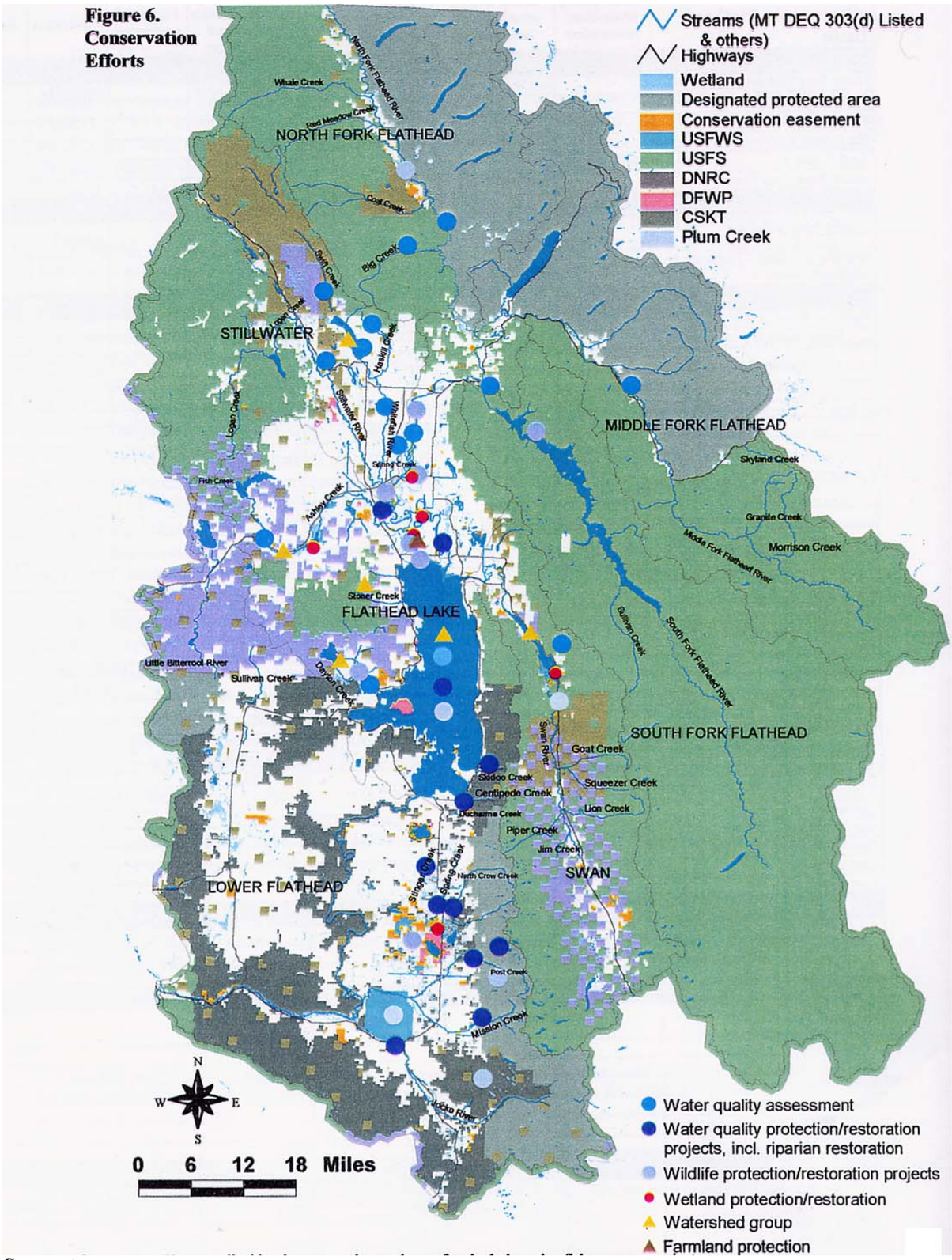
[1] Estimates for acreage are not exact since they are derived from maps at a scale of 1:100,000.

[2] The estimate is closer to 3,800 acres when including conservation easements west of the Stillwater River.

Table 4. Conservation efforts in the Flathead Basin[1]	Water quality protection/ restoration	Water quality monitoring & assessment	Wildlife habitat protection terrestrial & aquatic	Wetland & riparian corridor protection/ restoration	Farmland protection	Education	Recreation
NORTH FORK	**17010206°**						
North Fork Flathead River		FBC/FLBS, DEQ*	MWA	TNC,MLR, NHP		CRC, FL	
Red Meadow Creek √							
Whale Creek √							
Big Creek √		DEQ					
Coal Creek √	MLR		MLR				
South Fork Coal Creek √							
MIDDLE FORK FLATHEAD	**17010207**						
Middle Fork of the FR		FLBS, FWP, DEQ*				GNESA	
Granite, Skyland, Challenge & Morrison creeks √							
FLATHEAD LAKE	**17010208**						
Flathead River (FR)†		FLBS, FL	FWP				
River south of Foy's Bend		FCD		NRCS			
Flathead River Islands			DNRC/FWP/PO	DNRC/FWP MLR/PO		Audubon	FWP
Foy's Bend							FWP
Fennon Slough			FLT/PO	FLT/PO	FLT/PO		
Weaver Slough	FLT/FL*		FLT/FWP*	FLT/PO*	FLT/PO *		
McWenneger Slough	FLT/AFT*		FLT/AFT*	FLT/AFT/PO*	FLT/AFT/ PO*		
Upper Braided Area	FNF, MLR		FNF, MLR DNRC/FWP	FNF, MLR	MLR		FWP
Egan Slough				TNC/PO			
Church Slough							
Columbia Falls/CFAC lands				DNRC			FWP
Brenneman's Slough							
Ashley Creek √		FBC/ACWG,FLBS			MLR		
Shallow alluvial aquifer	FC	FBC*	FBC				
Flathead Valley agricultural lands					MLR, FLT		
Flathead Lake √		FLBS, FBC, CSKT	USFWS, FWP			FL, FBC FLBS	
north Flathead Lake shore	USFWS		MLR	MLR			
south Flathead Lake shore		CSKT	MLR	MLR			
Other shoreline areas	FBC, FL					FL	
Lake Mary Ronan √		FBC, FLBS		CSKT, NRCS	NRCS	NRCS	
Dayton Creek	CSKT/BPA	CSKT/BPA, NRCS, DCWC	CSKT/BPA	CSKT/BPA, NRCS	NRCS	NRCS	
Stoner Creek		FBC, SCWG					
Ronan Creek	PO	LCC/WC					
Ducharme Creek		CSKT					
Spring Creek √	FCD						
Fish Creek √							
SOUTH FORK FLATHEAD	**17010209**						
South Fork Flathead River √		DEQ*					
Hungry Horse Reservoir √			FWP				
Sullivan Creek √							
STILLWATER	**17010210**						
Stillwater River √		FLBS, FBC*	FLT	FLT* NHP			
Whitefish River √		FLBS, FBC		NHP			
Whitefish Lake √		FLBS, FBC				WLPA	
Swift creek √		FCD					
East & West Fork Swift Cr. √							
East & West Spring Creek √							
Logan Creek √			MLR	MLR			
SWAN	**17010211**						
Swan River √		DEQ, FoWS, SEC, FNF, SVC	FoWS, PC, FWP, MLR	TNC, NHP, MLR		SVC, SEC	BDC et al.
Jim, Goat. Elk, Lion, Piper, Squeezer creeks √		DEQ					
LOWER FLATHEAD	**17010212**						
Flathead River √	CSKT	FLBS			MLR		
Little Bitterroot River √		CSKT	MLR		MLR		
Ninepipe - pothole wetlands			USFWS, CSKT, MLR	MLR			
Jocko River		CSKT*					
Post Creek	NRCS, CSKT, MLR		NRCS, FRO, MLR	NRCS, CSKT,	NRCS, MLR		
Ducharme Creek			CSKT*	CSKT*			
Crow Creek		CSKT	FRO	CSKT			
Ronan and Stinger creeks		CSKT	CSKT	CSKT/PO			
Mission Creek		CSKT	MLR	CSKT	MLR		
Skidoo Creek			CSKT				
Sullivan Creek √							

† River corridors also refer to river drainage. Conservation efforts include conservation easements, land purchase, monitoring, etc.
√ This indicates that the lake, river or stream is listed as an impaired waterbody in the 1996 TMDL List
*The asterisk indicates projects proposed and sometimes initiated.
ACRONYMS on other side.

[1] This summary is not fully encompassing of all conservation projects. A more comprehensive summary can be obtained from the Flathead Lakers (Protection and Restoration Efforts in the Flathead Basin of relevance to the Critical Lands Project, May 2001).



Comments:

Water quality/riparian restoration projects often include native fish recovery projects.

Wildlife protection projects are not fully encompassing of all wildlife projects in the basin. Dots indicate a general area, which may expand throughout an entire protected area. Protected areas (e.g. FWS, conservation easements) are frequently an indication of a wildlife and/or wetland protection effort. Wetland protection/restoration projects indicated in this map are not fully encompassing of all wetland projects. These are often small and dispersed. The dots indicate some recent major efforts.

ACRONYMS

ACWG = Ashley Creek Watershed Group
AFT = American Farmland Trust
BDC et al. = Bigfork Development Company, American Whitewater, Bigfork Chamber Of Commerce, Bigfork Whitewater Association, Flathead County, Flathead Lakers, Flathead Whitewater Association, National Park Service, Montana Department of Fish, Wildlife and Parks, PacifiCorp, Swan River Corridor Committee & Riverbend Concert Series.
CRC = Community River Connections
CSKT = Confederated Salish and Kootenai Tribes
DCWG = Dayton Creek Watershed Council
DEQ = MT Department of Environmental Quality (responsible for conducting TMDL studies in 303(d) Listed waterbodies)
FWP = Dept. of Fish, Wildlife & Parks
FBC = Flathead Basin Commission
FC = Flathead County – Co Health Dpt.
FL = Flathead Lakers
FLBS = Flathead Lake Biological Station
FLT = Flathead Land Trust
FNF = Flathead National Forest
FoWS = Friends of the Wild Swan
FRO = Flathead Resources Organization
GNESA = Great Northern Environ Stewardship Area (former BNESA)
LCC/WC = Lakeside Community Council/Watershed Committee
MLR = Montana Land Reliance
NHP = Natural Heritage Program - wetland assessments.
NFPA = North Fork Preservation Association
NRCS = Natural Resources Conservation Service
PC = Plum Creek Timber Company
PO = Property owner
TNC = The Nature Conservancy
SCWG = Stoner Creek Watershed Group
SVC = Swan View Coalition
SEC = Swan Ecosystem Center
USFWS = U.S. Fish and Wildlife Service
WVMP = Wetlands Volunteer Monitoring Program
WLPA = Whitefish Lake Protection Association

The Y2Y Conservation Initiative has initiated or supported a number of reports to help guide conservation efforts, including:

- *Y2Y Aquatics Strategy Workshop* (1999)
- *Y2Y Science Strategy Forum* (1999)
- *Yellowstone to Yukon grizzly bear habitat suitability map (Y2Y, 2002)*
- *An evaluation of Wilderness and Aquatic Biointegrity in Western Montana* by Flathead Lake Biological Station (Hitt and Frissell, 1999).

- *Wildlife Movement Corridors Project* by American Wildlands.
- *Interior Columbia Basin Final Environmental Impact Statement (USDA & USDI, 2000).*
- *Nutrient Management Plan and TMDL Study for Flathead Lake (*MDEQ, 2001).
- Water quality research by the University of Montana's Flathead Lake Biological Station including: *Water Quality Data and Analyses to Aid in the Development of Revised Water Quality Targets for Flathead Lake, Montana.* Phase I of a Cooperative Study to Determine Total Maximum Daily Loads for Nitrogen and Phosphorous (Stanford, 1997).
- Flathead Basin Commission *Biennial Reports.*
- *Flathead River Sub basin Summary*. Draft, prepared by Lynn Ducharme (2000) for the Northwest Power Planning Council.
- The Confederated Salish and Kootenai Tribes' *Comprehensive Resources Plan* (CSKT, 2001).
- *Flathead County Master Plan* (1987).
- *Lake County General Plan* (1998).
- *Flathead National Forest Plan* (1986).
- A review of *Background Documents: Kalispell Growth Policy Plan, 1998 and 1999*, compiled by Citizens for a Better Flathead (2/12/00).
- The Confederated Salish and Kootenai Tribes' *Highway 93: Land Use and Growth Projections Study* by Janet Camel (CSKT, 1999).
- *Flathead Lake and River Fisheries Co-Management Plan* prepared by the Confederated Salish and Kootenai Tribes and the Montana Department of Fish, Wildlife and Parks (FWP and CSKT, 2000).
- Reports by the Montana Natural Heritage Program:
  - *Ecologically Significant Wetlands in the Flathead, Stillwater and Swan River Valleys*. *Studies of Ecologically Significant Wetlands* (Greenlee, 1998).
  - *Ecologically Significant Wetlands in the North Flathead River Watershed* (Cooper et al, 2000).

3. Programs

There are numerous local, state, federal and tribal government agency regulations and programs that provide technical and financial support for conservation work to protect or restore water quality, ecological values and recreation.

A few reports compile information about programs to help fund conservation projects on private lands:

- The Montana Watercourse, an adult and youth water education program at the Montana State University, publishes information about programs and regulations affecting wetlands in Montana, including *Who Does What with Montana's Wetlands: A Directory* (1998) and *A Landowners' Guide to Montana Wetlands* (1999).
- The Montana Council of Trout Unlimited published a *Funding Guide for Stream Restoration in Montana* (2001) to help agencies and organizations find funding for watershed and stream restoration projects.
- Regina Mahoney, a graduate student at the University of Massachusetts at Amherst, described several regulations and programs relevant to wetlands and riparian areas in her M.S. thesis "*Collaborative Planning Strategies for Wetland and Riparian Area Resources to Protect Water Quality in the Flathead Basin"* (2001 Draft).

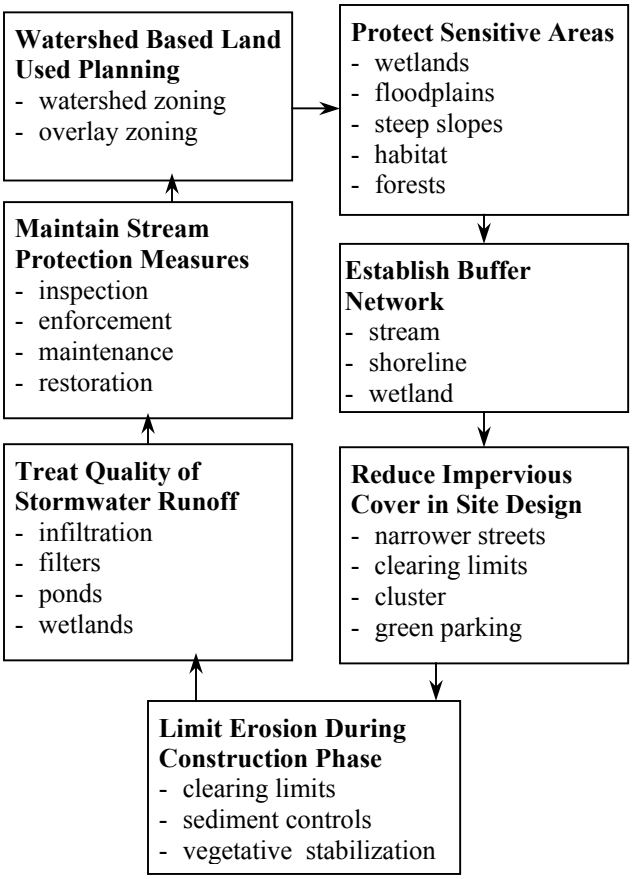
E. NEEDS AND OPPORTUNITIES FOR CONSERVATION

Table 5 (p.24) summarizes some of the concerns and needs for conservation in critical areas along the Flathead River, based on the Critical Lands evaluations (see Profiles of Critical Lands in the Flathead River Corridor, pgs. 25 to 47). These range from bank stabilization and exotic plant management to education and partnership building. Each profile has a discussion of site-specific conservation needs and opportunities.

Further assessment of needs, opportunities and strategies for conservation will be conducted collaboratively with Critical Lands Project partners.

The Center for Watershed Protection outlines a stream protection strategy relevant to areas undergoing development (Schueler, 1995). Figure 7 shows the main elements of the strategy as it follows the development cycle from zoning, planning, site design, construction, stabilization, and final occupancy. This strategy can help with the development of strategies for water quality protection and integrate other ecological and social values addressed in this report and of interest to project partners.

Figure 7. Stream Protection Strategy and the Local Development Cycle (Schueler, 1995)



Preliminary Conservation Recommendations based on evaluation of priority critical areas in the North Flathead Valley and along the Flathead River corridor, north of Flathead Lake:

- Discourage inappropriate development and removal of riparian vegetation along rivers, streams, wetlands and on shallow groundwater areas.
- Focus protection and restoration efforts on high priority areas along the Flathead River corridor, including Flathead River Islands, Flathead River sloughs,[1] Foy's Bend, upper braided area of the Flathead River.
- Coordinate with the FBC and local watershed groups to evaluate potential critical areas along the Stillwater and Whitefish rivers and Ashley Creek and develop protection and restoration strategies based on watershed assessments and Critical Lands Project evaluations.
- Protect intact riparian forests, including cottonwood forests, along the Flathead River and tributaries. Unprotected mature cottonwood forests are found in Leisure Island, Egan Slough, Foy's Bend and Brenneman's Slough. Ensure protection of cottonwood forests on public lands, including OSNA and FNF lands (Upper Braided Area).
- Protect wetlands contiguous to river corridors and in the floodplain, and on shallow groundwater areas.
- Restore riparian vegetation:
  - Identified problem areas exist along the Flathead River (Fig.1). Assess the need for bank stabilization prior to revegetation, especially south of the Flathead River Islands.
  - Along the Stillwater and Whitefish rivers, and Ashley Creek.
- Promote good stewardship practices on the shallow alluvial aquifer to minimize water quality impacts.
  - Assess the feasibility of extending the sewer districts to connect to new development.
  - Evaluate alternative septic systems that may be appropriate for shallow groundwater areas.
- Enact forestry stream management zone-type regulations and encourage adoption of best management practices for farming, housing development and other land uses.

[1] The sloughs that ranked highest have landowners who have shown interest in conservation and farmland protection. Other sloughs, such as Church and Half Moon, are also ecologically significant (Fig.1), but landowner interest needs further assessment.

- Implement measures for reduce runoff from agriculture and urban development along the Stillwater, Whitefish and Flathead rivers and Ashley Creek.

- Reduce water quality impacts from stormwater runoff, septic systems, and other pollutant sources.
  - Evaluate and establish policies and/or develop incentives to promote maintaining and upgrading of septic systems.
- Inform the public and key decision makers about design alternatives to reduce impervious cover created by new development in or near critical lands.
- Acquire fee or seek donation of easements on priority critical areas where feasible.
- Continue to develop and support partnerships for watershed protection and restoration.
- Inform the public about the importance of protecting and restoring critical lands in the Flathead Basin.
  - Develop a communications plan to provide information to the public about the importance of wetlands, riparian corridors and floodplains, actions people can take to maintain or improve water quality, sources of funding and technical assistance for protection/restoration projects, etc.

Previous recommendations by workshop participants that should be further explored include (Flathead Lakers, 2001):

- Explore linkages between the economy and ecologically significant areas. Publicize the value of riparian areas.
- Evaluate Missoula County's new riparian regulations.
- Ensure that key groups, including public officials, students, real estate brokers, buyers, farmers and landowners, are informed about critical areas that need protection or restoration and ways of implementing resource-compatible land use management.

F. Critical Lands Project: Going Forward

In 2002, the Flathead Lakers plan to bring Critical Lands Project partners together to discuss and develop strategies for protection and/or restoration of specific high priority critical areas along Flathead Valley river corridors, and consider more general strategies to reduce widespread threats to critical lands and water quality.

A plan will be developed collaboratively to define opportunities for action and guide implementation of protection and restoration efforts. The plan will initiate new projects and support ongoing projects. It will focus initial attention on a potential "early win" project that can be used to demonstrate positive results.

The plan will also consider funding strategies, tools and resources available to accomplish project goals. A third Critical Lands Project workshop in May 2002 will focus on developing the plan.

An education and outreach program will be developed to improve communication among project partners and to inform the public and decision-makers about the importance of critical lands to water quality and Flathead Lake. Components of the outreach effort will include a plan for sharing critical lands information and maps with the public, production of an educational map of critical lands, and a communications plan.

The critical lands information and maps have already been used to support ongoing projects and to provide information to public officials making planning decisions. The Critical Lands Project will provide a positive approach to address threats to water quality, provide information to improve stewardship of critical lands, and strengthen partnerships to expand conservation and restoration action.

TABLE 5. SUMMARY OF CONCERNS AND NEEDS ON CRITICAL LANDS

The following concerns recur in most critical lands evaluated in the Flathead Valley. For specific concerns, needs and opportunities please see individual profiles of critical lands (pgs. 25 to 47).

General priority water quality & habitat areas:

- Functional riparian corridors
- Wetlands and sloughs
- Functional floodplain
- Shallow groundwater aquifer

Other priority areas:

- Prime agricultural soils, farmland
- Significant recreational areas: rivers and riparian corridors
- Undeveloped lakeshore
- Highly scenic areas: rivers corridors, lakes, mountains views, open space and farmland
- Historic and cultural sites of native people

Threats to critical lands along the Flathead River corridor (non-site specific):

- Residential development and land subdivision of critical lands (river frontage, sloughs, floodplain, prime farmland and shallow groundwater areas)
- Floodplain regulations that are inadequate for protecting groundwater and preventing removal of riparian vegetation
- Removal of riparian forests
- Erosion caused by watercraft (wave action)

Other existing and potential threats to critical lands (non-site specific):

- Exotic plants and animals
- Agricultural runoff
- Old and poorly maintained septic systems
- Overgrazing
- Inadequate zoning

Needs:

- Protection of riparian corridors and wetlands
- Grazing improvement in riparian forests
- Discourage development on intact riparian forests, wetlands, islands and sloughs
- Bank stabilization
- Education about erosion caused by wave action
- Exotic plants management
- Gather neighborhood support for conservation projects
- Broad partnerships to increase funding for conservation projects
- Funding to help purchase conservation easements
- Education about the importance of riparian corridors

Ecologically significant areas:

- Riparian forests, including mature cottonwood forests
- Bull and westslope cutthroat trout migration corridors and winter sites
- Bald eagle and osprey nesting areas
- High bird diversity areas, waterfowl migration corridors

Negative impacts on critical lands, waters and wildlife:

- Non-point source pollution
- Loss of riparian vegetation along rivers, sloughs and wetlands
- Bank erosion and collapse
- Groundwater pollution
- Loss of agricultural lands
- Loss of native fish and wildlife

Long-term ecological benefits of protecting critical lands:

- Wetland, floodplain and riparian functions protect water quality
- Connectivity of riparian habitat (including mature cottonwood forests)
- Protection of unique slough formations
- Bank stabilization
- Protection of prime agricultural soils
- Protection of open space
- Protection of bull and cutthroat trout winter habitat and migration corridors
- Protection of unique and productive wildlife habitats for semi-aquatic furbearers, bald eagles, osprey, and neo-tropical migrants

Opportunities in critical lands (non-site specific):

- Protect unique landscape features
- Protect riparian corridor, wetland and floodplain functions
- Protect habitat used by species of concern
- Protect prime agricultural soils
- Increase public access to the river
- Educate landowners/community and build community support for conservation of critical lands

IV. Profiles of Critical Lands in the Flathead River

1. Flathead River Islands

Location
The Flathead River Islands are located on the river north of Flathead Lake, south of the Evergreen community, and east of Kalispell and include the Owen Sowerwine Natural Area (OSNA) and surrounding islands. DNRC (State Trust Lands), FWP and Audubon administer some islands. The others are privately owned.

Ecological significance

Water Quality (Sinks: High; Sources: Medium High)
The "Flathead River Islands" is a highly braided area on the Flathead River, including islands, sloughs, wetlands, and gravel and sand bars. The braiding in the river is a result of a transition in the river from permeable cobbles and floodplain soils to less permeable fine sediments of the Flathead River delta, which leads to a drop in the stream gradient. This decrease in energy leads to greater deposit of bedload in this stretch of the river (Greenlee, 1998).

Stillwater and Whitefish rivers contribute significant nutrient loads to Flathead Lake. These nutrients enter the Flathead River in this braided section. Nutrient filtering and sediment retention provided by wetlands and the floodplain in this area are critical for protecting water quality downstream, as well as protecting wildlife and plant species dependent on clean water.

Wildlife Habitat (High)
The riverine wetland communities and successional patterns present in the islands are dependent on the hydrologic regime of the river. OSNA and nearby islands comprise the best examples of riparian shrub and forest communities in the Flathead Valley, and exhibit a wide spectrum of successional stages (Greenlee, 1998). Young cottonwood forests seed where gravel bars and sandbars are created by natural floods. In the early stages young willow and black cottonwood communities are most common after gravel or sand bars are created by natural floods. In less frequently flooded areas, such as terraces, the forest becomes dominated by black cottonwood and red-osier dogwood. In areas where disturbances (flooding and fire) are low, conifers dominate in the canopy. An example of a late successional riparian community is the spruce/red-osier dogwood forest found on some islands. Rare plants were not found by the Natural Heritage Program (NHP) in the riparian forests, but are found in nearby sloughs (Greenlee, 1998). This section of the river has four mature cottonwood forest stands. These are found in the Owen Sowerwine Natural Area, Leisure Island, and Brenneman's Slough.

The Flathead River Islands provide valuable wildlife and fish habitat. Bull and cutthroat trout use the river system for migration. They winter in several locations around the islands (Fig.1) where the water flows are slower, there is protection from predators and water temperatures are higher. The islands and surrounding riparian vegetation and wetlands provide nesting and winter habitat for bald eagles. They also provide important year-round and nesting habitat for river otter, beaver, osprey, great blue herons, cormorants, wild turkey and pheasants. The area has the highest density of beaver colonies in Montana and large populations of river otter and osprey.

The Flathead River Islands can be considered part of a larger ecological unit within the Flathead River system, which extends from Foy's Bend north to Highway 35. Gael Bissell, Habitat Conservationist and

Wildlife Biologist at the Montana Department of Fish, Wildlife and Parks (FWP), considers this ecological unit to be the highest priority for wildlife protection in the Flathead River corridor between Flathead Lake and Columbia Falls. This ecological unit has one of the highest concentrations of mature cottonwood forests and bull and cutthroat trout wintering sites on the Flathead River.

Urgency of Existing & Potential Threats (Medium High)
The Flathead River Islands are highly unique and environmentally sensitive. County floodplain regulations include provisions to reduce the impacts of some development. However, floodplain regulations permit development within the floodway fringe by raising the area with fill so that the ground floor of a structure is two feet above the base flood elevation (Flathead Regional Development Office, 1991). Further, floodplain regulations do not prevent removal of the riparian vegetation. The area is mainly zoned for agriculture. Runoff from agriculture is likely from the east, in particular in areas lacking riparian buffers and in adjacent shallow groundwater areas. However, residential development is the greatest concern. Population pressure in adjacent lands is likely to increase pollution of the groundwater and river from individual septic systems, runoff from impervious surfaces, and the removal or deterioration of riparian vegetation and wetlands.

Development pressures are high, especially west of the Flathead River (Fig.2H, 1997 Structural Density). There are several gaps among existing protected areas (Fig.2D, Public Lands and Conservation Easements), especially to the north and south of OSNA.

The greatest development threat in this area is a proposed RV Park approved by the Flathead County Commissioners in 2001, which is partially located on the 100-year floodplain. The proposed RV Park will lead to the removal of important riparian vegetation in the floodplain and along the Flathead River corridor, the loss of important wildlife habitat, increased noise and use of the river corridor, as well as potential hazardous spills and erosion and consequent groundwater contamination.

Other known specific threats identified include removal of the riparian forest and potential housing development on the southern half of Leisure Island, replacement and upgrade of the Old Steel Bridge (could increase traffic, impact FWP Fishing Access Site and open the east side to greater development), heavy grazing along Brenneman's Slough, bank instability on the southeastern most end below the slough, and timber harvesting occurring on one of the islands.

Other major threats to the area include future housing development (septic systems, dogs and cats, removal of riparian vegetation, increased use of lawn fertilizers), timber harvesting and introduction of exotics. Frequent flooding disturbances make the islands susceptible to invasive exotic plants. A few exotic plants, such as Canada thistle, houndstongue, and redtop, are leading to degradation of cottonwood forests. In the sloughs, reed canary grass often forms dense patches, threatening the native vegetation communities. Other negative impacts of land use activities include past river alterations (e.g. dikes), water level fluctuations (caused by Kerr Dam), agricultural non-point source pollution and groundwater pollution. The biological integrity of the river system has deteriorated due to the presence of non-native fish.

Ecological Defensibility & Durability (High)
The area is well forested, large, and generally undisturbed (Fig.2G, 2H & 2B, 1997 Road, Structural Density and Land Cover maps). There is excellent connectivity and the hydrologic regime is highly functional. Several islands are under protected status, including lands administered by DNRC (approx. 354 acres), Flathead County, FWP (~ 112 acres) and USFWS (~ 11 acres) (Fig.2D, Public Lands and Conservation Easements). Bordering the east side of the river, there are several conservation easements (~ 400 acres). A few more agreements of this kind with private landowners would ensure excellent connectivity and protection of the Flathead River Islands. Restoration needs are low. Conservation efforts should be geared towards protection of existing riparian corridors, wetlands and sloughs and the associated shallow alluvial aquifer, which maintain the dynamic natural course of the river. The conservation easements include a monitoring program in place. Thus, a monitoring program could easily be established in the area for new conservation easements.

The long-term ecological benefits of protection and restoration projects in the area include: wetland, floodplain and riparian functions, connectivity of large, intact riparian forests (cottonwood/red-osier dogwood communities) along the Flathead River corridor at various successional stages, protection of the river's natural hydrologic regime, protection of bull and cutthroat trout winter habitat and migration corridor, protection of unique and productive wildlife habitats for semi-aquatic furbearers, bald eagles, osprey, great blue herons, neo-tropical migrants, reptiles and amphibians, and other non-game wildlife. Other benefits could include increased recreational benefits and public access, as well as protection of open space.

Cultural, recreational and aesthetic values (Medium High)
The area is highly popular for hunting, fishing, bird watching and boating. FWP has a fishing access at the Owen Sowerwine Natural Area and Leisure Island from the west side (Fig.1). The area was also a traditional river crossing area for the Kootenai Tribe.

Protection and Restoration Efforts
The Department of Natural Resources Conservation (DNRC) manages the Owen Sowerwine Natural Area. Three large conservation easements on the east side of the Flathead River provide some degree of protection of the riparian corridor and help prevent subdivision and development of the area.

Needs

- Improve grazing and fencing along riverbank and wetlands, in particular in Brenneman's Slough.
- Inventory noxious weeds.
- Evaluate the need to remove inadequate dikes in the Flathead River.
- Discourage development on intact riparian vegetation, wetlands, islands and sloughs.
- Protect gaps among protected areas on the west side of the river (between Old Steel Bridge and OSNA, and FWP's protected areas), which are undergoing development pressure.
- Build partnerships to support conservation project in order to increase chances of receiving funding.
- Gather neighborhood or agency/organizational support to influence Flathead County Commissioners' decisions about conservation easements, subdivisions, and other issues that might impact critical areas.

Opportunities

- Protect wetlands and riparian corridors on private lands, and increase connectivity among protected areas.
- Increase public access.

Overlapping values:

- Floodplain functions
- Riparian vegetation: four mature cottonwood forests; riparian forests in several successional stages
- Wetland functions
- Unique landscape formations: sloughs, river islands
- Bald eagle nesting site, use by osprey
- Bull and cutthroat trout migration corridor and winter sites
- Winter white-tailed deer habitat
- Historical significance to the Kootenai Tribe
- High scenic and recreational values

Feasibility (Medium)
Agencies (e.g. FWP) and organizations (e.g. Flathead Land Trust, Montana Land Reliance) working in the area have the capacity to implement protection and restoration projects, in particular conservation easements and wildlife enhancement projects. There is also some community support for conservation. Other agencies

and organizations that could be involved in conservation projects in the area include NRCS, DNRC, FNF, USFWS, Flathead County, Flathead Lakers, and Citizens for a Better Flathead, among others. A monitoring program for protection of fish and wildlife resources can be easily established through government agencies (G. Bissell, pers. comm. 2001). Monitoring of grazing practices, exotic plants distribution and health of riparian corridors could be established through conservation easements. Monitoring of water quality is conducted by the Flathead Lake Biological Station north of the Flathead River Islands, where the Whitefish River joins the Stillwater River, and south, in the proximity of Flathead Lake (Sportsman's Bridge). This data could help indicate over the long-term whether conservation efforts along the Flathead River are making a difference towards improving water quality.

Conservation easements on private lands appear to be an effective tool for protection. The cost of land in this area is rapidly increasing.

There is little support at this time from Flathead County Commissioners to restrict urban development in the proximity of the city. However, highly ecologically significant areas can be protected if there is wide community support (G. Bissell, pers. comm. 2001). Neighborhood support needs to be expanded for potential conservation projects in this area.

Sources of information

Bissell, G. 2001. FWP. Personal Communication.
Casey, D. 2001. American Birds Conservancy. Personal Communication.
Hanson, C. 2001. Flathead Conservation District. Personal Communication.
Flathead Lakers. 2001. Critical Lands Maps.
Flathead Regional Development Office. Flathead County 100-year and 500-year Floodplain Maps.
Flathead River Map. The Flathead River Partnership. Flathead Basin Commission. Kalispell, MT 39901.
FWP. Summary Report 1997-1999. Seasonal Distribution and Movement of Native and Non-native Fishes in the Upper Flathead River System, Montana. Prepared by Muhlfeld, C.C. et al. for Bonneville Power Administration. September 2000.
Greenlee, J.T. 1998. Ecologically Significant Wetlands in the Flathead, Stillwater and Swan River Valleys.
How, S. 2001. Flathead Land Trust. Personal Communication.
Marotz, B. 2001. FWP. Personal Communication.
McCallister, H. 2002. Department of Natural Resources Conservation. Personal Communication.
Montana Natural Heritage Program. 1/29/2002. *Land Ownership and Managed Areas of Montana.* Distributed by the Montana State Library, Natural Resources Information Service.
Rosario, A. 2001. NRCS. Personal Communication.
U.S. Forest Service. 1997 aerial photos.

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2. Foy's Bend

Location

Foy's Bend is located south of Kalispell and the Flathead River Islands on the Flathead River (Fig.1). The area evaluated includes the wetlands and riparian vegetation to the north and south of Foy's Bend. The wetlands and farmland are privately owned.

Ecological significance

Water Quality (Sinks: Medium High; Sources: Medium)

Foy's Bend comprises approximately 150 acres of wetlands (e.g. backwater sloughs) and black cottonwood forests to the north and inside of the river bend. The water levels in the wetlands are influenced by the fluctuating water levels in the river. These wetlands and the floodplain provide important sediment filtration and erosion control functions. The depth to the water table in the 100-year floodplain is less than five feet below the surface (Fig.2E, Depth to Water Table).

Wildlife Habitat (Medium High)
The mature cottonwood forest provides valuable wildlife habitat. It supports a wide range of songbird species dependent on riparian habitat. The backwater sloughs support large numbers of waterfowl during migration. There are two osprey nests (Fig.1) and two bald eagle nests in this area. Bull and westslope cutthroat trout use the Flathead River system during migration. They have recently been found to winter in sloughs, islands and deep pools, where water flows are slow, temperatures are moderate and there is some cover or protection from predation. In Foy's Bend the underwater structure provided by fallen logs from the cottonwood forest appears to provide excellent winter habitat for these species.

Foy's Bend can be considered part of the larger Flathead River Islands ecological unit within the Flathead River system (between Highway 35 and Lower Valley Road). Considered in conjunction with the Flathead River Islands, this area has one of the highest concentrations of mature cottonwood forests, as well as bull and cutthroat trout wintering sites. Bissell, FWP, considers this ecological unit to be the highest priority for protection on the Flathead River corridor between Flathead Lake and Columbia Falls (also see Flathead River Islands, p.25).

Urgency of Existing & Potential Threats (Medium High)
High summer and early fall water levels in Flathead Lake, maintained by Kerr Dam, back up 14 miles north on the Flathead River causing saturation of the soils and bank erosion. This further increases sediment inputs to the river. Foy's Bend is on the northern end of this phenomenon, but it is perhaps among the top three worst areas of the river experiencing bank erosion and collapse (C. Hanson, pers. comm. 2001; Fig.1). This area may be undergoing some natural erosion as well. Motorboats and jet skis are believed to further compound the problem by causing wave action. Loss of land and riparian vegetation along the riverbanks are the greatest impacts of erosion. The extent of the contribution of bank erosion and collapse to sediments and nutrients in the river and the lake are unknown.

Human population and structural density in this area is low (Fig.2H, 1997 Structural Density), and surrounding lands are still mainly used for farming and grazing. However, Foy's Bend is in the proximity of Kalispell and land subdivision is expected to happen within the next five years (S. How and G. Bissell, pers. comm. 2001). River frontage is in high demand for development. Floodplain regulations limit forest clearing and land use activities, but they are considered to be inadequate (G. Bissell, pers. comm. 2001). To date, bank erosion prevention techniques have had mixed results in the river. Further south along the river, the Flathead Conservation District is helping a landowner experiment with several bank erosion prevention techniques. The need for improving the connectivity of the riparian forests between Foy's Bend and the Flathead River Islands should be assessed.

Ecological Defensibility & Durability (High)
The area is relatively large (150 acres of wetland and 130 acres of farmland) and undeveloped. Water levels in the river may impact wetland functions. There is some connectivity with the Flathead River Islands, where there are several conservation easements and one protected area in place.

The long-term benefits of protecting the area include maintaining important wetland and floodplain functions, protection of the mature cottonwood forest and the numerous wildlife benefits they provide. A monitoring program could be easily established through the monitoring programs of the Montana Land Reliance and the Flathead Land Trust if a conservation easement is established in the area.

Cultural, recreational and aesthetic values (High)
The area is popular for hunting, fishing and boating. FWP has a fishing access on the south end of Foy's Bend on Lower Valley Road.

Protection and Restoration Efforts
The Flathead Land Trust, with the assistance of FWP, has initiated talks with one landowner (on the north section of the bend) to place a conservation easement on the wetlands and surrounding farmland

(approximately 250 acres). The landowner of the southern bend talked to Montana Land Reliance in the past about placing a conservation easement on the land.

Needs

- Stabilize banks.
- Educate watercraft operators about erosion caused by wave action created by motorboats and jet skiers in the river.
- Establish no-wake regulations to reduce wave action caused by jet skis and motorboats.
- Contact landowners: Landowners to the east and south of Foy's Bend have not been contacted by anyone in the past. Their interest and willingness to place conservation easements on their property are unknown.

Opportunities

- Protect wetlands and riparian corridors.
- Protect habitat used by species of concern (bull and cutthroat trout, bald eagle, waterfowl).
- Increase public access to the river.

Overlapping values:

- Floodplain functions
- Wetlands functions
- Riparian vegetation: mature cottonwood forest
- Unique landscape formations: sloughs
- Bald eagle nesting site, osprey nesting site, waterfowl production
- Bull and cutthroat trout migration corridor and winter sites
- Winter white-tailed deer habitat; beaver and river otter habitat.
- High scenic values

Feasibility (High)

The feasibility of protecting the wetlands and riparian corridor in Foy's Bend is *high*. The feasibility of preventing riverbank collapse is *low* at present, until better techniques or strategies become available. There is significant landowner support for placing a conservation easement in the area, covering most of the wetlands and riparian corridor on the north side of the bend. The Weaver Slough project augurs to open the door for conservation at other sites. Technical assistance by FWP can determine wildlife protection or enhancement needs (e.g. maintain winter habitat for native fish by protecting cover and minimizing land use impacts). Other potential partners for restoration of wetlands and riverbanks include Natural Resources Conservation Service, and the Flathead Conservation District.

Sources of information

Bissell, G. 2001. FWP. Personal Communication.
Casey, D. 2001. American Birds Conservancy. Personal Communication.
Flathead Lakers. 2001. Critical Lands Maps.
Flathead River Map. The Flathead River Partnership. Flathead Basin Commission. Kalispell, MT 39901.
Flathead Regional Development Office. Flathead County 100-year and 500-year Floodplain Maps
Hanson, C. 2001. Flathead Conservation District. Personal Communication.
How, S. 2001. Flathead Land Trust. Personal Communication.
Marotz, B. 2001. FWP. Personal Communication.
Montana Natural Heritage Program. 1/29/2002. *Land Ownership and Managed Areas of Montana.* Distributed by the Montana State Library, Natural Resources Information Service.
Muhlfeld, C.C. et al. September 2000. Montana Department of Fish, Wildlife and Parks. *Seasonal Distribution and Movement of Native and Non-native Fishes in the Upper Flathead River System, Montana*. Summary Report 1997-1999 to Bonneville Power Administration.
U.S. Forest Service, 1997 aerial photos.

3. Fennon Slough

Location

Fennon Slough is located on the Flathead River, immediately north of Highway 82 and Sportsman's Bridge (Fig.1). The wetlands, riparian habitat and farmland are privately owned.

Ecological significance

Water Quality (Sinks: Medium High; Sources: Medium High)
Fennon Slough has a surface water connection with the Flathead River, and it is located within the 100-year floodplain boundaries (Fig.2C, FEMA Flood plains). The area is surrounded by shallow groundwater (less than five feet deep, Fig.2E, Depth to Water Table). It has approximately 1,000 acres of riparian corridors and wetlands. One hundred and fifty acres of wetlands are protected by a conservation easement with the Flathead Land Trust (Fig.2D, Public Lands and Conservation Easements). Fennon Slough and surrounding wetlands and riparian vegetation provide important functions for water quality in the river, such as filtering of nutrients, water storage, and cooling of water temperatures.

Wildlife Habitat (High)
Fennon Slough is approximately one mile north of the Flathead Lake Waterfowl Production Area (WPA) on the north shore. From a wildlife habitat perspective, Fennon Slough can be viewed as an ecological unit, which includes Fennon and Johnson Sloughs, the wetlands and riparian corridor along the Flathead River (five miles north from Flathead Lake), and the Flathead Lake WPA. These areas provide excellent habitat for a number of wildlife species, especially those that benefit from aquatic vegetation found in the sloughs, and the mix of shrub and deciduous trees found in the riparian forests. The riparian forests are used by a wide variety of migratory waterfowl and songbirds. Ospreys, bald eagles, herons and Canada geese rely on both Fennon Slough and the Flathead Lake north shore. For instance, Fennon Slough is an important nesting and brood-rearing area for Canada geese, many of which then go to the north shore during their mid-summer molt, when the adults are flightless. Herons nesting at Fennon probably rely on north shore habitats for feeding. Migratory waterfowl move freely between the slough and the lake during fall and winter, and heavily use both Fennon and Johnson Sloughs for feeding. A bald eagle pair, which nested at Fennon Slough, moved to the north shore in 1985 after geese took over their nest.

The sloughs are important feeding areas for osprey nesting in the area. This area has the highest density of osprey and bald eagle nests on the mainstem of the Flathead River (Fig.1). There are approximately nine osprey nests in the proximity of Fennon Slough and several more on the Flathead Lake WPA. Several former osprey nests are now actively used by bald eagles. Common loons use the river during the spring and fall. Fennon Slough is also an important site for mallards, pintail, ruddy ducks, shovelers, pileated woodpeckers, kingfishers, and raptors. Bull and cutthroat trout are abundant in this stretch of the Flathead River. The slough has the potential to provide winter habitat for native fish since it is connected to the river by surface water. The remaining patches of riparian vegetation and wetlands along this section of the Flathead River provide important habitat for river otter and other wildlife as they travel along the river. These patches of riparian vegetation could be critical spots for wildlife along river sections that lack continuous riparian vegetation cover.

Urgency of Existing & Potential Threats (Medium High)
The natural formation of sloughs along the Flathead River may be reduced or temporarily arrested due to encroaching development. The western most section of the slough is protected by a conservation easement. The likelihood of development is estimated to be relatively low (ten or more years). However, farmland development and real estate values are rapidly increasing in the area. Present activities are a low threat to water quality. This could change with development in the proximity of the river. Subdivisions and urban development might lead to greater decline in water quality and especially loss of wetlands and riparian vegetation. Floodplain regulations apply to the slough. However, surrounding shallow groundwater areas, less

than five feet deep from the surface, are unprotected (Fig.2E, Depth to Water Table). Opportunities to protect intact wetlands and riparian corridors might be most effective while development threats are relatively low.

Bank erosion is one of the greatest threats to this stretch of the river. The high lake levels maintained by Kerr Dam cause soil saturation and loss of riparian vegetation on the river banks and the slough's shoreline. Erosion inside the slough is the landowners' main concern (Fig.1). They have put in some rock riprap to reduce erosion. Heavy sedimentation from bank erosion leads to degradation of water quality (increased turbidity, temperatures, nutrients and reduced oxygen levels). Hundreds of acres of riverbank are estimated to have been lost due to high water levels. Individual landowners are seeking compensation for lost acreage due to Kerr Dam operations.

Ecological Defensibility & Durability (High)
The area is open and relatively large, and it is associated with the Flathead Lake WPA on the north shore (Fig.2G & 2H, 1997 Road and Structural Density). About a mile of farmlands and Highway 82 separate Fennon Slough from the WPA. To the north, there is relatively good connectivity of riparian habitat up to the conservation easement held by NRCS' Wetlands Protection Program. A conservation easement held by the Flathead Land Trust covers the western most section of Fennon Slough, but it does not completely include all wetland habitat associated with the slough (Fig.2D, Public Lands and Conservation Easements). A thin strip of trees buffers the slough. Farming is the predominant land use surrounding the slough (Fig.2B, 1997 Land Cover).

To the north and south of Fennon Slough along the Flathead River, there are a few patches of wetlands and associated wetland and riparian vegetation. Connectivity among these patches is generally poor. Fragmentation on the west side of the river is mostly caused by farmland. On the east side of the river there are several cluster developments on the riverbank. The potential for restoration is better on the east side.

The long-term ecological benefits of a protection/restoration project in the area include: wetland, floodplain and riparian functions, protection of bull trout and cutthroat trout, bird habitat (including bald eagle, osprey and waterfowl winter and/or nesting habitat), and mixed habitats (which help transitional species), bank stabilization, and protection of the slough.

Cultural, recreational and aesthetic values (High)
The slough is located near prime agricultural soils. Landowners in the area are longtime family farmers and many are interested in maintaining open space and working farms. Fennon Slough is highly scenic and a popular canoeing and bird watching area.

Protection and Restoration Efforts
The Flathead Conservation District is conducting a demonstration project on one mile of bank along the Flathead River, north of Fennon Slough, to test various techniques for stabilization that might stop or reduce bank erosion and collapse. One conservation easement (Flathead Land Trust) protects approximately 156 acres of wetlands associated with the western most section of Fennon Slough. The Flathead Land Trust is discussing a restoration plan to address dying cottonwoods inside the slough. Natural Resources Conservation Service in Kalispell has a conservation easement on one property under the Wetlands Restoration Program (WRP).

Needs
- Stabilize banks.
- Educate watercraft operators about erosion caused by wave action created by motorboats and jet skies on the river.
- Establish no-wake regulations to reduce wave action caused by jet skis and motorboats.

Opportunities
- Protect wetland and riparian forests, and a variety of wildlife species dependent on these habitats.

- Protect nesting sites for bald eagles and ospreys.
- Protect productive farmland.

Overlapping values:
- Floodplain functions
- Wetlands functions
- Riparian vegetation: mature cottonwood forest
- Unique landscape formation: slough
- Bald eagle nesting site, use by osprey
- Bull and cutthroat trout pools and migration corridor
- Winter white-tailed deer habitat; beaver and river otter habitat; occasional use by bears
- Prime agricultural lands
- High scenic and recreational values

Feasibility (High)
There is general landowner interest in conservation, land parcels are still fairly large, and population density is low, except to the east of the river where there are several large housing developments.

Connectivity between the two properties with conservation easements (in Fennon Slough and NRCS' conservation easement) is good. The value of habitat protection between the slough and the north shore (WPA) should be evaluated in the future. One protection strategy proposed at present by the Flathead Land Trust is the purchase of conservation easements. The cost of purchasing a conservation easement in the Kalispell Valley can be as high as $2000/acre, unless the landowners have the capacity and interest to donate the easement. However, the owners of the island inside Fennon Slough have not shown interest in a conservation easement. The interest of landowners to the south is not known since they have not been approached. Other wetlands and riparian areas along the Flathead River are a greater priority for conservation, considering landowner and agency interest, and degree of development pressure.

The feasibility for increasing bank stabilization appears to be low. However, the bank stabilization demonstration project, conducted by the Conservation District on the bank of Flathead River north of Fennon Slough, might provide some useful designs.

Sources of information
Bissell, G. 2001. FWP. Personal Communication.
Casey, D. 2001. American Birds Conservancy. Personal Communication.
Flathead Lakers. 2001. Critical Lands Maps.
Flathead River Map. The Flathead River Partnership. Flathead Basin Commission. Kalispell, MT 39901.
Flathead Regional Development Office. Flathead County 100-year and 500-year Floodplain Maps.
FWP. Summary Report 1997-1999. Seasonal Distribution and Movement of Native and Non-native Fishes in the Upper Flathead River System, Montana. Prepared by Muhlfeld, C.C. et al. for Bonneville Power Administration. September 2000.
Hanson, C. 2001. Flathead Conservation District. Personal Communication.
How, S. 2001. Flathead Land Trust. Personal Communication.
Marotz, B. 2001. FWP. Personal Communication.
Montana Natural Heritage Program. 1/29/2002. *Land Ownership and Managed Areas of Montana.* Distributed by the Montana State Library, Natural Resources Information Service.
Rosario, A. 2001. NRCS. Personal Communication.
U.S. Forest Service. 1997 aerial photos.

4. Weaver Slough

Location
Weaver Slough is located north of Somers, south of the Flathead River and southeast of Kalispell (Fig.1). The area of concern also includes a stretch of Ashley Creek and surrounding farmlands. The wetlands and farmland are privately owned.

Ecological significance

Water Quality (Sinks: Medium High; Sources: Medium)
Weaver Slough is one of six naturally created oxbow lakes associated with the previous course of the Flathead River. A number of elongated wetlands are present between the slough and the lake, and most show signs of degradation from agricultural practices. Due to Kerr Dam operations, water levels in Weaver Slough rise about a foot in the spring and drop again in the fall. This fluctuation in water levels is not believed to have any negative impacts. Weaver Slough includes 200 acres, with approximately 150 acres of wetland/riparian habitat and five miles of shoreline (along the slough). The shoreline is in excellent condition and densely vegetated with emergent vegetation and native shrubs. The interior of the slough contains several pothole wetlands, and cottonwood and aspen forest stands. The riparian corridor along Ashley Creek, between Weaver Slough and the Fathead River, is in good condition and is widely used by a variety of wildlife species, including grizzly bears, mountain lions, migratory waterfowl and songbirds.

It is speculated that the wetlands may serve a filtering function similar to those found in Blasdel Waterfowl Production Area (WPA) to the south (J. Stanford, pers. comm. 2001). The WPA wetlands are thought to possibly function as discharge wetlands. Groundwater discharged into the wetlands evaporates leaving increased salinity concentrations in the wetland. Weaver Slough lies within the boundaries of the 100-year floodplain and depth to the water table varies between five and fifteen feet (Fig.2C, FEMA Flood plains and Depth to Water Table). Water exchange between the slough and the Flathead River occurs through Ashley Creek. Ashley Creek has been found to contribute high nutrient loads to the Flathead River (Stanford et al. 1997). It is therefore critical that wetlands and floodplain filtering functions be protected or restored if not fully functional.

Wildlife Habitat (High)
This portion of the Flathead Valley, south of Kalispell, is considered a high priority for conservation for wildlife. It is an important fly-way for migratory birds and a breeding area for several species of concern (Casey, 2000; Fig.1), including bald eagle, osprey, tundra swan and brown creeper. An intact strip of riparian and wetland vegetation around the slough provides important nesting habitat for birds and minimizes disturbances during critical migration periods. Other nearby sloughs lack this degree of protection, and waterfowl production in those areas has declined. It is an important site for Canada geese, mallards, pintail, ruddy ducks, shovelers, pileated woodpeckers and kingfishers. It supports abundant populations of beaver, muskrats, river otter, and mink, and provides year-round habitat for ring-necked pheasants, wild turkeys, Hungarian partridge, and white-tailed deer. The open space provided by the farms still supports valuable wildlife habitat.

Weaver Slough can be viewed as one ecological unit comprising the slough, some of the riparian corridor on Ashley Creek, and extending south towards the lake, partially including the Blasdel and Flathead Lake WPAs.

Urgency of Existing & Potential Threats (High)
There are few remaining sloughs in the area, and the river's ability to form new sloughs has been reduced by dams and development. Floodplain regulations apply to this area, but they are considered to be inadequate for protecting groundwater resources. Incompatible urban development surrounding the slough and Ashley Creek could potentially lead to water quality degradation of the river and lake. The wetland may partially filter some

of the excess nutrients before they reach the Flathead River. However, no data has been collected to determine the extent of the benefits this slough may provide for water quality protection.

The area is privately owned and mostly farmed, except on the wetlands. Water from the slough is regulated by two dikes and used for irrigation. Water removal does not appear to greatly affect water levels. There are presently four to five residences outside the slough, and none inside the slough. Increasing real estate values and population pressures in Flathead County are leading to the rapid loss of farmland to subdivision development. The likelihood of development in this area is estimated to be very high. Urban development, especially adjacent to the slough, is likely to lead to the degradation of the slough, wildlife habitat and water quality. House pets and vegetation removal would greatly impact this unique bird sanctuary.

Ecological Defensibility & Durability (High)
The area is open and large, and it is fairly well buffered in the interior by riparian vegetation. On the exterior, the slough has a dense riparian corridor that buffers the slough from agricultural impacts. Development is limited and disturbance to the slough appears to be relatively low.

The proposed conservation easements in Weaver Slough by the Flathead Land Trust would provide good connectivity between Weaver Slough, Blasdel WPA (approx. 423 acres) to the south, and the conservation easement to the north (approx. 172 acres). Further protection would be desirable to include the wetlands to the south. Most important from a water quality perspective would be to extend protection to the riparian corridor along Ashley Creek. Both the riparian corridor on the exterior of the Slough and along Ashley Creek would greatly benefit from restoration. However, restoration is not imperative to protect the existing functions provided by the slough, in particular for bird habitat. A program to monitor various protection or restoration efforts could easely be established in the area should a conservation easement be placed on the lands.

Cultural, recreational and aesthetic values (High)
The slough is located on prime agricultural soils. There is strong support by landowners to maintain open space and working farms. Farming is not only a lifestyle that local people cherish, but it also provides a local source of produce, open views and scenery important to both long-term residents and newcomers. Weaver Slough is a popular hunting and fishing area. Access, however, is limited and permission is given selectively by landowners.

Protection and Restoration Efforts
The Flathead Land Trust and FWP have received initial funds from USDA Farmland Protection Program, the Agriculture Heritage Program, and the Bonneville Power Administration, to place conservation easements on private lands in Weaver Slough and adjacent farmland to the east. Other federal and private funds are being sought to complete the conservation easements. Support for this project has been provided by several other organizations through letters of support. The Flathead Land Trust approached American Public Land Exchange for an interim loan to purchase a conservation easement from a farmer who is considering sale of its property.

Needs
- Secure funding to help purchase the proposed conservation easements. Several partners are needed to support the project in order to increase the chances of receiving funding.
- Secure immediate funding to prevent sale of land by one landowner.
- Protect the riparian corridor and wetlands to ensure that the existing connectivity is maintained. Protect the riparian corridor along Ashley Creek to protect both wildlife habitat and water quality.
- Research ecological linkages between the wetlands, riparian vegetation and Ashley Creek to understand the benefits, if any, provided by the wetland and riparian corridors towards maintaining or improving the water quality in Ashley Creek.

Opportunities
- Protect a unique landscape feature and protect wetland and floodplain functions.

- Protect significant waterfowl habitat.
- Protect productive farmland.
- Increase connectivity among protected areas. Landowners are willing to establish conservation easements.
- Demonstrate to the general public the potential to compensate farmers for conservation easements. There is general interest in the valley to see the results of this project. The conservation easements planned for Weaver Slough are expected to have a ripple effect from interested neighbors along the Flathead River.

Overlapping values:
- Floodplain functions
- Wetlands functions
- Functional riparian vegetation
- Unique landscape formation: slough
- Waterfowl production, high bird diversity and nesting density of Canada Geese
- Winter white-tailed deer habitat; beaver and river otter habitat Prime agricultural lands
- High scenic values

Feasibility (High)
A project to protect the slough and adjacent farmland with a conservation easement is already underway, led by the Flathead Land Trust and FWP. Federal funds are available that can be used to match private funds up to three to five times. Immediate assistance and support to this project would tremendously increase its probability of success.[1] There is significant landowner and community support. Restoration needs are limited to the riparian vegetation surrounding the slough and along Ashley Creek. Wetlands to the west and south might also need some restoration. They are not presently included in the project plans, and their contribution to wildlife habitat or water quality functions is unknown.

Sources of information
Bissell, G. 2001. FWP. Personal Communication.
Casey, D. 2001. American Birds Conservancy. Personal Communication.
Casey, D. Letter dated 3/22/01. Northern Rockies Coordinator for the American Bird Conservation, to potential funding partners for conservation easement projects on Weaver Slough.
Casey, D. 2000. Montana Bird Conservation Plan.
Casey, D. and M. Wood, 1987. Effects of Water Levels on Productivity of Canada Geese in the Northern Flathead Valley. Final Report. U.S. Dept. of Energy Bonneville Power Association.
Flathead Lakers. 2001. Critical Lands Maps.
Flathead Regional Development Office. Flathead County 100-year and 500-year Floodplain Maps
Flathead River Map. The Flathead River Partnership. Flathead Basin Commission. Kalispell, MT 39901.
FWP. Summary Report 1997-1999. Seasonal Distribution and Movement of Native and Non-native Fishes in the Upper Flathead River System, Montana. Prepared by Muhlfeld, C.C. et al. for Bonneville Power Administration. September 2000.
How, S. 2001. Flathead Land Trust. Personal Communication.
Montana Natural Heritage Program. 1/29/2002. *Land Ownership and Managed Areas of Montana.* Distributed by the Montana State Library, Natural Resources Information Service.
Sanford, J.A., Ellis, B.K. and Poole, G.C. 1997. Water Quality Data and Analyses to Aid in the Development of Revised Water Quality Targets for Flathead Lake, Montana. Phase I of a Cooperative Study to Determine Total Maximum Daily Loads for Nitrogen and Phosphorous. Flathead Lake Biological Station, The University of Montana, Polson, Montana.

[1] Since the initial evaluation of Weaver Slough for the Critical Lands Project, the Flathead Land Trust has successfully recruited the support of numerous agencies and organizations for the Weaver Slough Project. Based on the information gathered for the Critical Lands Project and presented in this report the Flathead Lakers have also provided their support to help ensure the success of this project.

U.S. Forest Service. 1997 aerial photos.

5. Upper Braided Area, Flathead River

Location
The Upper Braided Area of the Flathead River is located north of Flathead Lake, north of the Highway 35 bridge and south of Columbia Falls (Fig.1). The Flathead National Forest and the state (DNRC and FWP) own significant stretches of land in this braided area of the river.

Ecological significance
The Upper Braided Area refers to the braided section of the river north of the Flathead River Islands. While not as complex as the Flathead River Islands, it still includes several islands and small wetlands, gravel and sandbars.

Water Quality (Sinks: High; Sources: Medium)
The 100-year floodplain borders the river to the east and west (Fig.2C, FEMA Flood plain). To the west of the river, the shallow alluvial aquifer extends from the Flathead River to the Whitefish River. Groundwater exchange between the aquifer and the Flathead River is significant on this stretch of the river. Water movement is fast and nutrients are rapidly flushed from the shallow alluvial aquifer into the river (Noble and Stanford, 1986). Thus, pollution entering the shallow alluvial aquifer contributes to the pollution of the river and the lake. Protection of functional wetlands and riparian corridors along this stretch of the Flathead River, as well as on the shallow alluvial aquifer, is very important to filter nutrients and other pollutants.

To the west of this section of the Flathead River, the water table drops gradually from less than 5 feet to 15 and 25 feet, remaining mostly shallow north of Evergreen and south of Birch Grove Road (Fig.2E, The Depth to Water Table Map). To the east of the river, the groundwater table drops relatively fast from less than 5 feet to 20-25 feet around McWenneger Slough, and down to 50 feet to the north.[1] Nutrient filtering functions, provided by wetlands and the floodplain on the shallow alluvial aquifer, are critical for protecting water quality in the river and the lake.

Wildlife Habitat (High)
The Upper Braided Area of the Flathead River provides valuable wildlife and fish habitat. Bull and cutthroat trout use the river system for migration. One bull trout winter site was recorded near Eleanor Island (B. Marotz, 2001; Fig.1). Marotz indicated that there might be fewer winter sites in this section of the river than south of Old Steel Bridge because of faster river flows.

The river corridors also provide important year-round and/or breeding habitat for species of concern including several upland game birds and pheasants, as well as river otter, beaver and osprey. There is remarkably high bird diversity along the riparian corridor to the east of the river, extending from McWenneger Slough to the Presentine Fishing Access Site and including Fairview Marsh (Fig.1; D. Casey, pers. comm. 2001). Jackson, a graduate student at the University of Montana, recorded an osprey nest (Fig.1). Resource managers reported at least two additional bald eagle nests and one osprey nest. These nests will be confirmed by Jackson during the summer of 2002. This stretch of the river has two mature cottonwood stands and several young regenerating stands (Fig.1).

[1] The shift in the water table depth follows a shift in the soils from alluvium, gravel, sand, silt and clay to lacustrine sediments, fine sand and silt and clay overlain by dune sand.

Bissell, FWP, indicated that this stretch of the river has similar wildlife values throughout. However, the braiding in the river is more complex in the lower half of the Upper Braided Area and the riparian vegetation is wider.

Urgency of Existing & Potential Threats (Medium High)
Near the river, population, housing and road density are relatively low. However, development pressures are high northeast of Evergreen. The Housing and Road Density maps (Fig.2G & 2H) indicate high development pressures and impervious coverage in this area (east of Goodrich and Capistrano roads), as well as north of Eleanor Island (Kokanee Bend road). The riparian vegetation on the west side of the river is more disturbed, and the riverbank is exposed (vegetation cover lacking altogether) in several locations (Fig.1). This is due to the greater housing density and smaller land parcels found on the west side. However, there is still little unnatural erosion in this area. Groundwater contamination is of special concern as development increases to the west on the shallow alluvial aquifer. Floodplain regulations only partially protect the floodplain from development impacts. The 100-year floodplain boundaries do not include a large expanse of shallow groundwater areas to the west of the river (Fig.2C & 2E, FEMA Flood plain and Depth to Water Table).

Other major threats to the area include housing and commercial development to the west (septic systems, dogs, runoff), tree removal and gravel mining. Land subdivision and development to the east of the river are not imminent. However, development would degrade large intact riparian forests and high quality wildlife habitat. Other negative impacts of land use activities include past river alterations (e.g. dikes) and water temperature fluctuations (caused by Hungry Horse Dam). Water temperature fluctuations have been successfully modified to reduce impacts on bull and westslope cutthroat trout (B. Marotz, pers. comm. 2001).

Ecological Defensibility & Durability (High)
The Upper Braided Area is well forested and generally undisturbed. There is excellent connectivity and the hydrologic regime is highly functional. The U.S. Forest Service, DNRC and FWP own several land parcels (Fig.2D, Public Lands and Conservation Easements). There is one conservation easement between McWenneger Slough and the Flathead River.

Restoration needs in this portion of the Flathead River are low. Revegetation of four or five small bank stretches, between ¼ and ½ mile long, on the west side would be beneficial. However, conservation efforts should be focused on protection of existing riparian corridors, wetlands and sloughs and the associated shallow alluvial aquifer. Groundwater monitoring and weed management are needed. Some wildlife monitoring in the area is already conducted by FWP.

The long-term ecological benefits of protection and restoration projects in the area include: wetland, floodplain and riparian functions, connectivity of the riparian forests along the Flathead River, protection of the river's natural hydrologic regime, protection of bull and cutthroat trout winter habitat and migration corridor, protection of unique and productive wildlife habitats for semi-aquatic furbearers, bald eagles, osprey, neo-tropical migrants, and other non-game wildlife. Other benefits of special interest to the local communities include increased recreational benefits, public access, protection of open space and aesthetic values.

Cultural, recreational and aesthetic values (Medium High)
This stretch of the river is very scenic, open and quiet, and it provides numerous recreational opportunities for the local communities. The area is used for hunting fishing, bird watching and boating. FWP has several fishing access sites, including Presentine and Kokanee Bend.

Protection and Restoration Efforts
There are ongoing efforts to place a conservation easement on lands adjacent to McWenneger Slough.
The management objectives of the Flathead National Forest, DNRC and FWP are to enhance the riparian vegetation, wildlife diversity, water quality and fisheries.

Needs

- Discourage destruction of intact riparian vegetation, and development on wetlands and islands.
- Inventory noxious weeds and weed management.
- Extend protection of the riparian vegetation and shallow groundwater areas to the west, on the shallow alluvial aquifer. Impacts on groundwater, including mining, incompatible development and wetland degradation, will directly impact the quality of the water in the Flathead River and Flathead Lake.

Opportunities

- There are no ongoing projects in this area that would benefit from immediate support.

Overlapping values:

- Floodplain functions
- Riparian vegetation: two mature cottonwood forests; young regenerating riparian forests.
- Wetland functions
- Unique landscape formations: sloughs, river islands
- Osprey and bald eagle nesting sites
- Bull and cutthroat trout migration corridor and winter site
- Winter white-tailed deer habitat
- High bird diversity
- High scenic and recreational values

Feasibility (Medium)
Landowner and agency interest in conservation projects in the area is presently unknown. There is some interest by farmers to place their land in conservation easements if compensation for lost development rights is available. Agencies and organizations working in the area (e.g. FWP, FLT, MLR) have the capacity to implement protection and restoration projects, in particular conservation easements and wildlife enhancement projects. Other agencies and organizations that may be recruited to help include NRCS (riparian and wetland protection/restoration), DNRC, FNF, Flathead County and Flathead Lakers, among others. The cost of land in this area will undoubtedly increase over time as development expands along U.S. Highway 2. However, it is still not as prohibitive as on Flathead Lake shoreline or closer to Kalispell.

There is little political support at this time from Flathead County Commissioners to restrict urban development in the proximity of the city. Government and landowner support needs to be expanded for potential conservation projects in this area.

Sources of information

Bissell, G. 2001. FWP. Personal Communication.
Casey, D. 2001. American Birds Conservancy. Personal Communication.
Flathead Lakers. 2001. Critical Lands Maps.
Flathead Regional Development Office. Flathead County 100-year and 500-year Floodplain Maps
Flathead River Map. The Flathead River Partnership. Flathead Basin Commission. Kalispell, MT 39901.
FWP. Summary Report 1997-1999. Seasonal Distribution and Movement of Native and Non-native Fishes in the Upper Flathead River System, Montana. Prepared by Muhlfeld, C.C. et al. for Bonneville Power Administration. September 2000.
Greenlee, J.T. 1998. Ecologically Significant Wetlands in the Flathead, Stillwater and Swan River Valleys.
How, S. 2001. Flathead Land Trust. Personal Communication.
Marotz, B. 2001. FWP. Personal Communication.
McCallister, H. 2002. Department of Natural Resources Conservation. Personal Communication.
Montana Natural Heritage Program. 1/29/2002. *Land Ownership and Managed Areas of Montana.* Distributed by the Montana State Library, Natural Resources Information Service.

Nobel, R.A., and Stanford J.A. 1986. Groundwater Resources and Water Quality of the Unconfined Aquifers in Kalispell Valley, Polson, Montana. Montana Bureau of Mines and Geology Open File Report No. 177. Open File Report 093-86, Flathead Lake Biological Station, The University of Montana, Polson, Montana.
U.S. Forest Service. 1997 aerial photos.

6. Egan Slough

Location
Egan Slough is located north of Flathead Lake next to the Flathead River, and east of Monford Road. It is privately owned.

Ecological significance

Water Quality (Sinks: Medium High; Sources; Medium Low)
Egan Slough is a large oxbow formed by the Flathead River. It presently has a managed dike connection with the river. Water levels in the slough do not fluctuate with the river, but are managed by the private landowners cooperatively. The 100-year floodplain (FEMA) regulations apply to the slough (including the interior), and the lands to the southeast between the slough and Goose Bend. The Depth to Water Table Map (Fig.2E) shows the water table to be very shallow, less than five feet, around the slough and to the east. To the north and west the water table drops quickly to 20-25 feet.

Wildlife Habitat (Medium High)
Egan Slough has good examples of deep and shallow marsh and aquatic plant communities. These have been described by the Natural Heritage Program (Greenlee, 1998), and listed, as moderately significant, among the 54 most ecologically significant wetlands in the Flathead, Stillwater and Swan river valleys in the Natural Heritage Program report.[1] Four rare plants are found at this site: pygmy water lily (*Nymphaea tetragona*), Columbia water meal (*Wolffia columbiana*), water clubrush (*Scirpus subterminalis*), and water star-grass (*Heteranthera dubia*). An 80-acre aspen/snowberry community (*Populus tremuloides/Symphoricarpos albus*) on the north island is one of few stands like it in the valley. This stand supports a high density of cavity-nesting birds.

Egan Slough is rich in wildlife and bird species. It provides breeding habitat for migratory waterfowl. This area can be grouped together as one ecological unit with Church Slough, Half Moon Slough, and the adjacent wetlands complex along the Flathead River (G. Bissell, pers. comm. 2001). Wildlife species benefit from this conglomerate of sloughs and wetlands.

Urgency of Existing & Potential Threats (Medium High)
There are few remaining sloughs in the area, and the river's ability to form new sloughs has been reduced by development. The lands inside and surrounding the slough are used for agriculture and pasture, and water from the slough is used for irrigation. One 80+acre farm on the interior island of the slough was subdivided into approximately 20 and 40-acre lots and sold over the last five years. All mature cottonwoods and ponderosa pine trees in this parcel (including some on the slough's shoreline) were harvested prior to the subdivision. The landowner of the aspen/snowberry forest on the island was approached by a logger but has declined the offer at present.

Agricultural runoff may be the greatest contributor to nutrient loads. Whether this is contributing to greater eutrophication of the water in the slough is unknown. There are four residences inside the slough area and at least a dozen on the outside, mainly on the west side adjacent to the slough. Further from the slough (one mile radius), development rapidly increases and land has been subdivided into smaller parcels. Adjacent to the slough, present landowners actively farm and are interested in maintaining the agricultural character of the

[1] Egan Slough, McWenneger Slough and the Flathead River Islands were selected among the most ecologically significant wetlands in the Flathead River corridor.

area, but there is no zoning to ensure that this happens. Development adjacent to the slough is estimated to be between five and ten years away or more, but that could change rapidly (G. Bissell, pers. comm. 2001; S. How, pers. comm. 2001). Floodplain regulations apply to the slough and the lands to the southeast, but they do not prevent development on shallow groundwater areas or removal of riparian vegetation. Development impacts on water quality are probably mostly localized, although development inside the slough and on the floodplain (to the southeast) may contribute to degradation of the water in the river and lake.

A wetland on the southeast end of Egan Slough was drained in the past and is presently farmed. One landowner assessed the potential for restoring this wetland about ten years ago with the assistance of the Natural Resources Conservation Service (NRCS) in Flathead County. While restoration of the wetland would be relatively easy, efforts were dropped due to concerns over impacts on a neighbor to the east. Insufficient compensation may also have been an issue.

Present and past grazing impacts can be observed on the aspen/snowberry forest (on the north end), on the cottonwood/red-osier dogwood forest community (on the south end, between the slough and the river), and on the temporarily flooded wet meadow community on the margins of the slough. The meadow community is dominated by exotic pasture grasses. A number of exotic plants (Reed canary grass, Houndstongue, Canada thistle, Sow thistle, Common mullein) and bird species (Gray partridge, Ring-necked pheasant, European starling, House sparrow) threaten native communities (Greenlee, 1998).

Ecological Defensibility & Durability (High)
The southern most section of Egan Slough and adjacent wetlands to the southeast along the Flathead River (approx. 683 acres) are under a conservation easement donated to The Nature Conservancy (Fig.2D, Public Lands and Conservation Easements). Other conservation easements in the area are on farmland half a mile to the northwest of the slough (approx. 129 acres), and about two miles to the south, north of Weaver Slough (approx. 172 acres). A thin strip of trees along the banks buffers the slough, especially on the west side. On the east side, the slough generally lacks a natural vegetation buffer (Fig.1). Regeneration of the riparian corridor appears to be greatly reduced in areas that were heavily grazed in the past. Farming is the predominant land use inside the slough and on surrounding lands. Most wetlands in the proximity of Egan Slough along the Flathead River have riparian vegetation associated with them. Connectivity among these is relatively poor and fragmentation is generally caused by farming. However, the potential for riparian restoration is good because of the low human population density. On the east side, population density is estimated to be among the lowest in the North Flathead Valley (0.1-5 persons/sq. mile). Inside the slough and to the west, population density is relatively low (5-50 persons/sq. mile).

The long-term ecological benefits of protection and restoration projects in the area include: wetland, floodplain and riparian functions, improvement of waterfowl habitat, protection of a unique oxbow/slough formation on the Flathead River, protection of good agricultural soils and a unique aspen/snowberry community.

Cultural, recreational and aesthetic values (Medium High)
The slough is on prime agricultural soils and its water is used for irrigation. Waterfowl hunting and fishing occur in the slough and surrounding farmland. Access to the slough is limited but permission to access the shoreline is generally granted by landowners. Arrowheads from native tribes were found in the area in the past.

Protection and Restoration Efforts
The Nature Conservancy holds a conservation easement on the southern most section of Egan Slough, and the wetlands complex along the Flathead River.

FWP approached the landowners of the aspen/snowberry island on Egan Slough several years ago, but no protection contract was negotiated at the time. In this particular case, protection of the forest may require

removal of cattle grazing. Neighbors say the landowners would probably be interested in purchase of development rights if compensation for lost grazing benefits was provided.

Restoration of the dredged wetland was considered a few years ago. NRCS' wetland restoration program did not seem appropriate at the time, and potential flooding impact on the neighbors was a major concern, leading to abandonment of the project.

Landowners on the eastern border of the slough are interested in restoring the drained wetlands (impact on neighbors is still a concern) and the riparian vegetation that was removed by past grazing along the eastern bank of the slough. Some past bank revegetation efforts (mid 90s) by the landowners failed due to deer browsing.

Recently, landowners on the east side explored the possibility of establishing neighborhood zoning. The landowners were told by Flathead County that zoning was not possible until a new Growth Plan was approved.

Needs

- Improve grazing management, fence-off shoreline and riparian vegetation.
- Manage exotic plants.
- Restore cottonwood and ponderosa pine forest in island inside slough.
- Restore riparian corridor on the east and west banks of the slough.
- Determine farming impacts on water quality and management alternatives.
- Protect and restore (grazing management) the aspen/snowberry forest.

Opportunities

- Protect wetland and rare aspen/snowberry forest on the north end of the slough.
- Protect productive farmland from development. On the east side there are at least three landowners who are willing candidates for conservation easements (with compensation for lost value). Landowners are also interested in zoning for agriculture.
- Restore waterfowl habitat

Overlapping values:

- Floodplain functions
- Wetland functions
- Riparian vegetation: cottonwood/red-osier dogwood forest & aspen/snowberry community (regionally rare)
- Unique landscape formation: slough
- Bald eagle and osprey foraging
- Winter white-tailed deer habitat; beaver and river otter habitat; occasional use by bears
- Prime agricultural lands
- Potential tribal cultural values
- High scenic values

Feasibility (Medium or Medium High)
Land parcels are still fairly large, population density on the east side is among the lowest in the North Flathead Valley (0.1-5 persons/sq. mile), and landowners adjacent to the slough are interested in maintaining open space and working farms. Riparian and wetland restoration attempts were made in the past by landowners. A group of landowners on the east side of the slough is interested in neighborhood (agricultural) zoning. This initiative appears to be dependent on the approval of Flathead County's growth plan. Several landowners are waiting to see the results of the Weaver Slough project and whether farmers will be

compensated for giving up development rights. If compensation is available, several farmers appear to be interested in placing conservation easements on their lands.

There are several good opportunities to protect and restore critical lands in Egan Slough. There appears to be general landowner interest to maintain farming practices and open space. However, many of the landowners depend on the land for their livelihood and could not donate conservation easements.

There are a number of government programs sponsored by USDA, NRCS, FWP and USFWS that could be applied to this area, in particular the larger wetlands, riparian corridors and the waterfowl production area.

Sources of information

Bissell, G. 2001. FWP. Personal Communication.
Casey, D. 2001. American Birds Conservancy. Personal Communication.
Flathead Lakers. 2001. Critical Lands Maps.
Flathead River Map. The Flathead River Partnership. Flathead Basin Commission. Kalispell, MT 39901.
Flathead Regional Development Office. Flathead County 100-year and 500-year Floodplain Maps.
Greenlee, J.T. 1998. Ecologically Significant Wetlands in the Flathead, Stillwater and Swan River Valleys.
How, S. 2001. Flathead Land Trust. Personal Communication.
Marotz, B. 2001. FWP. Personal Communication.
Montana Natural Heritage Program. 1/29/2002. *Land Ownership and Managed Areas of Montana.* Distributed by the Montana State Library, Natural Resources Information Service.
Rosario, A. 2001. NRCS. Personal Communication.
U.S. Forest Service. 1997 aerial photos.
Waller, A. 2001. Landowner & wildlife biologist. Personal Communication.

7. McWenneger Slough

Location

McWenneger Slough is located northeast of Kalispell and east of Evergreen, on the east side of the Flathead River north of Highway 35. The wetlands and farmland are all privately owned.

Ecological significance

Water Quality (Sinks: Medium High; Sources: Low)

McWenneger Slough, an oxbow lake of the Flathead River, is a magnificent complex of wetlands and riparian forests and a unique example of a slough formed by previous changes in the course of the river. The significance of the area for protecting water quality is relatively high, in particular to maintain wetland and floodplain functions. There are 300 acres of functional wetlands and riparian forests associated with the slough. The depth to the water table is about 20-25 feet in this area (Fig.2E, Depth to Water Table) and water levels in the slough are not affected by Kerr Dam operations.

Wildlife Habitat (High)

McWenneger Slough is eutrophic/mesotrophic and is rich in plant diversity. The Natural Heritage Program listed McWenneger as moderately significant, among the top 54 most ecologically significant wetlands in the Flathead, Stillwater and Swan River valleys (Greenlee, 1998). NHP recorded a number of rare plant species in this site, and an unusually high diversity of pondweed (*Potamogeton sp.*) species.[1] The area holds particular value for wildlife. It has rich diversity of bird species and it is important for migratory waterfowl (Fig.1).[2]

[1] Despite the name, Pondweed species are native plants and not a weed.

[2] McWenneger Slough, Egan Slough and the Flathead River Islands were selected among the most ecologically significant wetlands in the Flathead River corridor.

The area can be viewed as part of a larger ecological unit including Shaw's Slough and the Upper Braided Area of the Flathead River, from Highway 35 north about 4.5 miles. This stretch of the river is well buffered by continuous riparian cover. The vegetation on the east side of the river hosts a rich diversity of bird species (see Upper Braided Area, Flathead River, p.37). Fish Wildlife and Parks documented the high species richness and importance of McWenneger Slough to wildlife in the 1980s as part of studies on the effects of Kerr Dam. McWenneger and the riparian corridor to the east of the braided area of the river provide important summer habitat for common loons, trumpeter swans, neo-tropical migrants and resident birds such as pileated woodpeckers and kingfishers, as well as nesting sites for Canada geese (Casey, D. and M. Wood, 1987). They also support abundant populations of beaver, river otter, muskrat, and mink as well as year-round habitat for ring-necked pheasants, wild turkeys, and white-tailed deer. There is one known mature cottonwood forest and an active osprey nest in McWenneger Slough (Fig.1).

Urgency of Existing & Potential Threats (High)
McWenneger Slough is considered to be fairly unique and fragile. There are few remaining sloughs in the area, and the river's ability to form new sloughs has been reduced by development. Floodplain regulations apply to this area (Fig.2C, FEMA Flood plain), but they may not be adequate for protecting groundwater. The area is privately owned and it is mostly farmed, except for the wetlands. Water skiers have been observed since the 1990s and may be responsible for creating an open gap in the vegetation of the slough. Despite this recreational use by water skiers, exotic species do not appear to have been introduced into the slough. Increasing real estate values and population pressures in the area are leading to subdivision and development of farmlands at a rapid pace. The likelihood of development in lands surrounding the slough is estimated to be very high.

The Flathead Land Trust believes that adjacent landowners would be willing to put a conservation easement on their land if funding was available to compensate them for lost development rights. Development is occurring to the north, on the upper ridge, but it is unlikely to impact riparian values. There are no known immediate restoration needs.

Ecological Defensibility & Durability (High)
The area is open, large, and appears to be generally undisturbed. There is also relatively good connectivity with the riparian corridor on the Flathead River (Fig.2G & 2H, Road and Housing Density maps). There is one conservation easement in the proximity, between McWenneger Slough and the Flathead River (approx. 106 acres). The Flathead National Forest administers land to the north on more than two miles of the Flathead River's Upper Braided Area. Protection of the riparian corridor is important to maintain connectivity between the river corridor, wetlands and sloughs.

McWenneger Slough is heavily farmed and grazed to the north and south. Highway 35 creates a barrier to the south and may be arresting natural processes, such as expansion of the vegetation and water flows. Most of this river corridor is in good condition and restoration needs are low. Conservation efforts should be geared towards protection of existing riparian corridors, wetlands and sloughs and the associated floodplain. A program to monitor protection and restoration efforts could easily be established in the area linked to a conservation easement.

The long-term ecological benefits of protection and restoration projects in the area include: wetland, floodplain and riparian functions, connectivity of riparian habitat along the Flathead River corridor, protection of habitat rich in bird diversity, waterfowl migration corridor, and protection of a unique oxbow/slough formation on the Flathead River.

Cultural, recreational and aesthetic values (High)
Landowners are interested in maintaining open space and productive farmland. McWenneger Slough is also a popular hunting and fishing area. Access to the slough is limited because it is privately owned, and permission is selectively given by landowners. The scenic beauty of this area is high.

Protection and Restoration Efforts
The American Farmland Trust is expected to purchase the eastern side of the slough - a total of 600 acres which includes 300 acres of wetlands - and resell it with a conservation easement on it. Support for this project has been provided by several organizations through letters of support. FWP is working on an upland game enhancement project to the west, on Shaw Slough.

Needs
- Support from numerous agencies and organizations to increase the chances of receiving funding for conservation projects.
- Protect riparian corridor and wetlands to ensure that existing connectivity of protected areas is maintained. Connectivity between existing protection efforts along the river should be encouraged.
- Monitor the impacts of farming and recreational uses on the aquatic plant communities and potential introduction of exotic species.

Overlapping values:
- Floodplain functions
- Wetland functions
- Good riparian vegetation
- Unique landscape formation: slough
- High bird diversity and nesting density of Canada Geese
- Bald eagle and osprey foraging
- Winter white-tailed deer habitat; beaver and river otter habitat
- High scenic values

Feasibility (High)
The proposed purchase and conservation easement on McWenneger Slough is relatively secure and underway. Further assistance would be critical to expand protection to adjacent lands.

The complementary wildlife and farming values in the area provide an opportunity for land trust organizations and wildlife groups and agencies to work together with local farmers. There is significant landowner and community support. Present landowners (contacts known to Flathead Land Trust and FWP) are interested in maintaining open space and working farms. However, funds may be needed to assist landowners in the purchase of conservation easements.

Wetlands and riparian vegetation are still in good condition, and restoration needs are limited to a few areas close to the Flathead River, where development pressure from the Evergreen community is felt on the riverbanks.

Sources of information
Bissell, G. 2001. FWP. Personal Communication.
Casey, D. 2001. American Birds Conservancy. Personal Communication.
Casey, D. and M. Wood, 1987. Effects of Water Levels on Productivity of Canada Geese in the Northern Flathead Valley. Final Report. U.S. Dept. of Energy Bonneville Power Association.
Flathead Lakers. 2001. Critical Lands Maps.
Flathead Regional Development Office. Flathead County 100-year and 500-year Floodplain Maps.
Flathead River Map. The Flathead River Partnership. Flathead Basin Commission. Kalispell, MT 39901.
Greenlee, J.T. 1998. Ecologically Significant Wetlands in the Flathead, Stillwater and Swan River Valleys.
How, S. 2001. Flathead Land Trust. Personal Communication.
Marotz, B. 2001. FWP. Personal Communication.
Montana Natural Heritage Program. 1/29/2002. *Land Ownership and Managed Areas of Montana.* Distributed by the Montana State Library, Natural Resources Information Service.
U.S. Forest Service. 1997 aerial photos.

8. Columbia Falls, CFAC Land

Location
The area extends from the Highway 2 bridge and the Montana Department of Fish, Wildlife and Parks (FWP) Teakettle fishing access site to the South Fork branch of the Flathead River, and includes State Trust Lands, Columbia Falls Aluminum Company (CFAC) lands, and private lands.

Ecological significance

Water Quality (Sinks: Medium High; Sources: Low)
The area has several hundred acres of cottonwood riparian forests and wetlands. The floodplain area associated with the river is highly functional (Fig.2C, FEMA Flood plain. FEMA boundaries follow the river contour and include wetlands and one-quarter to one-third of a mile of forest corridor along the south bank of the river). A complex of wetlands to the southwest, north of FWP Teakettle fishing access site, extends one mile from State Trust lands (DNRC) on the west of the Flathead river to the east. The wetland furthest east is heavily impacted by farming.

Wildlife Habitat (Medium)
Historically, bull and cutthroat trout spawned in the area and bald eagles used this area heavily in late fall during salmon spawning in the river. Bald eagles still winter in the area. Presently, bull and cutthroat trout use the river as a migration corridor. In winter, they also use a number of deep pools found along this stretch of the river. Several of these are associated with the wetland on State Trust lands. Elk use the riparian forest, but there is no stable elk population found in the area since they are readily hunted (potentially a positive value for local hunters if it does not adversely affect elk populations).

Urgency of Existing & Potential Threats (Medium High)
There are no apparent immediate threats, but potential threats are relatively high. Most of the riparian forests to the south of the river are privately owned by CFAC. Should the aluminum company shut down, the land might go up for sale. While this is not expected to happen, subdivision of the land and increasing real estate prices would make protection more difficult in the future. Subdivision and development would threaten the floodplain and wetland functions, as well as the integrity of this large cottonwood riparian forest. Floodplain regulations do not adequately protect the area. Currently, there are no known significant water pollution sources.

Ecological Defensibility & Durability (Medium High)
The area is a large open forest with a functional floodplain, wetlands and good riparian cottonwood stands. There is good connectivity at present with Flathead National Forest lands to the northeast and southeast, and State Trust and FWP lands to the southeast, except for some fragmentation caused by Highway 2 - bordering and crossing the Flathead River. There is also some loss in the connectivity of the riparian corridor along the Flathead River (1.5 miles south of State Trust Lands). To the north, the river is designated a Wild & Scenic River which regulates certain activities along the river. FWP monitors this area as part of the native fisheries recovery program. There is no other protection or recovery program in the area. If a conservation easement was established in the area, the land trust could provide some monitoring of the riparian corridor and wetlands for potential land use impacts.

Cultural, recreational, aesthetic values (Medium)
Fishing, boating, open space and scenic views are important assets for the local community. Culturally, the river was and still is a significant cultural resource for the Salish and Kootenai Tribes.

Protection and Restoration Efforts
FWP recently rehabilitated the banks of Taylor Slough, on the south end, to restore trout spawning areas.

FWP monitors the population and movement of bull and westslope cutthroat trout for the native fisheries recovery program.

Needs

- Approach CFAC and other landowners to determine their plans for the land.

Opportunities

- Protect area since there is only one large landowner to work with.
- Protect large functional riparian corridors.
- Protect wetlands.
- Protect good functional floodplain.

Protection of intact riparian vegetation and wetlands would be less costly than future restoration efforts. Floodplain and wetland regulations are not sufficient to protect the integrity of these resources. There are no good incentives at the state or county level to prevent deforestation of the riparian corridor.

A conservation easement on CFAC lands, specifically targeting the riparian corridor, wetlands and floodplain, may be the most feasible protection strategy if the company is amenable to this approach.

Overlapping values:

- Functional floodplain
- Functional wetlands
- Functional riparian vegetation
- Bull and cutthroat trout migration corridor and habitat
- Bald eagle winter site
- Historic spawning area and bald eagle nesting site
- Historic significance for the Tribes
- High scenic values

Feasibility (Low/unknown)

The feasibility of a project in this area did not rank high, probably because:

1) We are not aware of any community groups or landowners that are concerned with the future of these lands, or the loss of floodplain, wetland or riparian functions. Further inquiries should be conducted to evaluate this.
2) Agencies and organizations such as FWP and land trusts are presently more interested in protection of sloughs, wetlands, islands and open farmland in the valley area south of Kalispell.

Costs for protection of the area can be expected to be relatively low. There are little or no restoration needs, connectivity and size of the area are good, and the area is mostly owned by one large corporation. The probability of success is unknown.

Sources of information

Bissell, G. 2001. FWP. Personal Communication.
Casey, D. 2001. American Birds Conservancy. Personal Communication.
Flathead Lakers. 2001. Critical Lands Maps.
Flathead Regional Development Office. Flathead County 100-year and 500-year Floodplain Maps.
Flathead River Map. The Flathead River Partnership. Flathead Basin Commission. Kalispell, MT 39901.
FWP. Summary Report 1997-1999. Seasonal Distribution and Movement of Native and Non-native Fishes in the Upper Flathead River System, Montana. Prepared by Muhlfeld, C.C. et al. for Bonneville Power Administration. September 2000.
Marotz, B. 2001. FWP. Personal Communication.
U.S. Forest Service. 1997 aerial photos.

Bibliography and References

Arnold, Jr., C.L. and C.J. Gibbons. Spring 1996. *Impervious Surface Coverage. The Emergence of a Key Environmental Indicator*. Journal of the American Planning Association, Vol. 62, N.2. APA, Chicago, IL.

Bissell, G. 2001 & 2002. Habitat Conservationist/Wildlife Biologist, Montana Department of Fish, Wildlife & Parks. Personal communication, Summer 2001; Written communication, 2002.

Brooks, K. N., P.F. Folliott, H.M. Gregersen, and L.F. DeBano. 1997. *Hydrology and the Management of Watersheds* 2nd ed. Ames: Iowa State University Press.

Brown, K. Housing Density and Urban Land Use as Indicators of Stream Quality. Technical Note #116, from *The Practice of Watershed Protection*, editors Thomas R. Schueler and Heather K. Holland, published 2000 by the Center for Watershed Protection, Ellicott City, MD.

Carlson, J. 2001. Coordinator, Montana Animal Species of Concern Committee. Montana Animal Species of Concern. Montana Natural Heritage Program and Montana Fish, Wildlife and Parks, Helena, MT. 12 pp. http://nhp.nris.state.mt.us/

Casey, D. and M. Wood. 1987. Montana Department of Fish, Wildlife and Parks. *Effects of Water Levels on Productivity of Canada Geese in the Northern Flathead Valley*. Final Report to Bonneville Power Administration. 208pp.

Casey, D. 2001. Coordinator, Northern Rockies Bird Conservation Region. Personal communication.

Census Bureau website. Montana Census web page: www.census.gov/datamap/www/30.html.

Citizens for a Better Flathead. 2/12/2000. *Background Documents: Kalispell Growth Policy Plan, 1998 and 1999.* Compiled for the 1/3/99 Kalispell City Council Meeting. Kalispell, MT.

Citizens for a Better Flathead, Summer 2000. *Striking the Roots of Sprawl: A Look at Economic and Government Policies that Feed Sprawl*. Kalispell, MT.

Confederated Salish and Kootenai Tribes. 1999. W*etlands Conservation Plan for the Flathead Indian Reservation, Montana*. Prepared by M. Price for the Environmental Protection Agency, Region 8.

Confederated Salish and Kootenai Tribes. 1996. *Comprehensive Resources Plan*. Vol. 1, *Existing Conditions*. 1994, Revised 1996. Revised 2001.

Confederated Salish and Kootenai Tribes. 1996. *U.S. Highway 93: Land Use and Growth Projections Study.* Prepared by Janet Camel.

Connecticut River Joint Commission. 2000. *Guidance for Communities Fact Sheet No. 7*. Riparian Buffers for the Connecticut River Watershed Series. www.crjc.org

Cooper, S.V., J. Greenlee and C. Jean. 2000. *Ecologically Significant Wetlands in the North Flathead River Watershed.* Report to the Montana Department of Environmental Quality. Montana Natural Heritage Program, Helena, MT. 31 pp. plus appendices.

Critical Lands Evaluation Forms. 2001. Flathead River Islands, Foy's Bend, Fennon Slough, Weaver Slough, McWenneger Slough, Egan Slough, Upper Braided Area/Flathead River and Columbia Falls/ CFAC Land. Flathead Lakers, Polson, MT.

Dahl, A. 2002. Swan Ecosystem Center. Personal communication.

DEQ. See Montana Department of Environmental Quality.

Ducharme, L. 2000. *Flathead River Sub basin Summary*. Draft, prepared for the Northwest Power Planning Council.

Eaton, A. 2002. Glacier Flathead Director of the Montana Land Reliance, Personal communication.

Edwards, R.T. 1998. The hyporheic zone, pp. 399-429 in R.J. Naiman & R.E. Bilby, *River Ecology and Management*. Springer Verlag, New York.

Ellis, B. K., J. A. Craft and J. A. Stanford. 2000. *Monitoring water quality in Flathead Lake, Montana: 2000 Progress Report*. Open File Report 158-00. Flathead Lake Biological Station, The University of Montana, Polson, MT. 30 pp.

Ellis, B. K. 2001. Senior Researcher, Flathead Lake Biological Station, University of Montana. Personal communication.

Environmental Protection Agency. 1983. *Flathead River Basin Environmental Impact Study Final Report*.

Environmental Protection Agency. 2002. *Protecting and Restoring America's Watersheds. How is the Watershed Approach Working*. Chapter 4. What Can be Done to Improve Progress? www.epa.gov/owow/protecting/chap4.html

Flathead Basin Commission. 2001. *Letter from VNRS Coordinator to the Flathead Basin Monitoring Committee*. Meeting 12/18/01 - Groundwater Monitoring Plan Development Notes.
Flathead Basin Commission. *Biennial Report.* 1999-2000. Kalispell, MT. www.montanaweb.com/fbc
Flathead Conservation Roundtable. 2002. Draft Flathead Stewardship Index.
Flathead County, Montana, proposed Master Plan Update. 1994. White Paper Report "Ecosystem Management."
Flathead County. 1994. Noxious Weed Management Plan. Kalispell, MT.
Flathead Lakers. 1999. *Critical Lands Workshop Report*.
Flathead Lakers. 2001. *Critical Lands Workshop Report*.
Flathead Regional Development Office. Flathead County 100-year and 500-year Floodplain Maps.
Flathead Regional Development Office. Flathead County. *Floodplain and Floodway Management Regulations*. Amended 1991.
Flathead County. 1987. *Master Plan Amended 1996*. Kalispell, MT.
Flathead River Map. The Flathead River Partnership. Flathead Basin Commission. Kalispell, MT 39901.
Frissell, C.A. J.T. Gangemi and G.C. Poole, 1996. *Prioritization of Aquatic Diversity Areas for Design of a Conservation Reserve Network in Western Montana. Flathead Lake Biological Station*. Submitted to Pacific Rivers Council.
Frissell, C.A. J. J. Doskocil, J.T. Gangemi and J.A. Stanford. 1995. *Identifying priority areas for protection and restoration of aquatic biodiversity: A case study in the Swan River Basin, MT, USA*. Biological Station Open File Report # 136-95. Flathead Lake Biological Station, The University of Montana, Polson, MT.
FWP. See Montana Department of Fish, Wildlife and Parks.
Greenlee, J.T. 1998. *Ecologically Significant Wetlands in the Flathead, Stillwater and Swan River Valleys*. Unpublished Report to the Montana Department of Environmental Quality. Montana Natural Heritage Program, Helena, MT. 192 pp.
Hanson, C. 2001. Resource Conservationist and Watershed Coordinator, Flathead Conservation District, Kalispell, MT. Personal communication.
Hitt, N.P. and C.A. Frissell. A*n Evaluation of Wilderness and Aquatic Biointegrity in Western Montana* in McColl, S.F. et al, comps. 2000. Wilderness science in a time of change conference- Vol. 2: Wilderness within the context of larger systems; 1999 May 23-27, Missoula, MT. Proceedings RMRS-P-15-Vol.-2. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.
How, S. 2001. Executive Director. Flathead Land Trust. Kalispell, MT. Personal communication.
Jackson, B. 2001. Graduate student at The University of Montana Flathead Lake Biological Station, Personal communication.
Lake County. 1998. *Lake County General Plan.* Adopted by Lake County Board of Commissioners.
Logan, B., and B. Clinch. 1991. Montana Forestry BMPs. *Forest Stewardship Guidelines for Water Quality*. Montana State Extension Service.
Lorang, M.S., P.D. Komar, and J.A. Stanford. 1993. *Lake Level Regulation and Shoreline Erosion on Flathead Lake, Montana: A Response to the Redistribution of Annual Wave Energy*. Jr. of Coastal Research, 9(2): 494-508. Fort Lauderdale, Florida.
Makepeace, S. and B. Mladenich. 1996. *Contribution of Nearshore Nutrient Loads to Flathead Lake*. Confederated Salish and Kootenai Tribe Natural Resources Department.
Marotz, B. 2001. Fisheries Biologist, Montana Department of Fish, Wildlife & Parks, Kalispell, MT. Personal communication.
McCallister, H. 2002. Department of Natural Resources Conservation. Personal Communication.
Montana Association of Conservation Districts. 1997. *A Guide to Stream Permitting in Montana.*
Montana Department of Environmental Quality. 2001. Nutrient Management Plan and Total Maximum Daily Load for Flathead Lake, Montana.
Montana Department of Environmental Quality Website. 1996. http://www.deq.state.mt.us/ppa/mdm/303_d/pdf/1996_303d_ Lakes.pdf
Montana Department of Environmental Quality Website. 2000. http://www.deq.state.mt.us/ppa/mdm/303_d/303_d_list-draft.asp
Montana Department of Fish, Wildlife and Parks and Confederated Salish and Kootenai Tribes. 2000. *Flathead Lake and River Fisheries Co-Management Plan*, 2001-2010.

Montana Natural Heritage Program. 1/29/2002. *Land Ownership and Managed Areas of Montana.* Distributed by the Montana State Library, Natural Resources Information Service. http://www.nris.state.mt.us/nsdi/ab105/ownerse.html

Montana Trout Unlimited. 2001. *Funding Guide for Stream Restoration in Montana.* Missoula, MT.

Montana Watercourse. 1998. *Who Does What with Montana's Wetlands: A Directory*. Compiled by Rachel Kyle. Bozeman, MT.

Montana Watercourse. 1999. *A Landowners' Guide to Montana Wetlands.* Bozeman, MT.

Muhlfeld, C.C., S. Glutting, R. Hunt, B, Marotz. September 2000. Montana Department of Fish, Wildlife and Parks. *Seasonal Distribution and Movement of Native and Non-native Fishes in the Upper Flathead River System, Montana*. Summary Report 1997-1999 to Bonneville Power Administration.

National Wildlife Federation, March 2000. Innovative Site Design To Reduce Impervious Surface Cover Created by New Development. Funded by U.S. EPA.

NHP, see Montana Natural Heritage Program.

Nobel, R.A., and J.A. Stanford. 1986. *Groundwater Resources and Water Quality of the Unconfined Aquifers in Kalispell Valley, Polson, Montana.* Montana Bureau of Mines and Geology Open File Report No. 177. Open File Report 093-86, Flathead Lake Biological Station, The University of Montana, Polson, MT.

Rosario, A. 2001. Natural Resources Conservation Service, Kalispell, Montana. Personal Communication.

Russell, J., 2001. Director of the Flathead County. Personal communication.

Schueler, T. 1995. Site Planning for Urban Stream Protection. The Center for Watershed Protection, Silver Spring, MD. Funded by EPA, Office of Wetlands, Oceans and Watersheds.

Schueler, T. and H. Holland, eds. The Practice of Watershed Protection. Published 2000 by the Center for Watershed Protection. Ellicott City, MD. www.stormwatercenter.net

Stanford, J.A., B.K. Ellis, and G.C. Poole. 1997. *Water Quality Data and Analyses to Aid in the Development of Revised Water Quality Targets for Flathead Lake, Montana. Phase I of a Cooperative Study to Determine Total Maximum Daily Loads for Nitrogen and Phosphorous*. Flathead Lake Biological Station, The University of Montana, Polson, MT.

Stanford, J.A. 2001. Presentation by J.A. Stanford, Director of the Flathead Lake Biological Station, University of Montana, at the Critical Lands Workshop, May 1, 2001.

Stanford, J.A. 2001. Director of the Flathead Lake Biological Station, University of Montana. Personal communication.

U.S. Department of Agriculture [USDA], Forest Service. 2001. *Flathead National Forest Noxious and Invasive Weed Control Environmental Assessment*. Kalispell, MT.

U.S. Department of Agriculture [USDA], Forest Service. 1987. *Flathead National Forest Plan. Kalispell, MT.*

U.S. Department of Agriculture [USDA], Forest Service. 1995. *Inland native fish strategy environmental assessment decision notice and finding of no significant impact: Interim strategies for managing fish-producing watersheds in eastern Oregon and Washington, western Montana, and portions of Nevada* [INFISH]. Intermountain, Northern, and Pacific Nortwest Regions.

U.S. Department of Agriculture [USDA], Forest Service; and U.S. Department of the Interior [USDI], Bureau of Land Management. *2000. Interior Columbia Basin Final Environmental Impact Statement.* Interior Columbia Basin Ecosystem Management Project. Boise, ID.

U.S.G.S. 1968. Figure 1. D*istribution of Shallow Unconfined Aquifers and directions of groundwater movement, Kalispell Valley*. Based on Plate 4 & Figures 29 & 30 of Konikeski, Brietkrietz & McMurtre.

U.S. Forest Service. 1997 aerial photos.

Y2Y Aquatic Strategy Workshop. 1999. *Research strategies are proposed to analyze critical areas for wildlife and habitat connectivity.* http://www.rockies.ca/y2y/reports/aquatics.pdf

Y2Y Science Advisory Forum. Summary Report, 1999. http://www.rockies.ca/y2y/reports/jasper.pdf

Y2Y Conservation Initiative. 2002. *Where Can Grizzly Bears Live?* http://www.rockies.ca/y2y/grizzly/habitat_map.htm

Waller, A. 2001. Private landowner and wildlife biologist. Personal communication.

Whited, D. 2001. Geographic Information Systems and Landscape Planner at the Flathead Lake Biological Station, University of Montana. Personal Communication.

Zackheim, H. 1983. Final report of the steering committee for the Flathead River Basin Environmental Impact Study. Funded by EPA, Kalispell, MT.

Appendix A. Critical Lands Workshop Participants

† Indicates individual who attended the 2001 Critical Lands Workshop
* Indicates individual who attended the 1999 Critical Lands Workshop
Italics indicate individual who was invited to workshops but did not attend

Citizens for a Better Flathead
Mayre Flowers, Program Director†

Confederated Salish & Kootenai Tribes
Clayton Matt, Div. of Environmental Protection Manager (2001)
Mary Price, Wetlands Conservation Coordinator*
Lynn Ducharme, BPA Watershed Coordinator*
Barry Hansen, Fisheries Biologist*†
Janet Camel, Resource Planning Coordinator†
Lloyd Jackson, Shoreline Protection Manager
Seth Makepeace, Hydrologist

Flathead Basin Commission
Mark Holston, Information Officer*†
Elna Darrow, Chair (1992-2001)†

Flathead Conservation District
Cathy Hanson, Resource Conservationist*

Flathead County Regional Development Office
(Agency dissolved in July 2001. New agency representing Kalispell, Whitefish and Columbia Falls: Tri-City Planning Office; office representing the remainder of Flathead County: Flathead County Planning and Zoning Office)
Tom Jentz, Director
Carol (Cookie) Davis, GIS Technician†

Flathead County Health Department
Joseph (Joe) Russell, Health Officer

Flathead Lakers
Robin Steinkraus, Executive Director*†
Barry Flamm, Board Member (& Natural Resources Consultant) *†
Constanza von der Pahlen, Critical Lands Project Leader†
Phil Lehner, Board Member†
Sid Rundell, President†
Board members†: Rose Schwennesen, Chuck Mercord, Laney Hanzel, Paul Williams.
James Conner, Webmaster†

Flathead Land Trust
Susan How, Executive Director*†
Paul (Doc) Smiley, Board Member†

Flathead National Forest
Cathy Barbouletos, Supervisor
Liz Hill, hydrologist

Flathead Resources Organization
Thompson Smith, Executive Director (2001)

Lake County Conservation District
Dennis DeVries, Chair*

Montana Dept. of Fish, Wildlife & Parks
Gael Bissell, Habitat Conservationist†
Brian Marotz, Fisheries Biologist

Montana Land Reliance
Amy Eaton, Glacier Flathead Director*†

Montana Nature Conservancy
Marilyn Wood, NW Project Manager*†

Natural Resources Conservation Service
Carlos Rodriques, District Conservationist*†
Angel Rosario, District Conservationist
Don Wood, Montana Irrigation Program, Ronan Manager*

Pacific Rivers Council
Chris Frissell, Senior Staff Scientist

Salish & Kootenai College
Kerwin Werner, herpetologist*
Bill Swaney, Environmental Sciences Instructor*

U.S. Fish & Wildlife Service
Rox Rogers, Private Lands Biologist, Partners for Fish & Wildlife*

U.S. Fish & Wildlife Service
Bill West, Assistant Manager and Easements Program, National Bison Range

U. of M. Flathead Lake Biological Station
Jack Stanford, Director†
Bonnie Ellis, Senior Researcher
Diane Whited, GIS technician†

Appendix B. Criteria for Identifying Critical Lands

developed by participants at the 11/3/99 Critical Lands Workshop

Ecological Function

- Is the area of ecological significance?
- Is the area environmentally sensitive?
- Is the area natural, undeveloped or "open"?
- Does the area provide functional habitat, especially for key, rare or unique species?
- Is the habitat or species imperiled?

Urgency of Existing & Potential Threats

- Is the area currently protected or currently threatened?
- How likely is development? How immediate is the threat?
- Does the area need restoration or exhibit existing problems that need action?
- Is the area a water source (surface or ground)?
- Is the area a source of nutrients or other pollutants?
- Are there existing or potential human health risks?
- What is the ownership and regulatory status?
- What is the human population density?
- What are the current or potential negative impacts of land use activities/development?

Ecological Defensibility & Durability

- Is the area a large tract or contiguous to other protected critical areas?
- Is the project expandable beyond one site?
- What are the long-term benefits and risks of the project?
- Will the project make a measurable contribution to a stated goal?
- Does the project exhibit "conservation efficiency" (are there better uses of conservation efforts and resources)?
- Is an existing monitoring program in place or can one be established?

Societal Considerations & Human Values

- Are people willing and able to take action?
- Is there landowner and/or community support?
- What are the cultural and historical values?
- What are the aesthetic/scenic values?
- What are the potential political opportunities and/or roadblocks?

Feasibility

- Is there an opportunity to protect the critical area?
- Is the project technically doable?
- Is the project economically sound? What are the costs/benefits?

Appendix C. Critical Lands Evaluation Form

Location:
Sources of information:
Area of concern *(more detail if needed):*
Size of area:

Projects and responsible agencies in the area this makes reference to:
Date of evaluation:

I- Significant areas for WATER QUALITY downstream	**0 less ---- 3 more**
1- Does the area have a significant function for maintaining water quality? SINKS[1]	N Y
1- Riparian vegetation	0 1 2 3
2- Wetland	0 1 2 3
3- Headwater, spring, or groundwater source (is the area a water source)	0 1 2 3
4- Floodplain	0 1 2 3
5- Shoreline vegetation	0 1 2 3
6- Other	0 1 2 3
LOW (0 - 1) MED (2-4) HIGH (5-12+)	
2- Is the area presently or potentially responsible for water pollution? SOURCES[2]	N Y
7- High nutrients (P, N)	0 1 2 3
8- Toxic contamination. Are there existing or potential human health risks?	0 1 2 3
9- Sedimentation	0 1 2 3
10- Flow alteration	0 1 2 3
11- Other	0 1 2 3
LOW (0 - 1) MED (2-4) HIGH (5-12+)	

II- Functional HABITAT for key, rare, threatened or sensitive species	**0 less ---- 3 more**
a) Does the area provide functional habitat for rare, threatened, endangered or sensitive species?	Y N 0 1 2 3
b) Important breeding or birthing[3] areas.	Y N 0 1 2 3
c) Is the area a migration corridor?	Y N 0 1 2 3
d) Does the area have some other special function?	Y N 0 1 2 3
LOW (0 - 3) MED (4 - 6) HIGH (7 - 12)	

III- Urgency of Existing & Potential Threats	**0 less ---- 3 more**
1- Is the area environmentally sensitive/fragile[4]?	Y N 0 1 2 3
2- Is the area currently protected?	
a) Percent of area protected: 0-30% (3); 31-55% (2), 56-75% (1); > 70% (0).	Y N 0 1 2 3
b) Designated protected areas, RNA, WPA, Wilderness designated areas, tribal primitive TNC (0); State or federal lands (1); conservation easement (2); Private (3)	Y N 0 1 2 3
c) What is the ownership and regulatory status?	
Ownership: LIST.	
Regulatory Status	0 1 2 3
Area and/or issue of concern have:	
• Good regulations in place to address issue. (0)	
• Some regulations in place, but they do not fully protect resource. (1-2)	
• Voluntary regulations in place. List. Are they functional? (2)	
• No regulations in place. (3)	
d) What is the population density in the area? (*no ranking*)	
3- If the area is protected, are one or more ecological functions still at risk?	Y N 0 1 2 3
4- Is the area currently threatened? What are the current or potential negative impacts of land use activities/development? List threats and impacts.	Y N 0 1 2 3
5- How likely is development? How immediate is the threat (e.g. development)? List proposed development/threat and timeframe.	0 1 2 3
0 = 10 or more years away. (Low) 2= 1-5 yrs. (High)	
1= 5 to 10 yrs. (Medium) 3= happening or less than 1 year.	
6- Does the area need restoration or exhibit existing problems that need action?	Y N 0 1 2 3

[1] Sinks: areas with the capacity to uptake and assimilate nutrients and other pollutants. The ranking reflects ecological integrity, functionality, and "assimilative capacity" of a sink. While the presence of several sinks increases the scores, an area may have one habitat type and still be highly significant. Accompanying information is needed to explain the significance.
[2] Sources: areas that contribute excess nutrients and other pollutants.
[3] Breeding refers to various acts required to reproduce or propagate a species. Depending on the species it may include mating, birth, nesting, spawning.
[4] Sensitive/fragile: habitat where human activities greatly affect ecological functions/integrity. These habitats are easily damaged and are not resilient, thus they are unable to restore themselves to their original condition after bring disturbed.

LOW (0 - 6) MED (7 - 9) HIGH (10 - 21)

IV- Ecological Defensibility & Durability — **0 less ---- 3 more**

1- Is the area natural, undeveloped or "open"[1]? Y(1) N(0)
2- Is size important for protecting the values in the area? If yes, is it big enough (3)? Is it too small (0)? Y N 0 1 2 3
3- Are there protected areas adjacent to this? Y N 0 1 2 3
4- Is there potential to protect or restore adjacent areas? Y N 0 1 2 3
(Can protected area be expanded to protect/restore functionality)
5- What are the long-term ecological benefits of a protection/restoration project in the area? Are there potential risks? (*no ranking*)
6- Is an existing monitoring program in place or can one be easily established? Y N 0 1 2 3
(List existing program or potential monitoring and agency/group that can establish it).
0= one not in place. Interest to establish one not likely at present.
1= uncertain 2= one can be established 3= one in place

LOW (0 - 3) MED (4 - 8) HIGH (9 - 13)

V- Cultural, recreational and aesthetic values — **0 less ---- 3 more**

1- Are there cultural and historical values? 0 1 2 3
2- Are there recreational values? Could this be a potential lake/river access site? 0 1 2 3
3- Are there aesthetic/scenic values? Mountains, Lake/River, Open. 0 1 2 3

LOW (0 - 2) MED (3 - 6) HIGH (7 - 9)

RANKING AS CRITICAL AREA

LOW (1) MED (2) HIGH (3)

Significant areas for water quality	**Raw score**	Ordinal Score		Weight factor		**Final Weighted Score**
SINKS			**X**	**4**	=	
SOURCES			**X**	**4**	=	
Ecological significant habitat			**X**	**3**	=	
Threats			**X**	**2**	=	
Defensibility & Durability			**X**	**2**	=	
Cultural, recreational & aesthetic values			**X**	**1**	=	
TOTAL SCORE					=	

FEASIBILITY ASSESSMENT

a- **Societal Considerations**

1- Are landowners concerned? Y N 0 1 2 3
2- Is there landowner and/or community support? Are people willing and able to take action?
LOW support (1); SOME (2); SIGNIFICANT (3) Y N 0 1 2 3
3- What are the potential political opportunities and/or roadblocks? List. (*no ranking*)

LOW (0 - 1) MED (2 - 4) HIGH (5- 6)

b- **Other concerns**

1- Is a protection or restoration project technically doable? Can the threats be eliminated or mitigated?
2- Is there an opportunity to protect the critical area? What are potential protection or restoration strategies? Are there potential partners with the capacity to successfully implement strategies?
3- Is a project economically sound? What are the costs/benefits?
4- Is there an on-going project that could become successful if it received immediate assistance?
5- Does the project exhibit "conservation efficiency" (are there better uses of conservation efforts and resources)?

Definition of Feasibility and its ranking[2]

High = There is significant community/landowner support, partners have capacity to implement strategies, there is high probability of success, and the strategies can be implemented at reasonable cost.
Medium = Some community/landowner support, or uncertain capacity of partners, or medium probability of success, or high costs.
Low = Low or no community/landowner support, capacity unlikely to exist in 10 years, or probability of success low, or very high costs.

[1] Natural, undeveloped or open: This question seeks to indicate a degree of departure from natural/pristine. Undeveloped or open can be a non-residential with a wheat field. It can still provide habitat for certain species, or have important scenic value.
[2] Adapted from: Designing a Geography of Hope- A Practitioner's Handbook to Ecoregional Conservation Planning Volume I, Second Edition, April 2000

Appendix D. Geographic Information Data Directory

Geographic Theme	Type of Information	Source	Scale	Method of Compilation	Contents
1990 Digital Ortho Photo Quadrangles	Imagery	Imagery was downloaded from the NRIS website www.nris.state.mt.us	1:24,000	Used as is	Individual DOQs-Bigfork, Somers, Creston, Kalispell, Rose Crossing, Hash Mountain, Columbia Falls, Columbia Falls South
1997 Imagery	Imagery	Aerial photographs were acquired from the USFS in Kalispell	1:15,800	Each aerial photograph was scanned at 300 dpi and then geo-rectified to the 1990 Digital Ortho Photo Quads to create one image for 1997	Geo-rectified 1997 imagery for the Flathead River corridor
lu90	Polygon	1990 imagery and USFS NWI data	1:24,000	Land cover was digitized off of the 1990 imagery. The USFS NWI data was added to the land cover to improve wetland classification	Land cover attribute
lu97	Polygon	1997 imagery	1:24,000	Land cover was digitized off of the 1997 imagery. The USFS NWI data was added to the land cover to improve wetland classification	Land cover attribute
Roads97	Line	1997 imagery	1:15,800	Roads were digitized from the 1997 imagery	Roads
Structure97	Point	1997 imagery	1:15,800	Structures were digitized from the 1997 imagery	Structures
FEMA	Polygon	Tri-City Planning Offices	1:24,000	Used as is	100 and 500-year floodplain designations
Flatwells	Point	Downloaded from www.nris.state.mt.us. Data provided by MT Bureau of Mines and Geology	1:24,000	Used to determine water depth for static well level attribute	Well attributes
Rd_density	Polygon	1997 imagery	1:24,000	For a given quarter section (160 acres), the density of roads was calculated from the roads97 coverage	Density of roads per square mile
Stru_density	Polygon	1997 imagery	1:24,000	For a given quarter section (160 acres), the density of structures was calculated from the structures97 coverage	Density of structures per square mile
Own	Polygon	Downloaded from www.nris.state.mt.us.	1:100,000	Montana Natural Heritage Program	Montana public land ownership and management status, including conservation easement data (updated annually), special land-management designations, and administrative units. The original source for much of this data is 1:100,000 scale Bureau of Land Management (BLM) maps, digitized by the Montana BLM office in 1996
Nests01	Point	Dr. Charles Blem (Virginia Commonwealth University)	1:24,000	Coordinates for 2001 nest data in the Flathead Valley were converted into GIS coverage	Osprey and bald eagle nest locations, as well as inactive nests
Watertab	Polygon	MT Bureau of Mines and Geology well database and 1997 imagery	1:24,000	A depth to water table was created from the SWL (static water level) attribute in the well database and existing water features (rivers and streams) from the 1997 imagery. Wells that had a value of 0 or a negative value were excluded in the creation of the water table map (assumption that this data was either wrong or missing). Points along the river and streams were added to the database to simulate that water table depth was zero in the river and stream locations. Using the remaining wells with SWL values and the river and stream points a depth to water table was created	Depth to water table (feet)
Sewer_all	Polygon	Data obtained from Flathead County GIS Department and the City of Kalispell	1:24,000	Used as is	Sewer Districts for the cities of Kalispell, Evergreen, and Columbia Falls
Sewdensity	Polygon	Water table depth, structures, and sewer districts	1:24,000	The water table depth, structure density, and sewer districts were combined to identify non-sewered areas with high structural density on shallow water table	Within a particular structural density (e.g. > 1 unit per acre), identifies areas of water table depth in non-sewered locations

Appendix E. Critical Lands Maps, Figures 2A-2I.

Fig.2A 1990 Land Cover

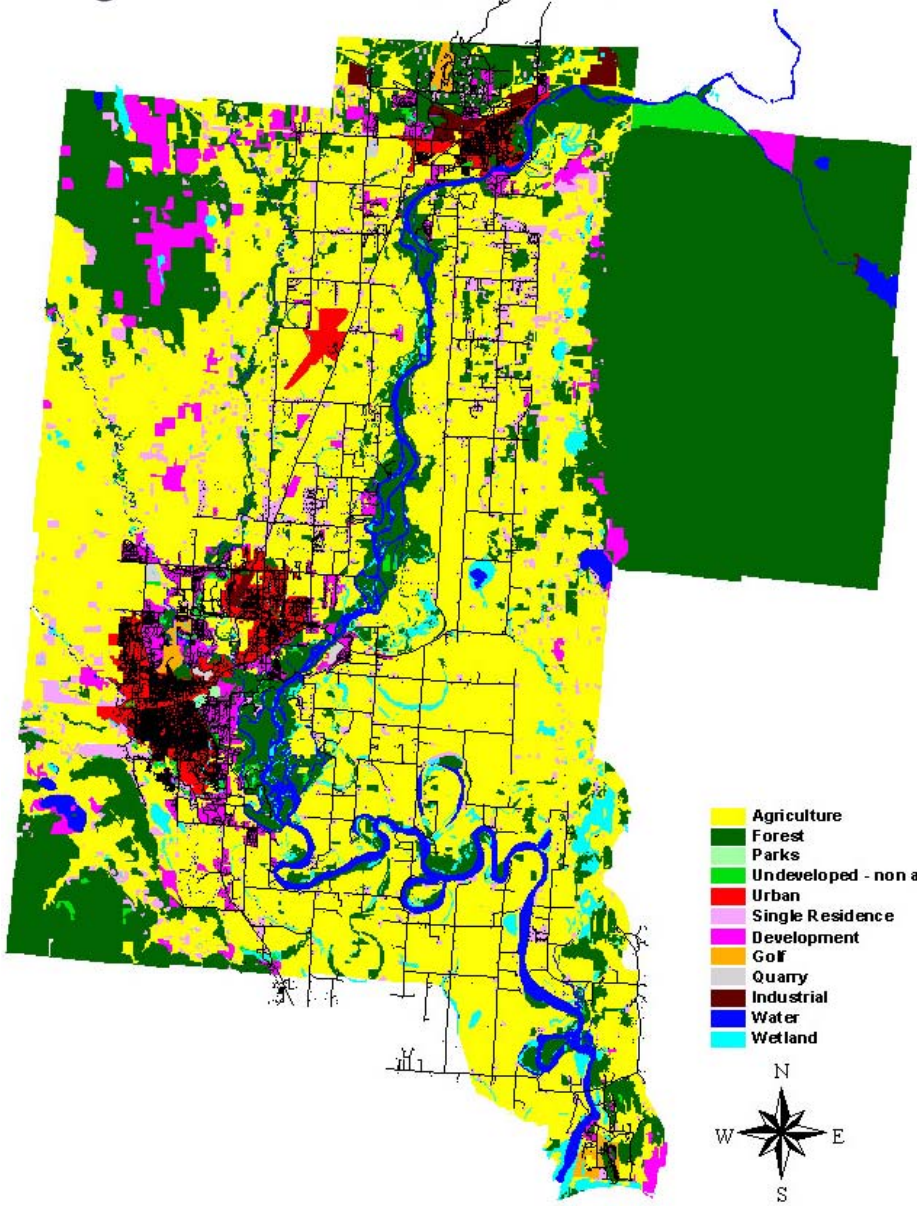


Fig.2B 1997 Land Cover

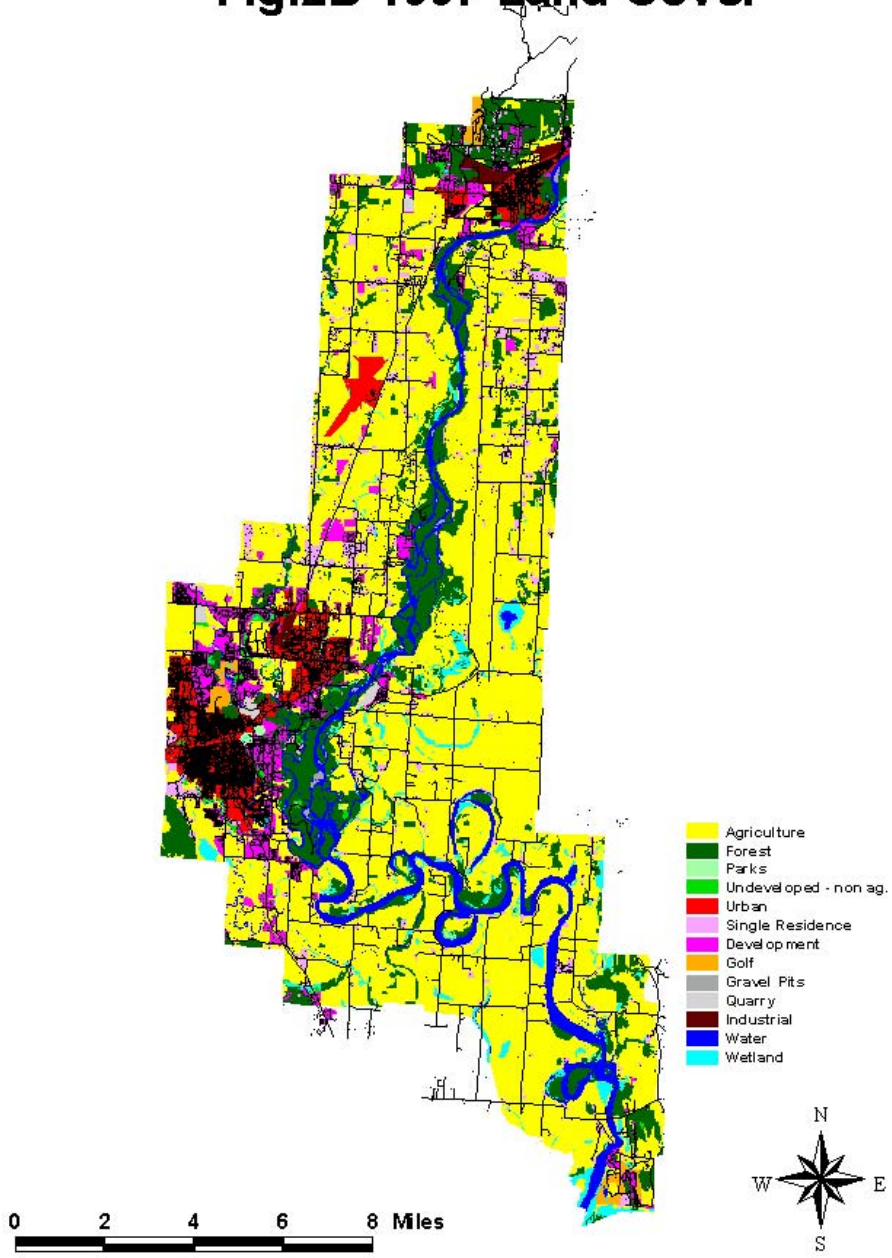


Fig.2C FEMA Flood plains

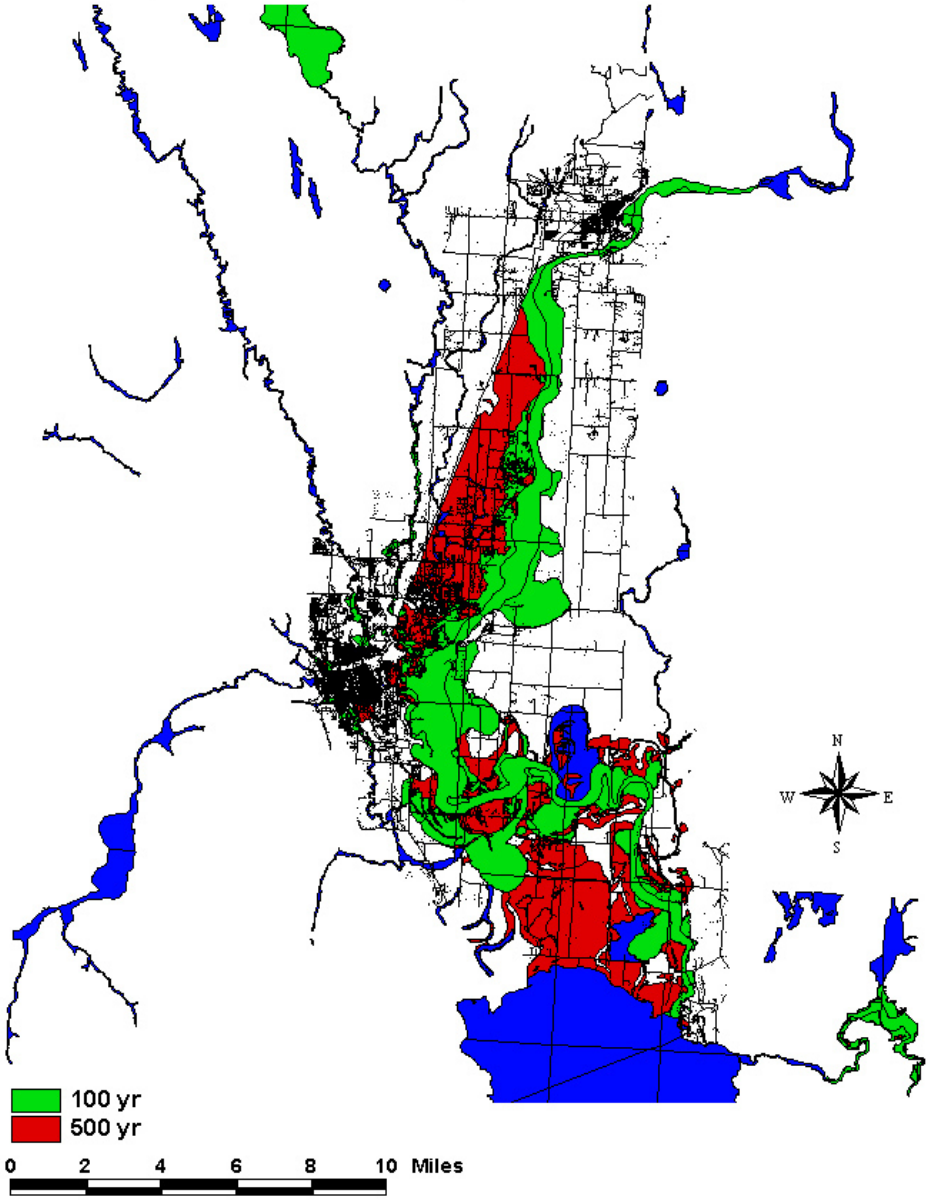


Fig.2D Public Lands and Conservation Easements

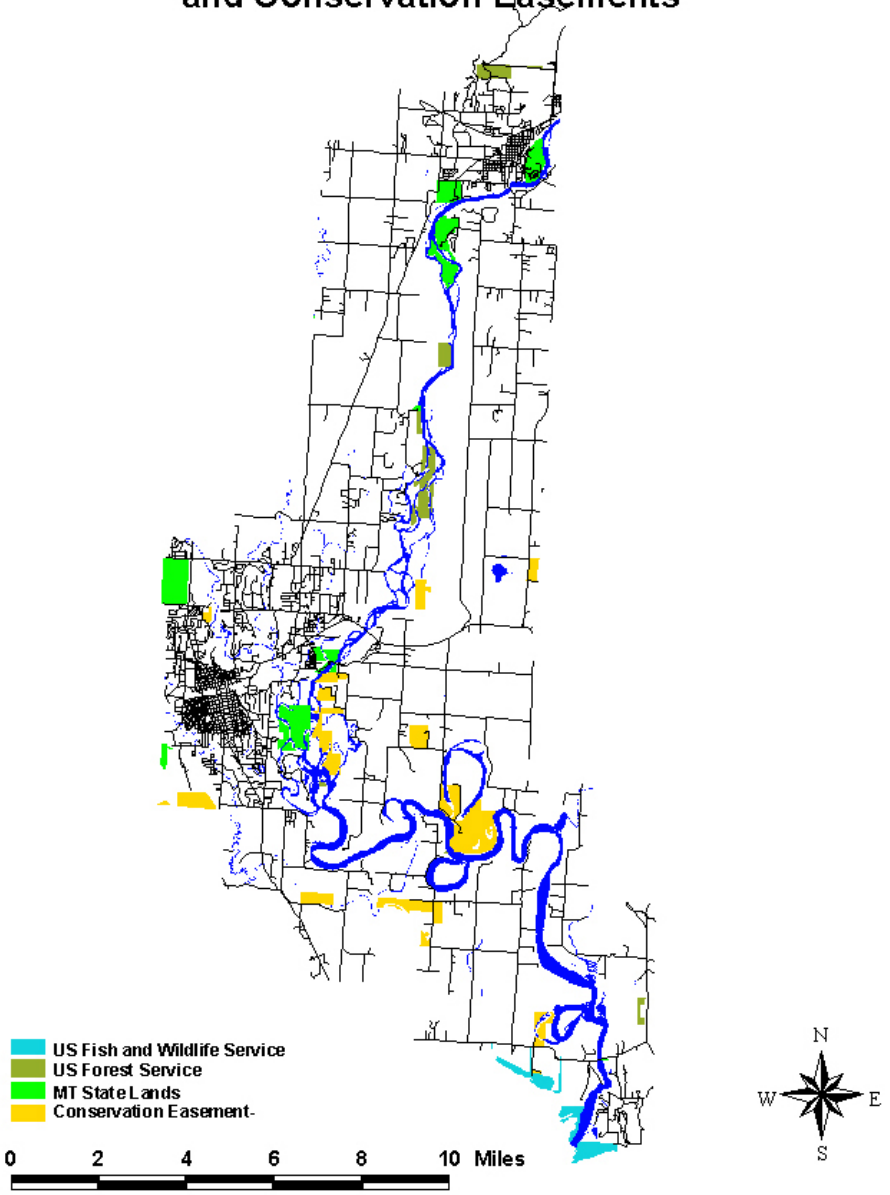


Fig.2E Depth to water table (feet)

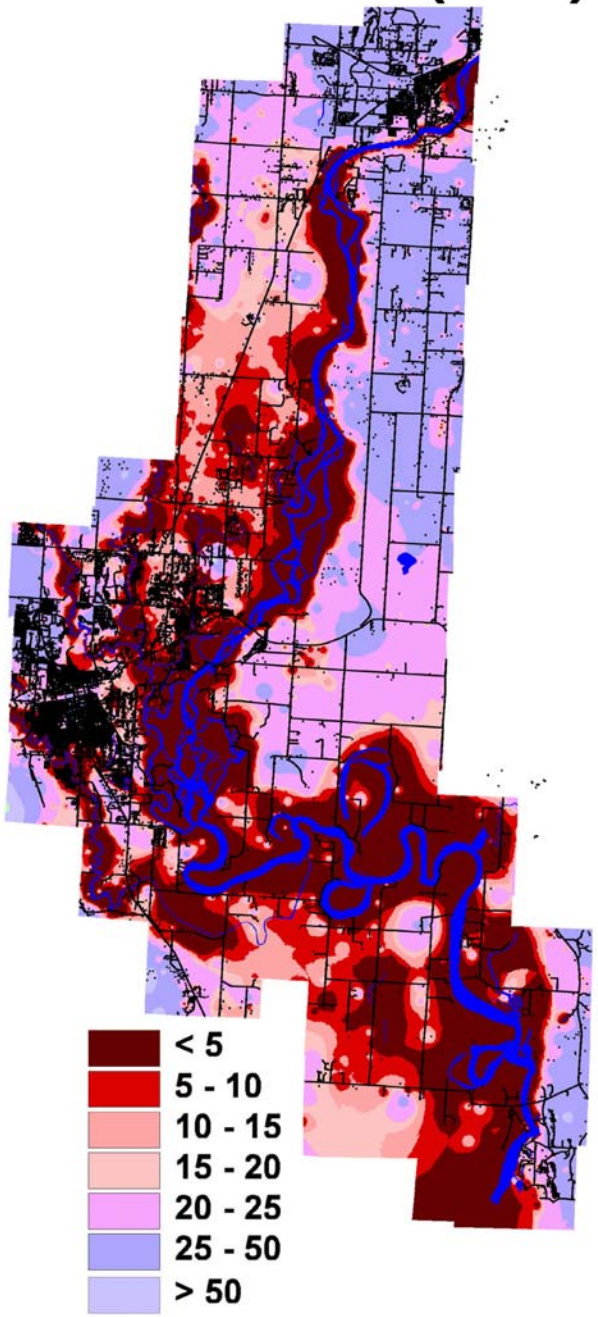


Fig.2F Sewer Districts

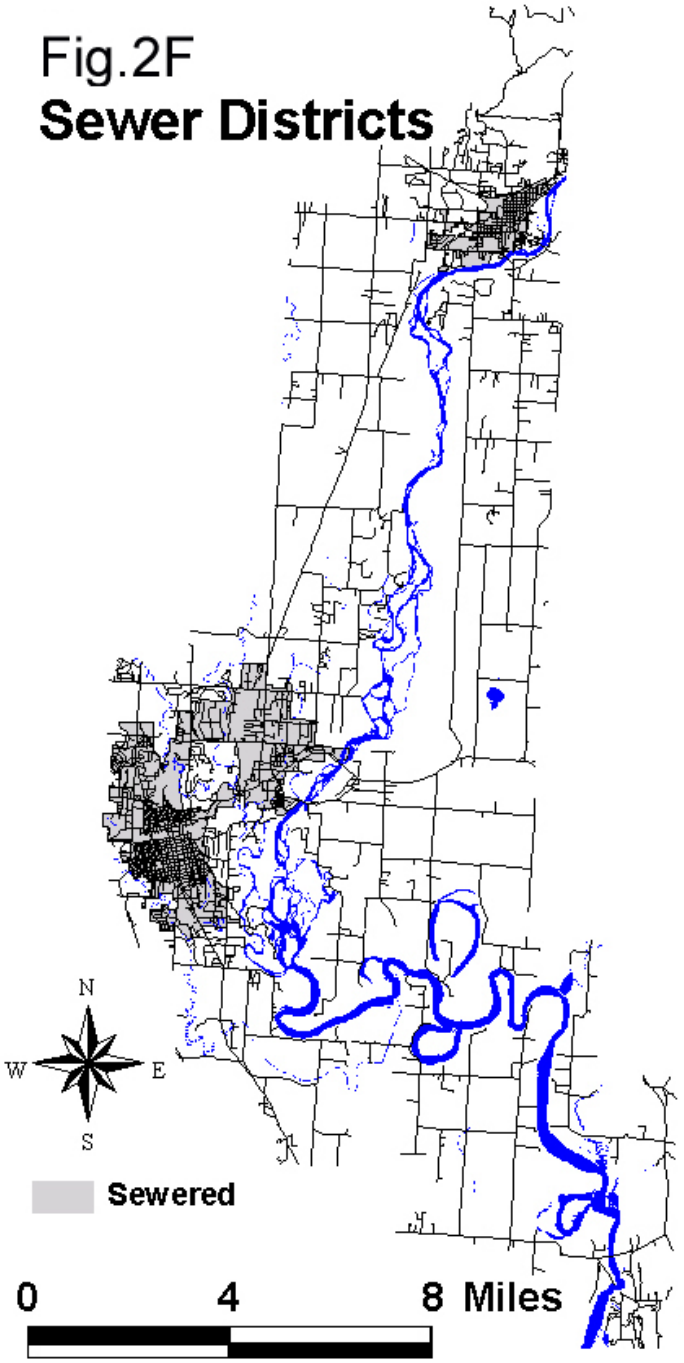
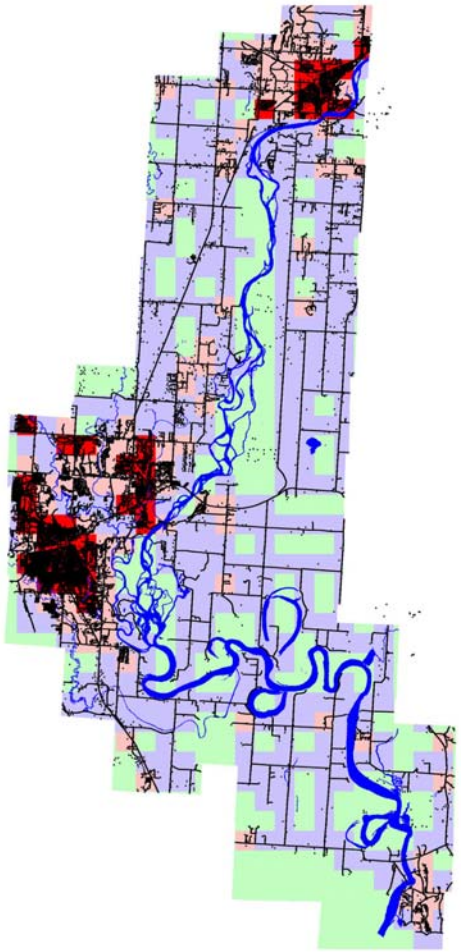


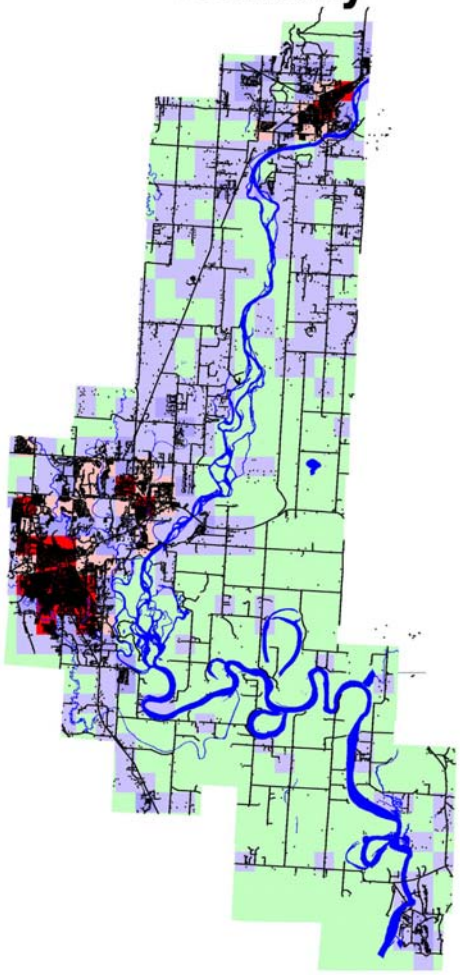
Fig.2G & 2H

1997 Road Density (miles/sq. mile)



> 10
5 - 10
1 - 5
< 1

1997 Structural Density



high density, > 2 units per acre
moderate to high density, 1 to 2 acre development density
moderate density, 2 to 5 acre development density
low density, 5 to 40 acre development density
very low density

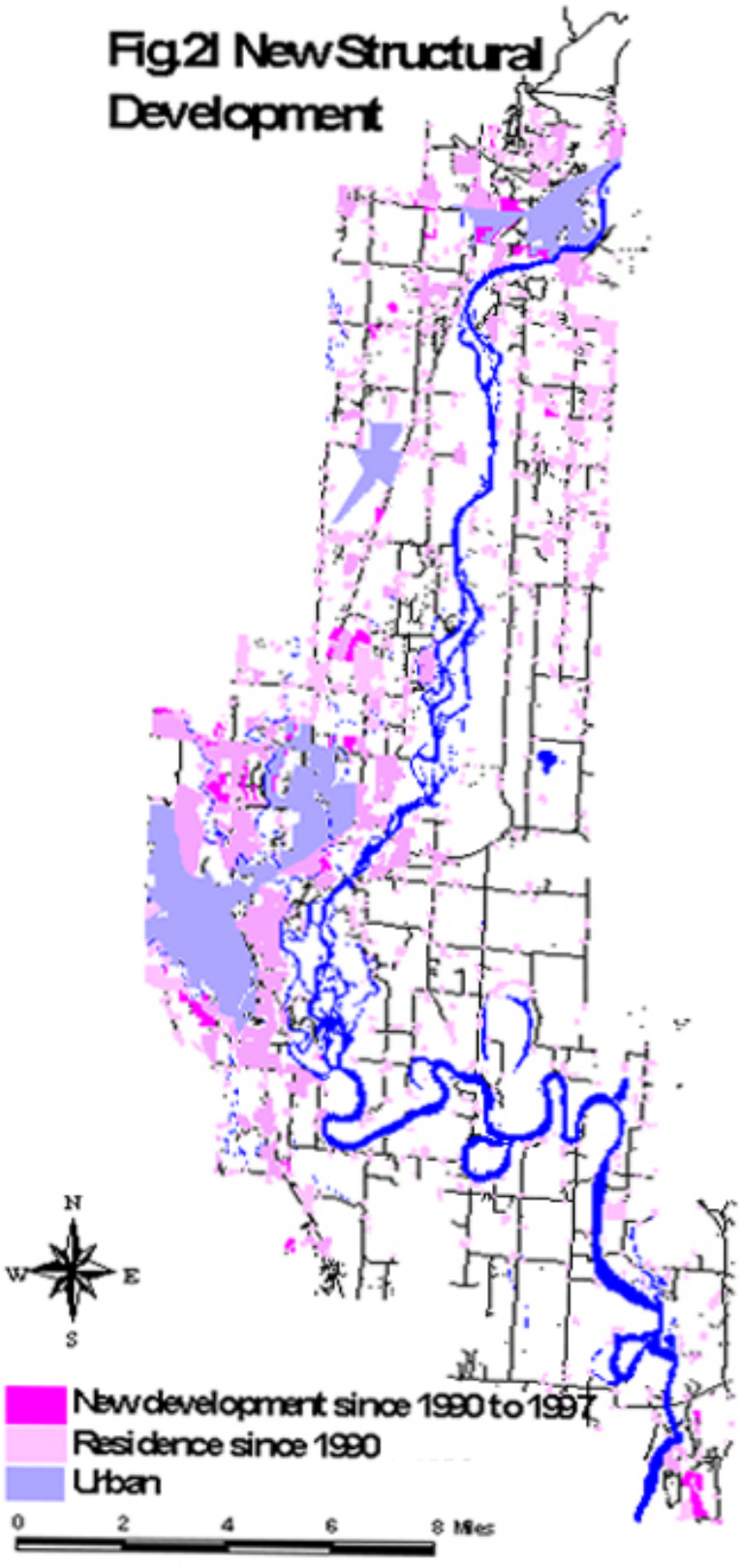
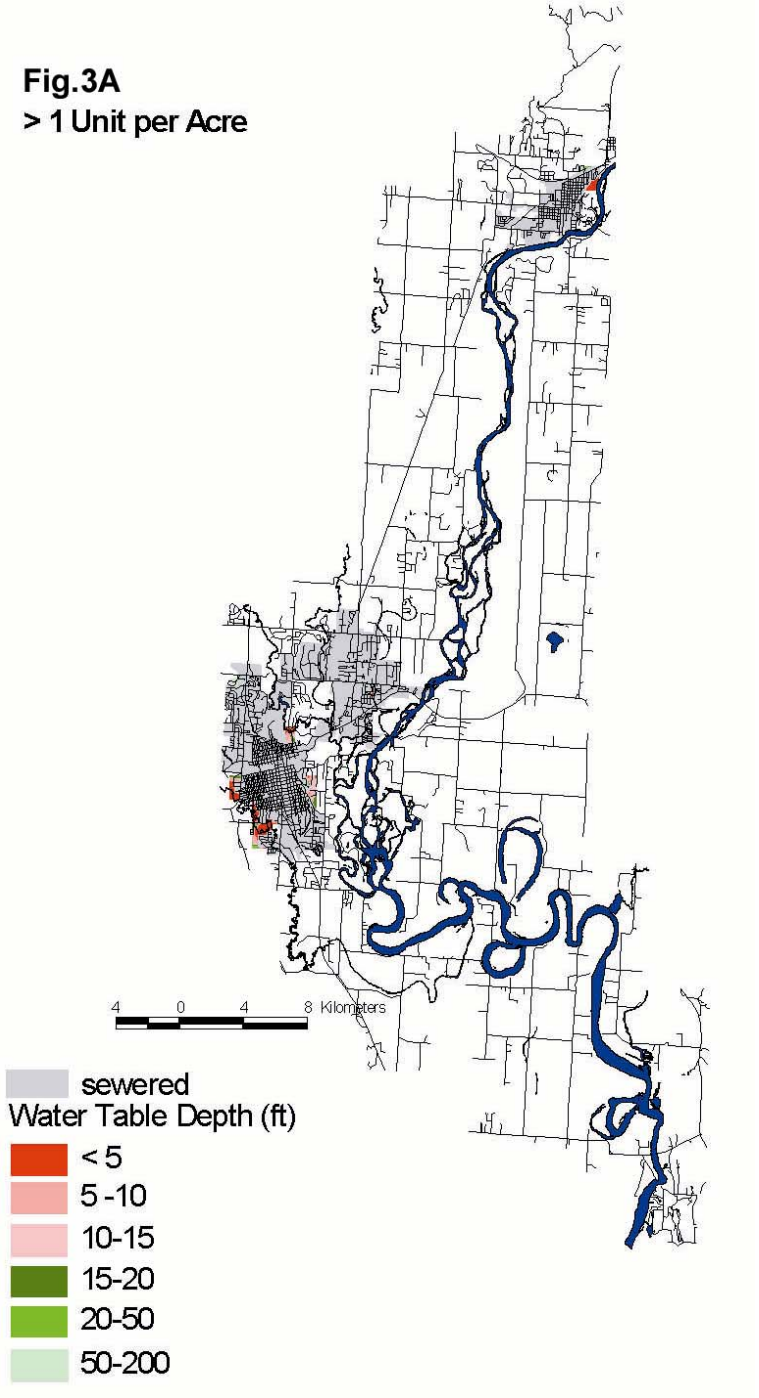


Fig.2l New Structural Development
N
W
E
S
New development since 1990 to 1997
Residence since 1990
Urban
0
2
4
6
8 Miles

Appendix F. Vulnerable Groundwater Areas Map, Figures 3A-3H.



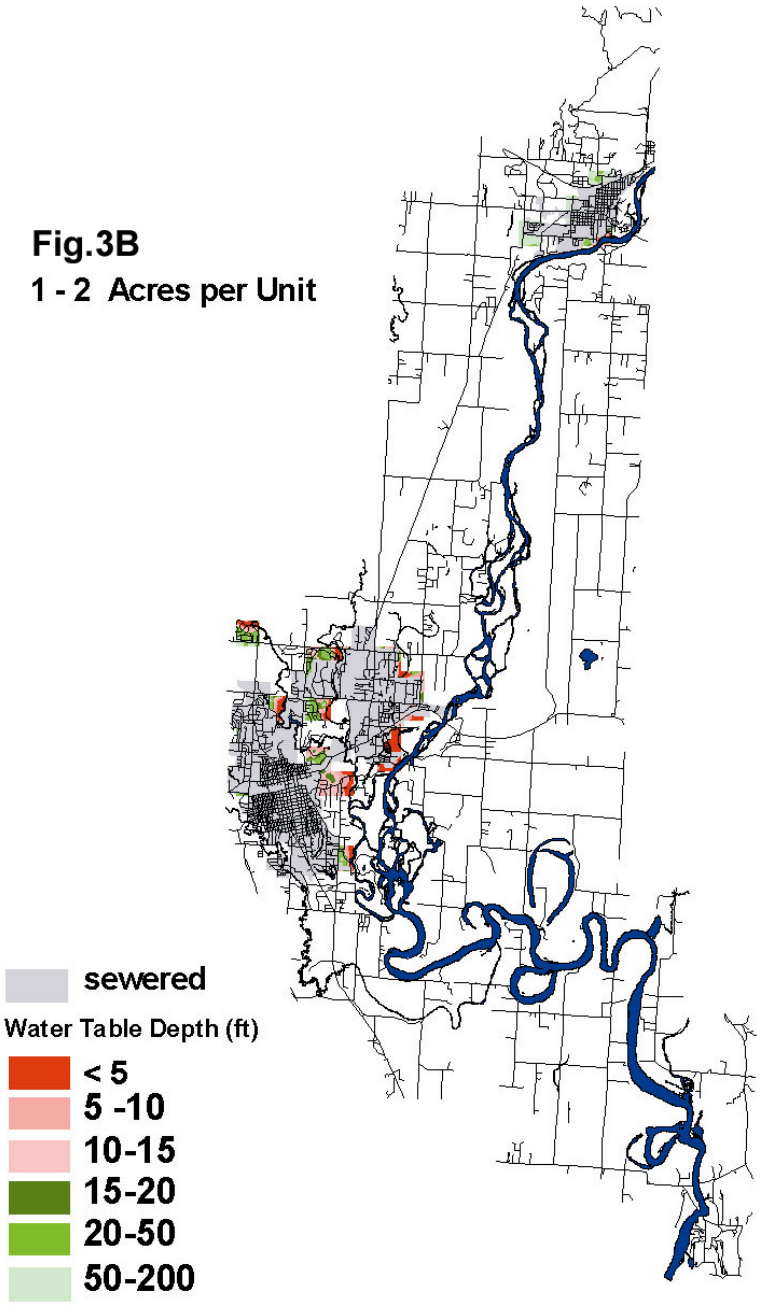


Fig.3C
2 - 5 Acres per Unit

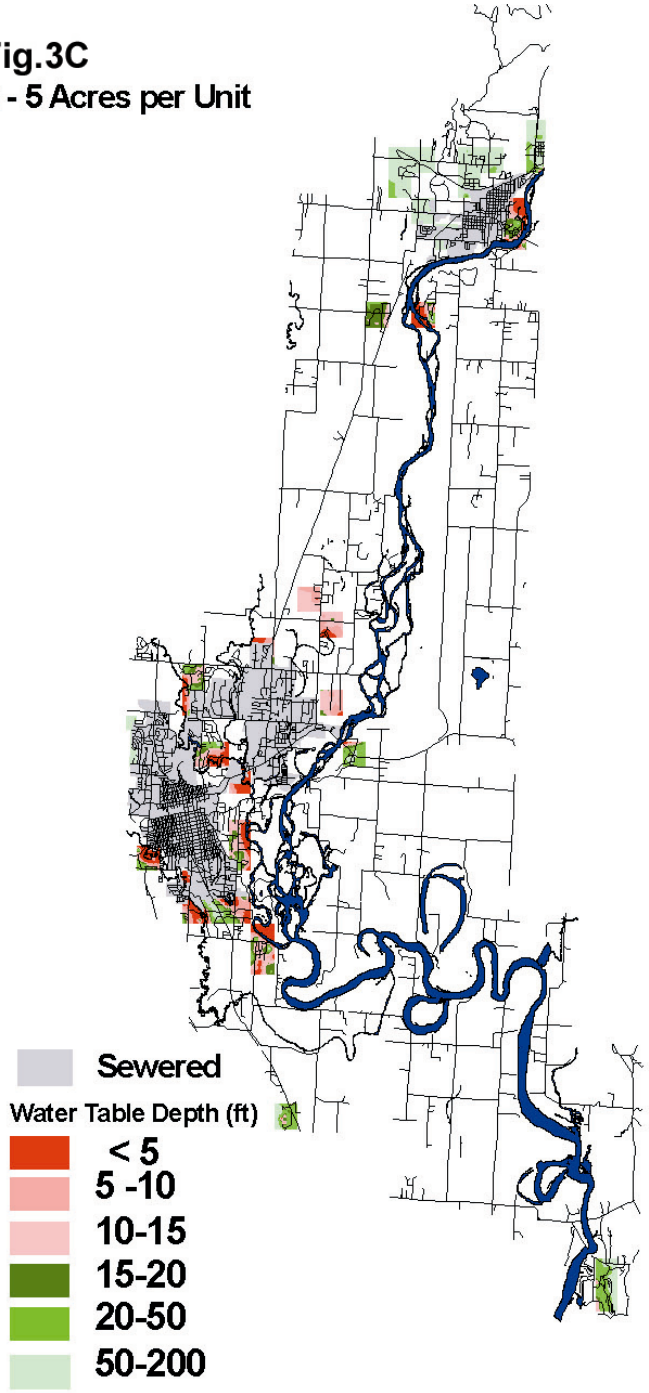


Fig.3D
5 - 10 Acres per Unit

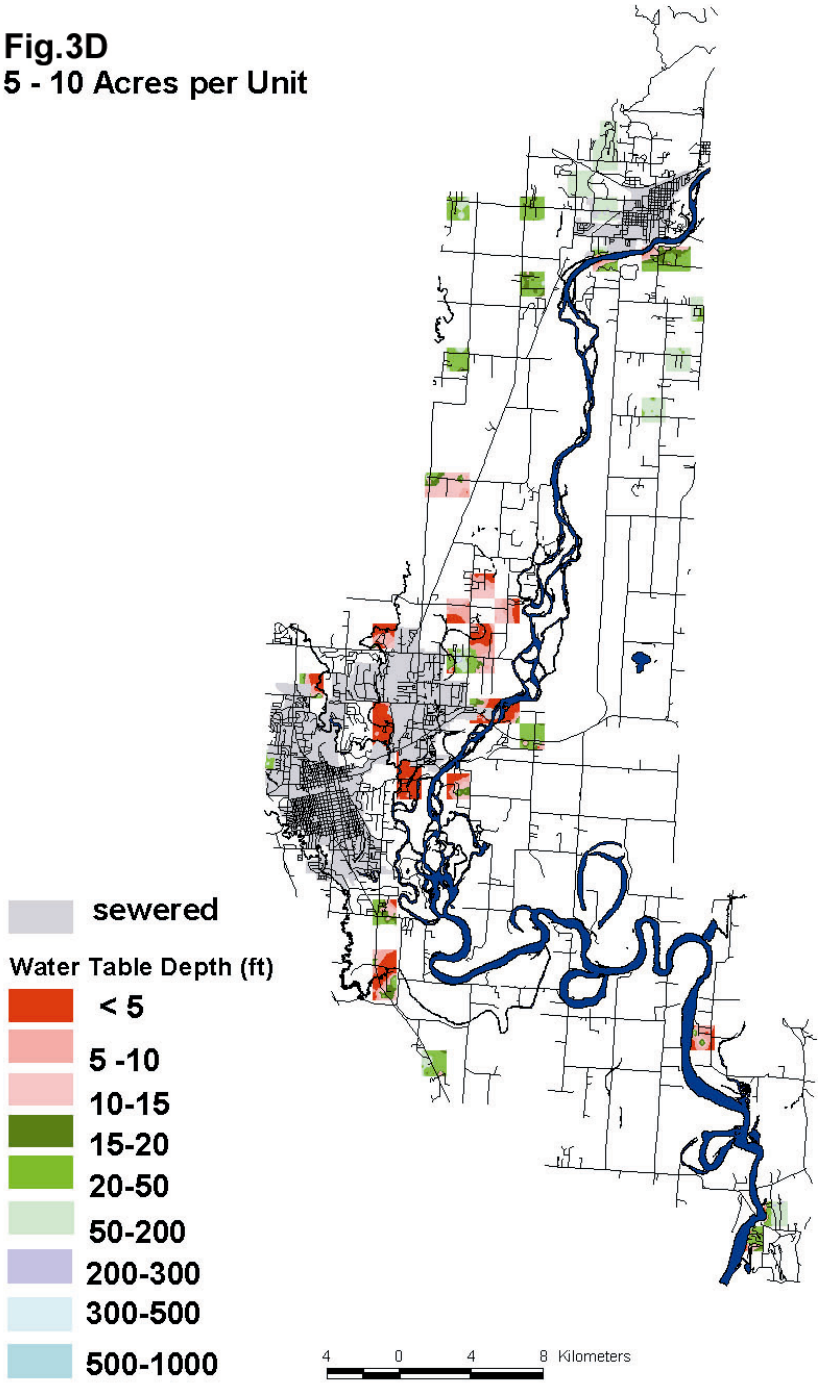


Fig.3E
10 - 20 Acres per Unit

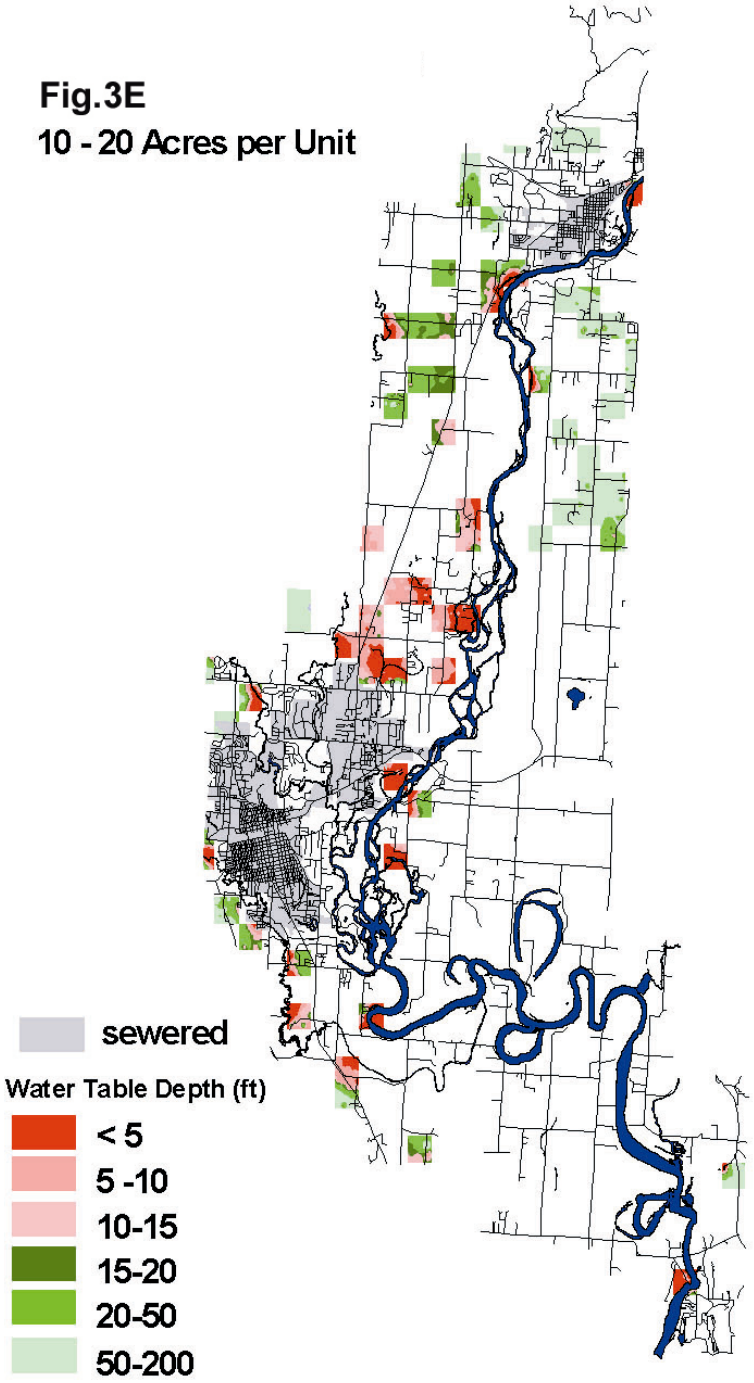


Fig.3F
20 - 40 Acres per Unit

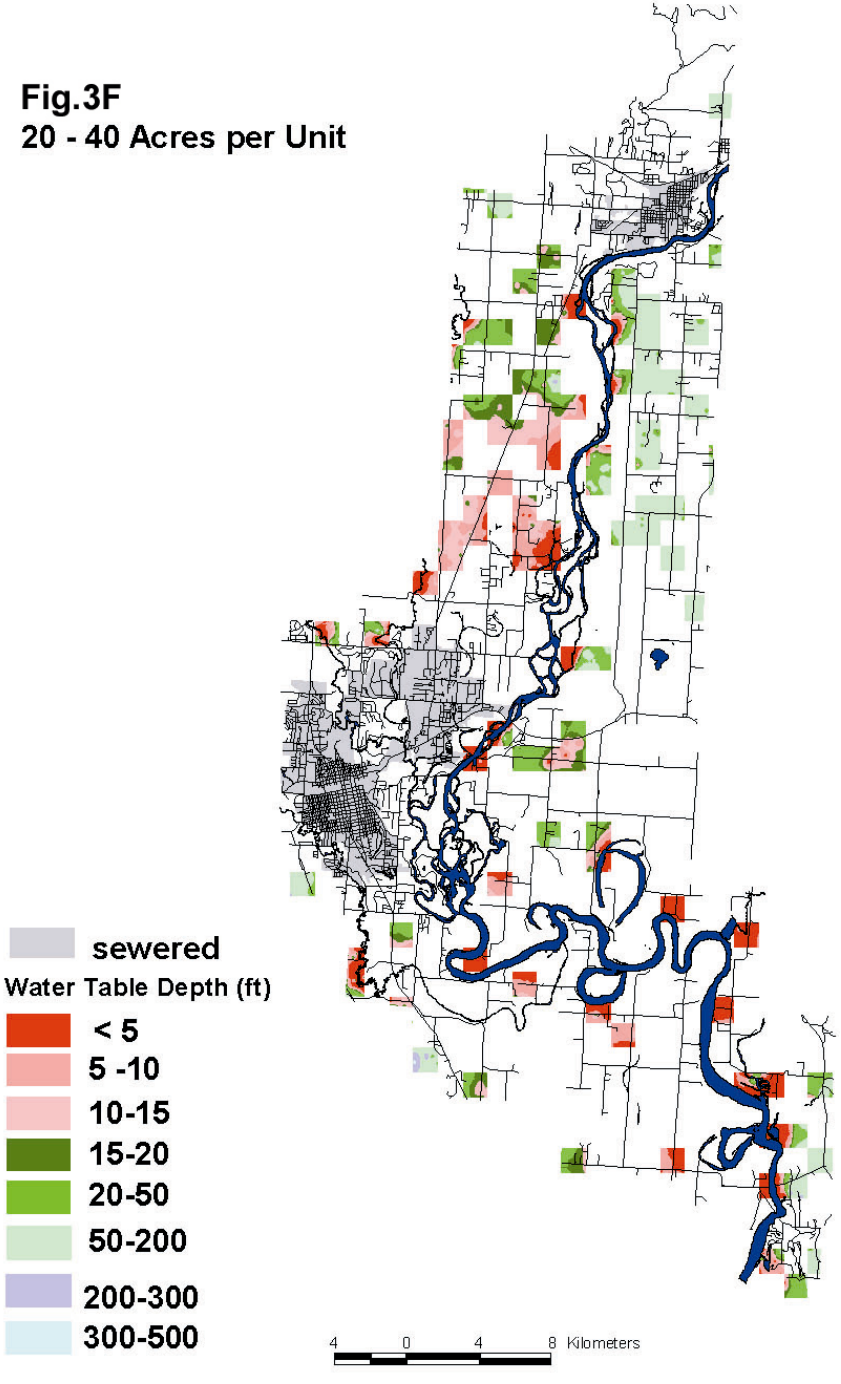


Fig.3G
Over 40 Acres per Unit

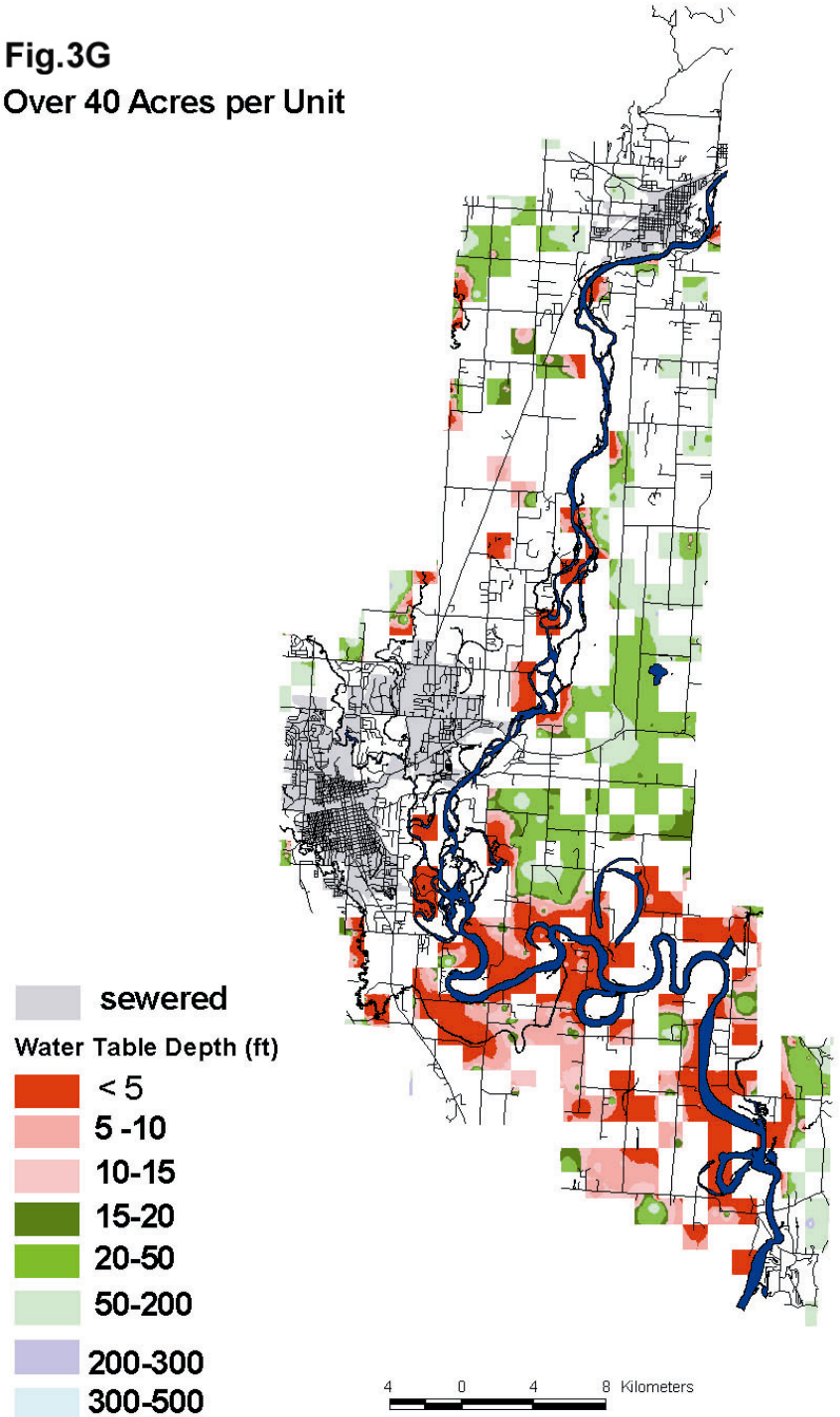


Fig.3H
No Structures in 1997