



**US Army Corps
of Engineers®**
Detroit District

**SECTION 905(B) WRDA 86
PRELIMINARY ANALYSIS OF ENVIRONMENTAL RESTORATION
FOR THE
CLINTON RIVER WATERSHED
NORTHERN OAKLAND COUNTY AND LAPEER COUNTY**

**Final Report
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TABLE OF CONTENTS

1. Study Authority.....	1
2. Study Purpose.....	1
3. Location of Study, Non-Federal Sponsor and Congressional Districts.....	2
4. Prior Studies, Report and Existing Water Projects.....	4
5. Plan Formulation.....	5
6. Federal Interest.....	26
7. Sponsor Intent.....	27
8. Summary of Feasibility Study Assumptions.....	27
9. Feasibility Phase Milestones.....	28
10. Feasibility Study Cost Estimate.....	29
11. Recommendations.....	29
12. Issues Affecting Initiation of Feasibility Studies.....	30
13. Views of Other Resource Agencies (if known).....	30
14. Project Area Map.....	31

LIST OF TABLES

Table 1. Civil Jurisdictions in the Study Area.....	3
Table 2. Studies Reviewed for the Clinton River Watershed Reconnaissance Report.....	4
Table 3. Lake Sampling Data.....	9
Table 4. Federally Threatened, Endangered and Candidate Species.....	11
Table 5. Park Acreage by Community.....	12
Table 6. Recreation Trails in Study Area.....	12
Table 7. Priority Water Resource Projects for the Upper Clinton River Watershed.....	19
Table 8. Preliminary Evaluation of Projects.....	23
Table 9. Feasibility Phase Milestones.....	28

LIST OF FIGURES

Figure 1. Study Area Map.....	2
Figure 2. Watershed Conceptual Model.....	17

SUPPLEMENTAL APPENDICES

A. References.....	A-1
B. Source Document Abstracts.....	B-1
C. Contributing Organizations and Individuals.....	C-1
D. Initial Project List.....	D-1
E. Project Screening Approach.....	E-1

1. Study Authority

Section 4047 of the Water Resources Development Act (WRDA) of 2007 states:

“Conduct a study to determine the feasibility of carrying out a project for environmental restoration, Clinton River, Michigan.”

This study shall be a Reconnaissance Study conducted following the Section 905(b) process. Within this report, the Study will be referred to as a Reconnaissance Report or a 905(b) Analysis.

Funds in the amount of \$84,229 have been appropriated for this study in FY 2010.

2. Study Purpose

The purpose of this Reconnaissance Study is to identify water resource impairment areas in the Upper Clinton River Watershed in Oakland and Lapeer Counties, Michigan, and to determine if there exists a potential Federal Interest in addressing those impairments through future environmental restoration studies or projects. Aquatic ecosystem and water quality impairments addressed in the study include:

- Nonpoint source water pollution;
- Point source pollution including Combined Sewer Overflows (CSOs);
- Impacts to wetlands and other wildlife habitat due to urban development in the watersheds;
- Beneficial Use Impairments (BUIs) identified in the U.S. Environmental Protection Agency’s (USEPA) Remedial Action Plan (RAP) for the Clinton River Area of Concern (AOC) and the Great Lakes Water Quality Agreement; and
- Additional issues identified by local stakeholders, including impacts due to county drains, invasive species control, streambank erosion areas, impacts to spawning and nesting areas, and health issues related to water quality, such as high bacteria loading levels.

The Reconnaissance Study includes an analysis of these and related water resource issues in the Upper Clinton River Watershed and a determination of Federal Interest in environmental restoration projects to address identified impairments. The analysis featured a multi-purpose and multi-objective “watershed approach” and, consequently, addressed a range of issues directly and indirectly (e.g., recreation, flooding) associated with water resource impairments and prospective environmental restoration projects. The analysis was conducted based on existing, readily available data, and professional and technical judgment. This report was prepared by the U.S. Army Corps of Engineers (USACE) Detroit District.

The Clinton River Watershed is located in southeast Michigan, north of the Detroit metropolitan area. The Clinton River flows 80 miles (128 km) from its headwaters to Lake St. Clair near the city of Mt. Clemens. The river’s watershed drains 760 square miles (1,968 km²) of land in southeast Michigan, including portions of Oakland and Macomb Counties and small areas of St. Clair and Lapeer Counties. Specifically, the focus of this Reconnaissance Study is the Upper Clinton River Watershed in Oakland and Lapeer Counties. The study area encompasses 205 square miles and over 520 miles of waterways. Land use in the study area reflects the diverse nature of the region and includes urban, agriculture, woodland and grassland areas.

The adjacent portion of the Clinton Watershed located within Macomb and St. Clair Counties is currently being studied in a Reconnaissance Study conducted under a separate specific authorization by USACE- Detroit District. That study is entitled “Reconnaissance Report for the Clinton River and Anchor Bay Watersheds, Flood Risk Reduction and Environmental Restoration, Macomb County and St. Clair County.” This document complements that study; together they provide an overview of Federal Interest in water resource issues throughout the entire Clinton River Watershed.

The study area encompasses all or part of 15 municipal jurisdictions, as documented in Table 1.

Table 1. Civil Jurisdictions in the Study Area.

County	Jurisdiction
Lapeer County (2010 Population- 88,319)	Almont Twp.
	Almont Village
	Dryden Twp.
	Hadley Twp.
	Metamora Twp.
Oakland County (2010 Population- 1,202,362)	Addison Twp.
	Brandon Twp.
	City of the Village of Clarkston
	Independence Twp.
	Leonard Village
	Oakland Twp.
	Orion Twp.
	Oxford Twp.
	Oxford Village
	Springfield Twp.

The Oakland County Water Resources Commission (OCWRC) has been identified as a prospective local non-Federal sponsor. In addition to exercising control over legally established drainage systems within the county, the OCWRC also operates water and wastewater systems, manages engineering and construction projects, and establishes and conducts environmental programs. Further, the OCWRC is responsible for administering pollution prevention efforts, soil erosion control and enforcement programs, and educational programs for Oakland County residents. In addition, other local entities were actively engaged as stakeholders during the study process. Cooperation of these parties in the preparation of the Reconnaissance Report entailed

providing relevant reports, data, information, and staff assistance for consultation and document review.

The study area lies within three congressional districts:

- Michael Rogers (R), 8th Michigan District;
- Gary Peters (D), 9th Michigan District; and
- Candice Miller (R), 10th Michigan District.

4. Prior Studies, Reports and Existing Water Projects

More than 25 planning documents were reviewed as part of this Reconnaissance Study. The reports were drawn from international, Federal, state, local and non-governmental sources. A bibliography is included in the appendix. Key documents (summarized in Table 2 below) were reviewed to characterize existing watershed conditions, develop planning objectives, and identify potential watershed projects.

Table 2. Studies Reviewed for the Clinton River Watershed Reconnaissance Report.

Report Title and Publication Date	Author	Key Topics
Restoring the Flow: Improving Selective Small Dam Removal Understanding and Practice in the Great Lakes States (2001)	Small Dam Removal Workshop and Work Meeting	Presents general recommendations for facilitating adaptive management, project monitoring, research initiatives, and community outreach for small dam removal initiatives throughout the Great Lakes region.
St. Clair River and Lake St. Clair Comprehensive Management Plan (June 2004)	USACE and Great Lakes Commission	Provides a comprehensive management plan for the St. Clair River and Lake St. Clair.
Great Lakes Regional Collaboration Study (December 2005)	Great Lakes Regional Collaboration Executive Committee	Provides guidance for decision making and prioritizing projects for funding support. Also serves as a benchmark for evaluation of funding requests and project proposals by the various Collaboration partners.
Clinton River Main Subwatershed Management Plan (August 2006)	Clinton Main Subwatershed Advisory Group	Provides management guidance for the identified subwatershed.
Clinton River Area of Concern (AOC) Clinton River Restoration Plan (2008)	U.S. Environmental Protection Agency	A comprehensive Remedial Action Plan (RAP) document that updates actions to address Beneficial Use Impairments (BUIs), with the primary purpose being to achieve delisting of the watershed as an AOC through restoration of eight identified BUIs.
Michigan Great Lakes Plan (January 2009)	Office of the Great Lakes, Michigan Department of Environmental Quality (MDEQ)	Presents recommendations of the Great Lakes Regional Collaboration and highlights specific needs, challenges and strengths within Michigan. The fundamental premise is that the economy and the long-term well-being of the citizens of the state are dependent on the health of the waters that feed the lakes and the nearshore areas that buffer the lakes.

Report Title and Publication Date	Author	Key Topics
Criteria for Restoration of Beneficial Use Impairments to Clinton River Area of Concern (April 2009)	River Area of Concern Public Advisory Council	Presents criteria to be used as guidance in restoring BUIs for the Clinton River AOC.
Delisting Targets for Non-Habitat Beneficial Use Impairments for the Clinton River Area of Concern (April 2009)	Clinton River Watershed Council	Addresses the question of “how-clean-is-clean” for the Clinton River Watershed. Endpoints are developed to facilitate the ultimate delisting of the watershed as an AOC under the Great Lakes Water Quality Agreement.
Michigan Department of Environmental Quality Water Bureau (MDEQ-WB) Measures of Success (November 2009)	MDEQ-WB	Reports on progress in achieving Water Bureau goals to make Michigan’s waters safe and clean for drinking, fishing and other water-based recreation, and healthy aquatic ecosystems.
Great Lakes Restoration Initiative Action Plan (December 3, 2009)	USEPA and various other public agencies	Identifies goals, objectives, measurable ecological targets, and specific actions for each of five focus areas.

5. Plan Formulation

As part of this investigation, USACE-Detroit has coordinated with interested Federal, state, and local entities to identify problems and opportunities for environmental restoration in the Upper Clinton River Watershed. This inquiry was complemented by a thorough literature search and correspondence with interested stakeholders in the interest of accessing additional data, information and viewpoints to identify potential environmental restoration and enhancement opportunities for further study. The comprehensive nature of this approach identified many opportunities outside of USACE authority. These opportunities should be handed off or coordinated with interested partners for implementation.

Plan formulation was conducted using a five-part process. First, a profile of existing conditions was developed, including a summary of existing water resource conditions related to habitat, recreation, water quality and flood control within the watershed, and the identification of problems related to the degraded ecosystems. Second, planning objectives and constraints were specified. Third, environmental restoration opportunities were identified. Fourth, selected sites were evaluated for potential Federal interest. Finally, discussions were held with potential non-Federal sponsors to determine their interest in participating in feasibility phase investigations.

Federal Planning Principles and Guidelines

The formulation process used in this Reconnaissance Study is consistent with national objectives as stated in the Planning Guidance Notebook (Corps Engineering Regulation 1105-2-100, April 2000). In accordance with that document, ecosystem restoration plans must contribute to National Ecosystem Restoration (NER) through a restoration of degraded ecosystem structure, function, and dynamic processes to a less degraded, more natural condition.

The NER criteria provide general planning guidance within any study area. Plans to address the needs in the study area must be formulated with clearly identified outputs. Critical factors in NER plan development include 1) the significance of the outputs; 2) scarcity of the outputs; and

3) risks and uncertainties in achieving the projected outputs. These objectives impose general planning constraints within any study area:

- Completeness is defined in ER 1105-2-100 as the extent to which the alternative plans provide and account for all necessary investments or other actions to ensure the realization of the planning objectives, including actions by other Federal and non-Federal entities.
- Effectiveness is defined as the extent to which the alternative plans contribute to the achievement of planning objectives.
- Efficiency is defined as the extent to which an alternative plan is the most cost-effective means of achieving the objectives.
- Acceptability is defined as the extent to which the alternative plans are acceptable in terms of applicable laws, regulations, and public policies.

Planning Objectives and Constraints

Based on the key water resource problems identified by stakeholders through literature review and direct contact, a number of overarching opportunities and objectives were developed. These objectives respond to the issues raised in the authorization for this Reconnaissance Report. The following objectives will be used to assess the ability of potential projects to meet the most pressing water resource needs in the Upper Clinton River Watershed:

- To preserve, maintain and, to the extent possible, enhance the resources of the existing natural and social environment in the project area;
- To preserve, to the extent possible, existing open space areas and associated recreational opportunities in the project area; and
- To provide a plan that is compatible with future economic development opportunities.

Ecosystem restoration alternatives that satisfy area needs and objectives are partially limited by economic, environmental, and technical constraints:

- Improvements for ecosystem restoration purposes shall have benefits in excess of estimated costs;
- The projects must be feasible from an engineering standpoint, socially acceptable and cost effective, using proven technology;
- There must be a reasonable assurance that a public entity (i.e., state or local unit of government) is capable and willing to participate as a non-Federal partner in a cost-shared feasibility study; and
- Federal funding limitations may result in an inadequate or inconsistent funding stream.

5a. Existing Conditions in Clinton River Watershed

This section characterizes existing conditions in the Upper Clinton River Watershed, focusing on key water resources issues and environmental degradation problems identified in the review of plans and reports, as well as through stakeholder outreach activities. The section also includes a description of likely future conditions if actions are not taken to address the identified problems.

Conditions documented in the initial (1988) RAP for the Clinton River (and revisited in later updates and related documents) remain largely relevant today, and explain why the study area obtained, and currently has, AOC status as one of the most severely degraded areas within the Great Lakes Basin. As discussed elsewhere in additional detail, the eight BUIs of concern include the following:

- Restrictions on fish and wildlife consumption;
- Eutrophication or undesirable algae;
- Degradation of fish and wildlife populations;
- Beach closings;
- Degradation of aesthetics;
- Degradation of benthos;
- Restrictions on dredging activities; and
- Loss of fish and wildlife habitat.

The primary causes of these BUIs include factors such as habitat degradation, fragmentation and destruction; alteration of natural stream flow regimes; excessive erosion and sedimentation; contaminated sediment (including heavy metals, PCBs, oil and grease); and water quality degradation due to point and nonpoint source pollutant inputs ranging from conventional pollutants (e.g., fecal coliform bacteria, nutrients) to toxic contaminants. Associated issues identified during the examination of existing conditions included such items as flood control and water-based recreational activities. This section also includes a description of likely future conditions if actions are not taken to address identified problems.

Land Use and Stormwater

The study area, as shown in Figure 1, encompasses 205 square miles and over 520 miles of waterways. Land use in the study area reflects the diverse nature of the region and includes urban, agriculture, woodland and grassland areas. The subwatersheds in the study area include the Clinton River, Paint Creek, Clam Lake, Green Lake, Sashabaw Creek, West Branch Stony Creek, Stony Creek, East Pond Creek and North Branch Clinton River.

Oakland County is the most rapidly developing county in the state, and the direct and indirect effects of land use (i.e., development) are considered to be the largest contributors to the river's decline in the urbanizing portion of the watershed. The increase in impervious surfaces associated with such development has resulted in increased stormwater peak flows and volumes throughout the Upper Clinton River Watershed. Consequences of this increased instability of the river include accelerated stream bank erosion, increased sediment loads and sediment deposition that have directly contributed to BUIs such as degradation of fish and wildlife populations; degradation of benthos; and loss of fish and wildlife habitat.

Reducing the amount of stormwater volume delivered to the Clinton River during rain events is critical because many of the BUIs and associated goals for the watershed are directly influenced by flow within the channel. For example, USEPA has identified degradation of fish and wildlife populations as a BUI for the watershed, and reducing the flashiness of the river will enhance habitat and rehabilitation of populations. In situations such as this, the role of streamflow in exacerbating or influencing impairments is an important consideration.

Sediment Quality

Water quality problems associated with stormwater volume have been exacerbated by the presence of contaminated sediment (i.e., metals, semi-volatile organic compounds) in some areas of the watershed. This has resulted in concentrations of metals, nutrients, petroleum hydrocarbons, PCBs, DDT and other organic compounds found in various portions of the mainstem river from Pontiac to the mouths of the river and the spillway. This has led to the designation of BUIs such as restrictions on fish and wildlife consumption; degradation of fish and wildlife populations; degradation of benthos; restrictions on dredging; and loss of fish and wildlife habitat.

The prevalence of closed landfills is also of concern as a contributing source of environmental degradation. If not addressed, land use impacts will continue to be manifested in increasing soil erosion and sedimentation, turbidity, deterioration of river habitat, and increased local and regional flooding.

The upstream reaches of the river system are characterized by a well-connected and developed floodplain, with a stream morphology that gradually transitions to an incised river system. This transition is evidence that the accumulating effect of increased flows generated from upstream reaches is beyond the original channel's capacity to handle these flows, resulting in excess erosion and incision on the downstream reaches. Hydrology data, located at U.S. Geological Survey (USGS) gage 04164800, has shown a substantial increase in peak flows, annual mean flows and bankfull flows over time (ECT, 2009).

Groundwater Quality

The most common impairments to groundwater quality in the study area involve aesthetic issues such as high concentrations of hardness, iron and sulfur which occur naturally in the subsurface geology (Aichele, 2005).

River Water Quality

A comparison of water quality throughout the watershed, based upon 1966-1970 data as well as 2000-2003 data, shows mixed results. While some declines in nutrient concentrations (e.g., nitrate, phosphorus, sulfate) have been observed, total dissolved solids and chloride have approximately doubled over this period (Aichele, 2005). While that report does not include baseline data for these two parameters, it does note that, since 1980, multiple samples taken by USGS and analyzed for chloride have exceeded the USEPA primary and secondary maximum levels for groundwater contaminants common in Oakland County.

Lake Water Quality

Beach closings and other full body contact restrictions are prevalent within the watershed, an indication of the increasing threats to water quality due to a range of pollutant inputs (e.g., sewage discharges, illicit sewer connections, industrial discharges/ spills, waste management sites, agricultural run-off, on-site disposal systems, animal feedlots). These challenges are of

increasing concern, and are reflected in the multiple BUIs listed within the Clinton River AOC, including beach closings; degradation of aesthetics; and eutrophication or undesirable algae.

As part of a USGS study, samples were taken from 12 Oakland County lakes in 2002-2003 and subsequently compared to samples from a 1967 study. Two of the lakes (Lakeville Lake and Lake Orion) are within the study area. The data collected for both study areas is detailed in Table 3.

Table 3. Lake Sampling Data.

Lake	1967 Data				2002-2003 Data			
	Sulfate (mg/L)	Chloride (mg/L)	Nitrate (mg/L)	Specific conductance (µs/cm)	Sulfate (mg/L)	Chloride (mg/L)	Nitrate (mg/L)	Specific conductance (µs/cm)
Lake Orion	62	16	1.6	785	32.5	66	<0.022	554
Lakeville Lake	36	12	0.6	402	25.6	39.9	<0.022	485

Similar data results have been observed in lakes throughout Oakland County during this timeframe. Of note, sulfates and nitrates have declined while chlorides have increased (Aichele, 2005). Lakes within the study area generally exhibit adequate “buffering capacity” (i.e., calcium carbonate alkalinity) which protects against rapid changes in pH harmful to aquatic macroinvertebrates and fish.

Habitat

The study area is highly vulnerable to degradation, fragmentation and destruction of natural habitat due to human activities that pose significant threats to wildlife populations. Large portions of the study area have been converted to agriculture, while urban and suburban development continues to consume more habitat. Over time, wetlands have been subjected to draining and filling, invasion of nuisance species (e.g., phragmites), impacted by air and water pollution, bisected by roadways. According to a 1991 United States Fish and Wildlife Service report, for example, over 50% of all original wetlands in Michigan have been drained or filled, making the protection of remaining wetlands that much more important. Specific to the Clinton River AOC, presettlement wetlands totaled 150,457 acres, with an average size of 30 acres. As of 1978, however, wetlands totaled 40,730 acres with an average size of seven acres. This represents a 73% loss in total wetland acreage over that time (Michigan Department of Environmental Quality, 2005). Much of the habitat that does remain is highly impaired, as indicated by the eight BUIs associated with the Clinton River AOC.

Though declining in number, the swamps and marshes that do remain within the study area provide habitat for wildlife, including mammals, wading birds, shorebirds, waterfowl, and songbirds. Where present, dense cattail stands also provide quality winter habitat, food supply and cover for several species of frogs, toads, turtles, snakes, and salamanders. Swamp and marsh areas that have constant hydrology provide suitable habitat for several species of fish that utilize these areas for spawning or nurseries. Wildlife also relies on springs and seeps when rivers, creeks, ponds and other water sources are absent. These sources do not readily freeze during winter months and, as such, offer a dependable source of flowing water throughout the year. In addition, the ground water that percolates at lower elevations often creates a snow-free area in

winter and provides wildlife with access to green vegetation. In spring and summer, reptiles and amphibians, including several kinds of salamanders, favor the constantly moving shallow water of springs and seeps.

A fisheries assessment of the limited aquatic habitat remaining in the study area was conducted by the State of Michigan in 2001 using Great Lakes and Environmental Assessment Section (GLEAS) Procedure 51 methods. Despite increasing threats to the fishery, the quality of this remaining habitat was generally rated (at that time) as “good” and, with some exceptions, the status of the remaining fish community was rated as “good” to “excellent.”

The fact that multiple BUIs in the Clinton River AOC are tied to the fishery and fish habitat speaks to the urgency of programs and projects that safeguard the integrity of the limited remaining high quality habitat while reversing the ongoing trend of habitat loss and degradation. This is particularly important given the ecological significance of highly threatened systems within the study area. For example, Paint Creek is one of the few remaining cold water systems in Southeast Michigan, and its ability to support a viable trout population is threatened by the various stressors noted above. In addition, Indianwood Lake has the potential for a revitalized walleye fishery, including spawning habitat, provided that improvements are made (i.e., installation of structures to enhance habitat and fish spawning).

Threatened and Endangered Species

State threatened and endangered species are protected under state law (Act 451 of 1994, the Natural Resources and Environmental Protection Act, Part 365, Endangered Species Protection). Federally threatened and endangered species are protected under federal law (Endangered Species Act of 1973).

The Michigan Natural Features Inventory (MNFI) is the repository for all Michigan records of occurrences for both state and Federally listed plant and animal species, as well as other elements such as special concern species and unique natural communities. The following table (Table 4) lists the known Federally-threatened, endangered, and candidate species and their associated habitats found in counties that are located within the Clinton River AOC (i.e., Macomb, Oakland and Wayne Counties). These records are the best available information regarding species tracked by the MNFI.

Table 4: Federally Threatened, Endangered, and Candidate Species within Clinton River AOC

Scientific Name	Common Name	Federal Status	Habitat
<i>Myotis sodalis</i>	Indiana bat	Endangered	Caves and mines; small stream corridors with well-developed riparian woods; upland forests
<i>Sistrurus catenatus catenatus</i>	Eastern massasauga	Candidate	Shallow wetlands or shrub swamps; small animal burrows; open fields, grassy meadows or farmed sites.
<i>Oarisma poweshiek</i>	Poweshiek skipperling	Candidate	Wet prairie and fens
<i>Dysnomia torulosa rangiana</i>	Northern riffleshell	Endangered	Large streams and small rivers in firm sand of riffle areas; also occurs in Lake Erie
<i>Epioblasma triquetra</i>	Snuffbox	Endangered	Small to medium-sized creeks in areas with a swift current and some larger rivers
<i>Plantathera leucophaea</i>	Eastern prairie fringed orchid	Threatened	Mesic to wet prairies and meadows

*United States Fish and Wildlife Service, Revised February 2012

Based on MNFI data, four percent of the total area of the Clinton River AOC has a high probability for the occurrence of threatened, endangered, or special concern species. MNFI data is not a definitive statement on the presence of such species, and it is recognized that 1) plant and animal populations and natural communities change with time and, 2) not all potential sites have been surveyed.

Recreation

The study area features an abundance of rivers, streams, lakes and wetlands that factor into water-based recreational facilities and programs. Such activities include swimming, boating and fishing, while activities in adjacent areas (i.e., shoreline) include picnicking, hiking and biking, among others. BUIs within the study area, however, place significant limitations on the quality of the water-based recreational experience. Among others, these include beach closings; eutrophication or undesirable algae; degradation of aesthetics; and the several “habitat” BUIs that adversely impact the recreational fishing experience (i.e., degradation of fish and wildlife populations, degradation of benthos, loss of fish and wildlife habitat).

Communities within the study area feature an array of recreational resources, including public parks and trail systems, as noted in 5 and 6 below. (Private parks and trails are not included in this summary.)

Table 5. Park Acreage by Community.

Community	Acreage
Addison Twp.	1,139
Independence Twp.	1,420
Oakland Twp.	1,076
Orion Twp.	5,827
Oxford Twp.	481
Lake Orion	10
Oxford	40

Table 6. Recreation Trails in Study Area.

Trail System	Location or Authority	Length
Mill Race Trail	Oakland Twp.	0.3 mi
Paint Creek Trail	Paint Creek Trailways Commission	8.9 mi
Polly Ann Trail	Polly Ann Trailways Management Council	14.2 mi

Oakland County Parks

The Oakland County Parks and Recreation Department manages three parks within the study area, consisting of Independence Oaks, Addison Oaks, and Orion Oaks. All have significant water resources and natural areas, and are actively managed to address issues such as invasive species impacts (i.e., via periodic prescribed burns, invasive species treatment, prairie seeding, plant plugging).

Bald Mountain State Recreation Area

Located in Orion Township, the Bald Mountain Recreation Area consists of 4,637 rolling acres. The picturesque park area has some of the steepest hills and most rugged terrain in southeast Michigan. Camping is limited to rustic cabins, and the extensive trails, inland lakes, trout streams and wild game provide year-round recreational opportunities.

Paint Creek Trail

Owned and managed by the Paint Creek Trailways Commission (PCTC), the Paint Creek Trail is an 8.9 mile linear park located in northeast Oakland County. It was the first Rail-to-Trail in Michigan, as it was converted to a trail from the former Penn Central Railroad. Open to the public since 1983, the Paint Creek Trail receives over 100,000 visitors annually. The non-motorized Trail is eight feet wide and comprised of an all-weather surface of crushed limestone. The trail traverses through Rochester, Rochester Hills, Oakland Township, Orion Township and the Village of Lake Orion. Paint Creek Trail closely follows Paint Creek and offers scenic river viewsheds, as well as access to water-based recreational opportunities such as fishing and canoeing.

Polly Ann Trail

The Polly Ann Trail is a 14.2 mile trail beginning in Orion Township and continuing northeast through Oxford, Addison, and Leonard to the Oakland-Lapeer county line at Bordman Road. It then continues north through Dryden Township and ends in the City of Dryden. The trail surface is crushed aggregate with some asphalt surface in densely populated areas. Though a separate path for horses is planned for the north segment of the trail, the trail is primarily a pedestrian and equestrian trail only, with motorized

vehicles strictly prohibited. Polly Ann Trail features numerous creek crossings via foot bridges that provide access to ponds and lakes within the watershed.

5b. Future Without-Project Conditions

The portions of the Clinton River Watershed that comprise the study area are partially developed and retain some open, wooded and agricultural areas. According to forecasts of the Southeast Michigan Council of Governments (SEMCOG), the population of the watershed within Oakland County is expected to grow by about 0.4% annually over the next 25 years, and the number of households is expected to grow by approximately 0.5% annually. Oakland County is presently the most rapidly growing county in the state and, accordingly, the study area will see a continuing trend toward urbanization and an associated increase in impervious surfaces. This will result in greater instability in river and stream flows, with an attendant increased potential for soil erosion and sedimentation, non-point source pollution, and loss of species diversity and populations.

Such development is likely to exacerbate persistent problems with water quality and ecosystem degradation and, consequently, place additional limitations on water-based recreational activity. If practices remain as they are now, the watershed will continue to see loss of wetlands, erosion of streambanks, loss of aquatic habitat, limitations on recreation and other BUI's identified in the planning documents cited in Section 4. These conditions are likely to lead to further loss of aquatic species diversity and abundance through slowly declining quality and quantity of habitat, further compounded by degraded quality of the water through increased sediment and contaminant loading.

Climate change impacts within the basin are anticipated to primarily concern further-altered (flashier) hydrologic conditions within the basin, and potential biodiversity loss. Anticipated responses include less-frequent but more intense warm-weather precipitation events, severely reduced summer low-flow conditions and degraded water quality, less winter ice cover and more cold-weather erosion issues. Riparian habitats may change character and milder climate invasive species may migrate into the area; the exact impacts are not currently known, but would be adaptively managed in the non-federal sponsors O&M work. A primary goal of restoration activities within the Clinton River basin is to develop measures that consider these potential climate change impacts and would be tolerant to a wider range of conditions. Additional steps may need to be taken to provide more robust natural bank protection, runoff retention ponds and buffer strips to reduce sedimentation and contaminant loading.

Without actions that target identified beneficial use problems that are developed sensitive to climate change, the study area will remain as one of the most highly degraded areas within the Great Lakes Basin. It will continue to be a designated AOC with eight BUIs that severely restrict ecosystem functions. (See Section 5c for additional detail). Given the increasing vulnerability of the study area to a range of environmental stressors, inaction will result in further exacerbating current BUIs and compromising future ability to delist them.

Some communities within the watershed are engaged in efforts to improve ecosystem conditions (e.g., fish stocking in the Clinton River, locating/ eliminating illicit connections to the storm sewer systems). While these initiatives are contributing to ecosystem improvements, a much larger and more concerted effort is needed to address systemic problems in the watershed that will lead to the delisting of BUIs and, ultimately, delisting of the Clinton River AOC.

5c. Problems (or Needs) and Opportunities

Problems

As evidenced by its standing as a designated AOC (one of just 14 such sites in Michigan), the Clinton River Watershed is severely degraded. Eight BUIs (of a total of 14 identified in the Great Lakes Water Quality Agreement) are present in the Clinton River AOC and, as noted earlier, include:

- Restrictions on fish and wildlife consumption;
- Eutrophication or undesirable algae;
- Degradation of fish and wildlife populations;
- Beach closings;
- Degradation of aesthetics;
- Degradation of benthos;
- Restriction on dredging activities; and
- Loss of fish and wildlife habitat.

As noted within this study, these BUIs are a consequence of continuing environmental problems that include habitat degradation, fragmentation and destruction; alteration of natural stream flow regimes; excessive erosion and sedimentation; water quality degradation; and flooding. These and related problems are the consequence of such factors as sewage discharges; illicit discharges and spills; dams and other waterway obstructions; various sources of point and nonpoint source pollution; and improper land use practices/ development that exacerbates erosion and sedimentation. All such problems require concerted attention to prevent future additional degradation as well as to restore and protect beneficial uses presently designated as impaired.

The documented water resource and related ecosystem problems in the Upper Clinton River Watershed reflect the detrimental impacts of decades of significant, increasing urbanization and agricultural land use activity. Approximately 13.4% of the watershed is urbanized, with another 6.2% in agricultural land usage, according to USGS (based upon 2002 GIS data for Lapeer County) and SEMCOG (based upon 2008 GIS data for Oakland County). These development pressures, along with other factors resulting in the listing of eight BUIs, are well documented by RAP process for the Clinton River AOC.

Additional detail on selected problems within the study area is provided below, drawn from review of relevant data, reports and other documents:

- Habitat degradation, fragmentation and destruction pose increasing threats to the health and viability of wildlife populations in the Upper Clinton River Watershed, as evidenced by the multiple “habitat” BUIs assigned to the AOC. Large portions of the study area have been converted to urban, suburban and agricultural uses over time. Draining and filling of wetlands continues to have deleterious implications for many species. Terrestrial and wetland habitats that are still available are highly vulnerable due to the negative impacts resulting from an increasing number of roadways that bisect formerly continuous habitat areas.
- Dams and lake level control structures in the Upper Clinton River Watershed continue to alter natural stream flow regimes, adversely impacting fish populations through thermal pollution, obstructions to fish passage, loss of suitable spawning habitat and disruption of

sediment and woody debris transport. Historically, for example, the North Branch of the Clinton River was a significant spawning area for walleye migrating from Lake St. Clair. Dams and lake level controls upstream and west of the City of Pontiac have prevented natural flows and substantially reduced base flows, thus contributing to BUI designations for habitat degradation; degradation of fish and wildlife populations; degradation of benthos; and loss of fish and wildlife habitat.

- Observations along much of the river indicate that streambanks throughout the study area are subjected to high levels of erosion, particularly during storm events. Of primary interest to this study are the areas where erosion is considered moderate to severe. Erosion within these areas is continuing, resulting in the ongoing degradation of the streambed, as well as reduced water quality through increased turbidity and temperature, coupled with a decrease in dissolved oxygen levels. In addition, excess sediment loads continue to reduce suitability of the streambed habitat for aquatic macroinvertebrates and fish. The severity of the streambank erosion and sedimentation problem is reflected in numerous BUI designations and, in particular, degradation of benthos; loss of fish and wildlife habitat; and loss of fish and wildlife populations.
- Sediment quality in the Upper Clinton River Watershed has been, and continues to be degraded by the presence of metals and semi-volatile organic compounds. These areas include the Main Branch of the Clinton River at Dixie Highway in Clarkston; Upper Paint Creek downstream of Newman Road; Salt Slang Drain on the east side of the Garfield Road overpass; Newland Inter-county Drain at the north end of Almont Road Conduit; and Coon Creek Inter-county Drain at Pratt Road. The magnitude of the problem is reflected in the multiple BUIs for the AOC, including restriction on dredging activities.
- Water quality degradation in the Watershed includes a substantial increase in recent years for total dissolved solids and chloride concentrations. Long-standing water quality problems are also due, in part, to the continuing presence of illicit sewer connections throughout the study area. A study in the Village of Leonard, for example, revealed a problem with multiple failing or misconnected Onsite Sewage Disposal Systems from local businesses and residences discharging to the Clark and Leonard Drains. In addition to adverse impacts on fish and wildlife habitat (and populations), such water quality degradation problems contribute to multiple BUIs including eutrophication or undesirable algae; beach closings; and degradation of aesthetics.
- Continuing habitat degradation in the study area has also been linked to flooding problems. A large number of complaints were filed with OCWRC between January 1, 2008 and October 10, 2010 and included (among others), clogged rear yard catch basins, flooding from streams and rivers, high lake levels, and log jams. Collectively, these issues have altered flow regimes and adversely affected water quality and habitat conditions, translating into the designation of multiple BUIs. Projects directed at reversing these sources of habitat degradation will also yield the ancillary benefit of reduced flood risk.

Opportunities

A number of opportunities for environmental restoration arise from the problems described above, and can be used to assess the ability of potential projects to meet the most pressing water resource needs in the Upper Clinton River Watershed. These include the following:

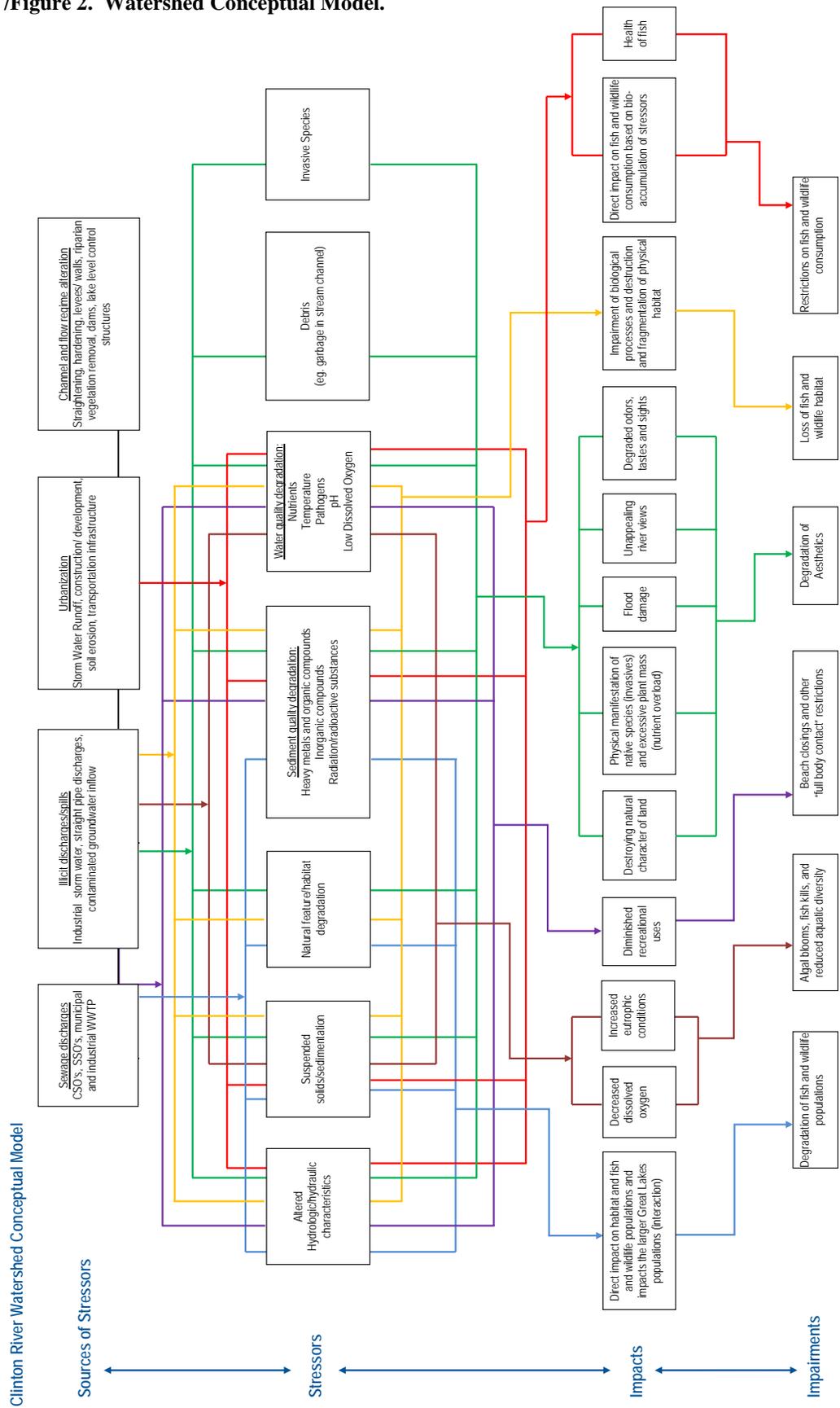
- Improve aquatic and terrestrial habitat by restoring wetland and riparian ecosystems, as well as natural flow regimes. This will restore cool and cold water fisheries in selected parts of the study area, enhance biodiversity and native populations, improve existing habitat, and yield new fish and wildlife habitat. Among others, enhanced sport fishing opportunities will result.
- Provide and protect natural greenways to mitigate habitat fragmentation by reconnecting isolated areas of habitat. This will enhance biodiversity by removing obstructions to aquatic and terrestrial organisms throughout the area.
- Remove dams or provide fish passage structures to limit aquatic habitat fragmentation and mitigate water quality impacts. This will provide an increase in available habitat to aquatic species.
- Improve water quality by reducing point and nonpoint pollution sources contributing to existing problems. This may include soil erosion programs to reduce excessive amounts of sedimentation, as well as clean-up of contaminated sediment and sites that contribute to water quality degradation via runoff.
- Reduce the potential for damage from flooding (including adverse impacts on habitat quality and associated fish and wildlife populations) by implementing stormwater Best Management Practices (BMPs) such as Low Impact Development (LID).
- Identify regional-scale opportunities for restoring habitat for threatened and endangered species. This should be pursued in consultation with the U.S. Fish and Wildlife Service (USFWS) and the Michigan Department of Natural Resources (MDNR).

These opportunities were used as screening factors to identify prospective high value projects warranting detailed evaluation. They are direct responses to the key issues identified in the literature review and stakeholder coordination activities of this Reconnaissance Study, and are consistent with the overall study objectives outlined in the Scope of Work. Appendix E includes details of the initial screening of potential projects in the Upper Clinton River Watershed and the application of these opportunities in evaluating projects.

Watershed Conceptual Model

The conceptual model flow chart (Figure 2) graphically presents how pollutant sources, stressors, impacts and impairments are related, and how such relationships result in environmental degradation as reflected in BUIs. Those listed are considered to be of “medium” to “high” concern within the study area. For ease of presentation, similar types of sources are grouped together on the graphic. Primary sources contributing to degradation in the watershed are typical of those observed in larger urbanized areas of the United States. As noted, impacts adversely affect the physical, chemical and biological integrity of the resource.

/Figure 2. Watershed Conceptual Model.



5d. Alternative Plans

Various local planning organizations and citizen groups, including the non-Federal sponsor, have identified potential projects to address water resource issues in the Upper Clinton River Watershed. Projects with prospective merit were determined to be those consistent with Great Lakes Restoration Initiative (GLRI) goals, while also enjoying strong stakeholder support. Following additional evaluation, such projects have the potential to advance to the feasibility study phase, at which time which specific alternative plans will be developed for each project.

The objective of environmental restoration is to improve ecosystem function and enhance ecosystem values by addressing the factors that resulted in degradation. The intended result is a more naturally functioning ecosystem that provides wildlife habitat, flood storage, and pollutant reduction. The Upper Clinton Watershed also functions as an important recreation area and, therefore, human use is a valid and critical component of the restoration objective. Indicators of a successful environmental restoration project may include, among others, the establishment of a native vegetation community (including eradication/ control of non-native invasive species such as phragmites), a measurable improvement in water quality, a measureable improvement in the fishery, and/or increased recreation hours.

A variety of tools are available to achieve environmental restoration objectives. Among others, restoration techniques- and associated improvements- include the following:

- Streambank stabilization to reduce turbidity – either through bioengineering techniques or a combination of bioengineering and traditional engineering techniques;
- Re-establishment of native vegetation in the riparian corridor (including the removal of non-native or invasive vegetation which adversely affect habitats and biodiversity;
- In-stream habitat modification, including the creation of pool and riffle complexes or the introduction of boulder groupings or other structures for habitat diversity;
- Removal or modification of in-stream obstructions (e.g., dams, log jams, and perched culverts) that adversely affect habitat quality and associated fish and wildlife populations;
- Removal of sediment and/or debris from depositional areas;
- Modifications to dams to improve dissolved oxygen levels, fish passage and/or water temperature; and
- Creation of riparian wetland communities adjacent to the stream corridor.

In addition to the physical, chemical and biological aspects of environmental restoration efforts, socio-economic considerations must be taken into account. Restoration projects should be designed for long-term sustainability and the functional, habitat, and aesthetic benefit of the project should exceed the cost of project implementation.

Preliminary Screening Analysis

For this Reconnaissance Study, a descriptive listing of potential projects in the Upper Clinton River Watershed was compiled from planning documents and communications with local stakeholders (i.e., municipalities, counties, non-governmental organizations). These projects (presented in Appendix D) were screened for their ability to meet Corps objectives for environmental restoration. In addition, their relevance to GLRI criteria (i.e., delisting BUIs in the Clinton River AOC) was assessed. High-value, high-priority projects were selected for more detailed evaluation to determine Federal Interest.

A screening table was employed to facilitate project comparisons, a preliminary evaluation of potential environmental restoration benefits, and a determination of the feasibility of implementation. The screening process also included consideration of other benefits to the watershed such as improved water quality, potential for flood risk management benefits, stakeholder support, and improvements to public safety. These secondary factors were used to more finely prioritize projects that satisfy the Federal Interest.

A detailed explanation of the screening process is included in Appendix E. Projects selected for further development and evaluation are summarized in Table 7 below, followed by additional narrative. As noted, they each address one or more of the previously identified problems in the watershed, with an emphasis on the “habitat” BUIs.

Table 7. Priority Water Resource Projects for the Upper Clinton River Watershed.

Project	BUIs Addressed (Direct/ Indirect)	Location
Brown Drain Improvement	Eutrophication or undesirable algae; degradation of fish and wildlife populations; degradation of aesthetics; degradation of benthos; loss of fish and wildlife habitat	Orion Township
Axford Drain Improvement or Relocation	Eutrophication or undesirable algae; degradation of fish and wildlife populations; degradation of aesthetics; degradation of benthos; loss of fish and wildlife habitat	Orion Township
Brandon – Oxford Drain Stabilization and Cleanout	Eutrophication or undesirable algae; degradation of fish and wildlife populations; degradation of aesthetics; degradation of benthos; loss of fish and wildlife habitat	Oxford Township
Addison-Dryden Stabilization and Cleanout	Eutrophication or undesirable algae; degradation of fish and wildlife populations; degradation of aesthetics; degradation of benthos; loss of fish and wildlife habitat	Addison and Dryden Townships
Paint Creek Road Crossings	Degradation of fish and wildlife populations; degradation of benthos; loss of fish and wildlife habitat	Orion and Oakland Townships, City of Rochester Hills
Paint Creek Buffers	Degradation of fish and wildlife populations; degradation of benthos; loss of fish and wildlife habitat	Oxford Township
Indianwood Lake Habitat Enhancement	Degradation of fish and wildlife populations; degradation of benthos; loss of fish and wildlife habitat	Orion Township
Independence Oaks Wetland Restoration	Degradation of fish and wildlife populations; degradation of benthos; loss of fish and wildlife habitat	Clarkston
Paint Creek Dam Removal	Degradation of fish and wildlife populations; degradation of benthos; loss of fish and wildlife habitat	Orion

Project	BUIs Addressed (Direct/ Indirect)	Location
Oakland County Wetland Restoration	Degradation of fish and wildlife populations; degradation of benthos; loss of fish and wildlife habitat	Springfield, Independence and Oakland Townships

Brown Drain Improvements

Improvements to Brown Drain in Orion Township provide a significant opportunity to increase/enhance fish and wildlife habitat and, consequently, reverse the loss of fish and wildlife populations in the study area. Brown Drain was originally constructed to address agricultural drainage requirements in an area that has been urbanized over the last 20 years, resulting in numerous, well-documented drainage problems. To date, no major improvements have been undertaken and the drain is in need of a major reconstruction and cleanout to continue to serve the watershed. Improvements to this drain will provide several opportunities to implement naturalized streambank stabilization measures and the creation of in-stream aquatic habitat. Native wetland areas will be constructed to provide additional flood storage as well as terrestrial habitat for wildlife. Additionally, these ecosystem restoration activities would also serve to restore some degree of natural hydrology in the project area, and thus have secondary flood risk management benefits.

Estimated to cost \$500,000, the Brown Drain Improvements project will stabilize and restore habitat along approximately 2,500 feet of streambank, with associated reductions in sediment loads.

Axford Drain Improvements or Relocation

The improvement and/or relocation of Axford Drain, in the northeast section of Orion Township, will stabilize and restore streambank habitat, reduce sediment loads, contribute to an increase in fish and wildlife populations and, as an ancillary benefit, reduce flood risk. This is a 100 year-old enclosed drain with poor functionality. The project provides an opportunity to determine the drain’s precise location and return it to “daylighted” status, where possible (along with natural streambank stabilization measures and in-stream habitat BMPs), and construction of in-line wetland areas with the purpose of improving habitat and (secondarily) addressing flood risk.

The Axford project is estimated to cost \$1,600,000.

Brandon-Oxford Drain Streambank Stabilization and Clean-out

The Brandon-Oxford Drain project entails streambank stabilization and clean-out with benefits that include the creation of in-stream aquatic habitat and construction of wetland areas that will address the several “habitat” BUIs while also providing additional flood storage. The drain is an open channel watercourse that traverses Brandon and Oxford Townships. To date, no significant actions have been undertaken and, due to bank erosion, the drain is in need of major improvements including sediment removal and streambank stabilization.

Estimated to cost \$1,000,000, the Brandon-Oxford Drain project will stabilize and restore habitat along approximately 2,500 feet of streambank, with associated reductions in sediment loads.

Addison-Dryden Drain Streambank Stabilization and Cleanout

The Addison-Dryden Drain project entails sediment removal and streambank stabilization work that will address the “habitat” BUIs through the creation of in-stream aquatic habitat and the construction of wetland areas which can provide terrestrial habitat for wildlife as well as additional flood storage.

The Addison-Dryden Drain project is estimated to cost \$500,000, and will stabilize and restore habitat along approximately 1,250 feet of streambank, with associated reductions in sediment loads.

Paint Creek Road Crossing Improvements

Improvements at several Paint Creek road crossings (i.e., Clarkston, Kern, Silver Bell and Dutton Roads) have pronounced benefits for a downstream managed trout area. A significant amount of sediment is discharged to Paint Creek from roadside ditches at these gravel road crossings with that drain to Paint Creek, contributing to the “degradation of benthos” BUI. Road improvements directed at reducing the discharge of sediment would include conversion of the gravel surface to asphalt (to reduce sediment loading to Paint Creek); installation of/ modification to stormwater conveyance facilities to eliminate high-velocity discharges that carry sediment and increase bank erosion; and/or installation of a sedimentation pond or other BMP to further reduce discharge velocities and allow for additional sediment removal. Resultant benefits will be realized in all downstream areas of the Paint Creek sub-watershed and, by addressing the “habitat” BUIs, significant improvements will be realized in this cold water trout fishery, including an anticipated increase in recreational fishing activity.

The Paint Creek Road Crossing Improvements project is estimated to cost \$250,000, and will reduce sediment loading and improve aquatic habitat for a distance of approximately ¼ mile downstream from each roadway crossing.

Paint Creek Buffers

Riparian buffers are proposed along a small portion of Paint Creek (at the southern edge of Oxford Township) with the goal of stabilizing the streambank to protect against erosion.

The Paint Creek Buffers project is estimated to cost \$100,000, and will improve habitat along approximately 250 feet of streambank.

Indianwood Lake Habitat Enhancement

This project directly addresses the “loss of fish and wildlife habitat” BUI through the enhancement of walleye and yellow perch spawning habitat, as well as fishery refuge, near the Indianwood Lake inlet. Other BUIs addressed include eutrophication or undesirable algae; degradation of fish and wildlife populations; and degradation of benthos. Project tasks include habitat assessment, identification of locations for woody structures, permitting, construction and installation.

The Indianwood Lake Habitat Enhancement project is estimated to cost \$25,000 for the installation of 20 structures.

Independence Oaks Wetland Restoration

This project entails the restoration of a natural flow regime within a wetlands complex in Oakland County's Independence Oaks County Park. Wetland restoration will be accomplished through the removal of a road that bisects the wetland and, consequently, impedes natural flow. Severed habitat areas will be reconnected through the project, with pronounced benefits in addressing the "loss of fish and wildlife habitat" BUI as well as the "degradation of fish and wildlife populations" BUI.

Studies to define the scope of work and quantify the acreage of prospective wetland improvements have yet to be prepared. Based on similar projects, however, a cost estimate of \$50,000 per acre of restored wetland will be used to evaluate this project.

Paint Creek Dam Removal

Removal of this small, low-head dam near the intersection of Gunn and Orion Roads will result in pronounced improvements to Paint Creek, one of the few remaining- and highest quality- cold water streams in Southeast Michigan. The dam is located near the creek's midpoint and, its removal will enhance cold water habitat and fish passage, thereby addressing all "habitat" BUIs identified in the study area. Recreational fishing activity is expected to increase, offering an ancillary benefit to the habitat and fish and wildlife improvements.

The Paint Creek Dam Removal project is estimated to cost \$500,000 and, given its location at the mid-point of the creek, will reconnect and improve fragmented cold water habitat for nearly half the length of the creek.

Oakland County Wetland Restoration

Three sites in the Upper Clinton Watershed (i.e., Springfield, Independence and Oakland Townships) have been targeted for restoration in the interest of addressing the "habitat" BUIs. Activities include restoring a natural hydrologic flow regime to create and enhance aquatic and terrestrial habitat that will benefit fish and wildlife populations within the watershed. With the assistance of MDNR and the Michigan Natural Features Inventory, these sites were identified based on analysis of hydric soils, pre-settlement wetland maps, proximity to existing wetlands or waterways, landscape context, proximity to protected areas, existing wetland easements, headwater areas, development threats and significant biological features. This project, consisting of the three individual sites noted above, is estimated to cost \$10,000,000, assuming \$50,000 per acre for 200 acres of wetland restoration.

5e. Preliminary Evaluation of Project Locations

Table 8 summarizes the preliminary evaluation of the potential projects identified above. Habitat restoration benefits are represented by linear of feet of streambank stabilization or acres of wetlands restored (where applicable), and accompanied by preliminary project costs estimates. Each of the projects addresses multiple BUIs, as listed in Table 7 above.

Table 8. Preliminary Evaluation of Projects.

Project	Preliminary Project Cost Estimate	Habitat Restoration Benefits
Brown Drain Improvement	\$500,000	2,500 feet of shoreline
Axford Drain Improvement or Relocation	\$1,600,000	To be determined
Brandon – Oxford Drain Stabilization and Cleanout	\$1,000,000	2,500 feet of shoreline
Addison-Dryden Stabilization and Cleanout	\$500,000	1,250 feet of shoreline
Paint Creek Road Crossings	\$250,000	Improvement of habitat for 1,300 feet downstream of each of four crossings
Paint Creek Buffers	\$100,000	250 feet of shoreline
Indianwood Lake Habitat Enhancement	\$25,000	Metric to be determined
Independence Oaks Wetland Restoration	\$50,000 / acre	Acreage to be identified
Paint Creek Dam Removal	\$500,000	Reconnection of fragmented habitat
Wetland Restoration	\$10,000,000	200 acres of wetland restoration

As noted, many of these projects will improve fish and wildlife biodiversity and populations through a net increase in aquatic and terrestrial habitat, improved habitat quality, and removal of obstructions to the movement of aquatic and terrestrial organisms. Such enhancements can be quantified via the use of Habitat Suitability Index (HSI) methodologies or similar metrics. In addition, many of the projects will yield ancillary benefits in the form of improved water quality and flood risk management, among others. Specifically:

- Drain Improvements in the Upper Clinton River Watershed

This set of four projects (i.e., Brown Drain Improvements Axford Drain Relocation, Brandon-Oxford Drain Stabilization, Addison-Dryden Drain Stabilization) will produce significant, measurable environmental restoration benefits in linear feet of streambank stabilization and habitat restoration. This will result in a net increase in both the quantity (i.e., surface area) and quality of aquatic and terrestrial habitat. Furthermore, these projects are likely to improve water quality in the watershed by reducing sediment loadings, and will also have significant secondary flood risk management benefits via hydrologic improvements. Preliminary cost estimates are not well developed at this time, but it is anticipated that these projects can be completed for approximately \$200-\$400 per linear foot of improved streambank. These projects total approximately 6,250 feet of habitat restoration benefits (excluding the Axford project where the extent of improvements has not yet been fully quantified).

These projects are recommended for a feasibility phase analysis based on their potential for significant environmental restoration benefits.

- Paint Creek Road Crossing Improvements

These improvements will have a positive impact on water quality and fish and wildlife habitat in a managed fishery area by reducing sediment loads downstream (approximately 1,300 feet) of each of four crossing locations. Project benefits to aquatic habitat have yet to be quantified in detail, but are expected to be substantial given that these road crossing improvements directly affect the highest quality cold water fishery in Southeast Michigan- one of the few such fisheries that remain in the area.

This project is recommended for a feasibility phase analysis based on its potential for environmental restoration benefits.

- Paint Creek Buffers

The construction of riparian buffers along 250 feet of streambank will reduce erosion and sedimentation by capturing and slowing the flow of stormwater into the creek and allowing some stormwater to infiltrate before entering the creek. As a result, this project will address “habitat” BUIs by protecting and improving existing riparian and aquatic habitat, and creating additional habitat. Improvements to water quality will also result due to sediment load reductions. The project is also expected to have secondary beneficial impacts relative to flood risk management. The preliminary cost estimate is not well developed at this time, but it is anticipated that the project could be completed for approximately \$400 per linear foot of protected streambank, including labor and materials.

This project is recommended for a feasibility phase analysis based on its potential for environmental restoration benefits.

- Indianwood Lake Habitat Enhancement

Restoring, creating and enhancing walleye spawning habitat through the installation of multiple structures in the lake will directly improve ecosystem conditions for an important species in the Upper Clinton River Watershed. This project will have a direct and positive impact on aquatic habitat and fish populations and, consequently, yield benefits for the recreational fishery in the study area. A habitat assessment methodology will be employed to document and quantify resultant benefits. The project cost is estimated to be \$25,000.

This project is recommended for a feasibility phase analysis based on its potential for environmental restoration benefits.

- Independence Oaks Wetland Restoration

By restoring the hydrology of the project area and reconnecting severed habitat, this project will have a direct positive impact on ecosystem conditions in the Upper Clinton River Watershed. The project will also yield secondary benefits for flood risk management by improving the carrying capacity of the landscape. Additionally, this project area is located in the popular Independence Oaks Park, and would enhance water-based recreation opportunities (including fishing) in the park by improving overall water quality, as well as fish and wildlife habitat. Cost estimates have yet to be developed in detail and the wetland acreage to be restored is in need of quantification. However, similar wetland restoration projects in the area have been completed for a cost of \$50,000 per acre.

This project is recommended for a feasibility phase analysis based on its potential for environmental restoration benefits.

- Paint Creek Dam Removal

Removing the Paint Creek Dam would have a beneficial effect on aquatic habitat by restoring severed habitat and opening upstream reaches of the creek to fish and other aquatic species. This project would also have an ancillary benefit in terms of enhanced recreational opportunities in one of the study area's key cold water fisheries. Habitat assessment methodology prescribed in the project's scope of work will provide a means to measure benefits. This project is estimated to cost \$500,000 to complete.

This project is recommended for a feasibility phase analysis based on its potential for ecosystem restoration benefits.

- Oakland County Wetland Restoration

Presently in a preliminary stage of development, this project will have a direct positive impact on the Clinton River Watershed by restore the natural hydrology of the project area and creating aquatic and terrestrial habitat. The project will also yield secondary benefits for flood risk management by improving the water carrying capacity of the landscape. Potential project locations are high wetland function value sites, and were

selected through a detailed evaluation process. Cost estimates to complete this project (approximately 200 acres) have not been prepared in detail, but similar wetland restoration projects have been completed for approximately \$50,000 per acre.

This project is recommended for a feasibility phase analysis based on its potential for ecosystem restoration benefits.

6. Federal Interest

Federal Interest is established once it is determined that the potential action being considered under the Reconnaissance Study phase falls under one of the seven Corps primary mission areas (i.e., navigation, flood damage reduction, ecosystem restoration, hurricane and storm damage reduction, water supply, hydroelectric power generation, recreation).

As noted above, ecosystem restoration is one such primary mission. The Corps objective for National Environmental Restoration (NER) is to contribute to the nation's ecosystems through the restoration of significant ecosystem function, structure, and dynamic value with contributions measured by changes in the amounts and values of habitat. Additionally, the proposed projects should also be justifiable based on preliminary analysis of cost versus economic and environmental benefits. Further, the proposed projects should be sensible and be in the public interest. Last, a potentially willing and capable non-Federal sponsor should be identified for projects to be recommended to proceed to feasibility analysis.

The restoration opportunities described above represent prudent approaches to restoration of degraded aquatic, wetland, and riparian habitat in the Upper Clinton River Watershed. These actions will result in significant ecosystem benefits of local, regional, and national significance. Although a benefit-cost analysis is beyond the scope of this Reconnaissance Study, based on preliminary cost estimates, these project locations demonstrate reasonable and consistent costs typical for their range of environmental outputs. Ecosystem restoration efforts at the proposed project locations would serve the public interest by improving overall conditions in the watershed while contributing to opportunities for aquatic recreation. As noted in Section 7, the OCWRC has been identified as a prospective non-Federal partner for these various projects.

In sum, the 10 projects listed below appear to be viable under the ecosystem restoration mission of the Corps, meeting the criteria for Federal Interest:

- Brown Drain Improvement, Orion Township
- Axford Drain Relocation, Orion Township
- Brandon-Oxford Drain Stabilization, Oxford Township
- Addison-Dryden Drain Stabilization, Addison and Dryden Townships
- Paint Creek Road Crossing Improvements. Oakland Township and City of Rochester Hills
- Paint Creek Riparian Buffers, Oxford Township
- Indianwood Lake Habitat Enhancement, Orion Township
- Independence Oaks Wetland Restoration, Clarkston

- Paint Creek Dam Removal, Orion Township
- Oakland County Wetland Restoration, Springfield, Independence and Oakland Townships

These projects should be advanced to feasibility phase. They will substantially address the watershed problems identified in this study by restoring aquatic and riparian habitat, reducing habitat fragmentation, increasing species diversity, reducing flood risk, and/or providing enhanced recreation opportunities. In so doing, they will advance efforts to delist the eight BUIs in the Clinton River AOC as previously identified and discussed. Further, they are consistent with other Federal, state and regional planning efforts, and will complement other GLRI-funded projects focused on the Clinton River Watershed and other major tributary systems to the Great Lakes.

A more detailed and precise quantitative evaluation of project benefits is beyond the scope of this Reconnaissance Study, but will be undertaken during the feasibility phase analysis via the application of HSI methodologies or similar metrics.

7. Sponsor Intent

The OCWRC has expressed initial interest in serving as non-Federal sponsor for the environmental restoration projects in the Upper Clinton River Watershed recommended for the feasibility analysis phase. The OCWRC understands the cost sharing responsibilities associated with both feasibility analyses and project implementation. The OCWRC also understands its responsibility for operating and maintaining any such completed projects at 100 percent non-Federal expense. However, the OCRWC has yet to provide a Letter of Request (LOR) to serve as the non-Federal sponsor for any of the recommended projects. A Project Management Plan (PMP) and Feasibility Cost-Share Agreement (FCSA) will be produced once a LOR is received in support of one or more of the identified projects.

8. Summary of Feasibility Study Assumptions

A number of assumptions will be used to guide the development of a PMP and schedule, and to initiate the feasibility phase analysis of selected projects (typically cost-shared on a 50/50 basis with the non-Federal sponsor). These assumptions are as follows:

1. A single feasibility study for each potential environmental restoration project in the Upper Clinton River Watershed will be executed, depending on the willingness of the non-Federal sponsor(s) and the availability of Federal funds;
2. The decision document will be an integrated Feasibility Study and a National Environmental Policy Act (NEPA) document, as necessary;

(It is anticipated that the appropriate NEPA document associated with the reconnaissance study recommendations would be the development of an Environmental Assessment (EA) which will determine the magnitude of the project's socioeconomic and environmental impacts on the human environment. At the end of the EA public review

period, the Detroit District Engineer will consider all comments submitted by individuals, agencies, and organizations and will make a final decision regarding the necessity of preparing an Environmental Impact Statement (EIS), the next higher level of environmental impact investigation under NEPA) .

3. Based on the non-Federal sponsor’s fiscal year and budgets, the precise amount of funds available cannot be determined at this time;

Alternative Plan features that have both ecological and traditional economic benefits (e.g., streambank stabilization using bioengineering techniques) will be evaluated with both Cost Effectiveness and Incremental Cost Analysis (CE/ICA) and traditional benefit-cost evaluation techniques in order to evaluate and select the recommended plan.

9. Feasibility Phase Milestones

A draft schedule of feasibility study milestones will be prepared in conjunction with the development of a PMP. A preliminary list of typical tasks and their estimated duration is presented in Table 9.

Table 9. Feasibility Phase Milestones.

Milestone	Duration in Months
Execute Feasibility Cost Share Agreement	1
Feasibility Study Initiation	2
Notice of Intent	2
Joint Environmental Impact Statement (EIS) /Environmental Impact Report (EIR) Scoping Meeting – Public Workshop	2
Field Investigations	6
Alternative Designs	9
Alternative Formulation and Evaluation	6
Alternative Formulation Report	3
Alternative Formulation Briefing	1
Draft Feasibility Report (DFR), Draft EA	3
Comment Period	1
Transmit DFR and DEIS to Division and HQ and distribute to public	1
Comment Period	1
Prepare Final Feasibility Report (FFR) and Final EA	2
Transmit FFR and FEIS to Division and HQ	1
Division Commander’s Public Notice	2
TOTAL	~ 43

10. Feasibility Study Cost Estimate

The costs to complete the Feasibility Studies for the projects detailed in this report will be fully developed with the completion of a PMP. In that process, study costs will be negotiated with the non-Federal sponsor. It is anticipated that the cost to complete each of the Feasibility Studies will fall in the range of \$250,000 to \$500,000 (or possibly more), depending upon the nature and scope of work associated with a given project. If initiated under the Continuing Authorities Program (CAP), the first \$100,000 of the feasibility phase would be fully-Federally funded, with the remaining cost of the study cost-shared with the non-Federal sponsor 50-50.

11. Recommendations

This investigation has clearly demonstrated a Federal Interest in environmental restoration and associated benefits (e.g., habitat and water quality improvements) in the Upper Clinton River Watershed. Examples of potential environmental restoration measures have been provided. It is anticipated that the benefits of such measures will exceed project costs in each of the recommended projects within the study area, resulting in positive contributions to the NER account. There is significant local support for environmental restoration, and it is expected that a non-Federal project partner will be identified that is willing and able to cost share feasibility studies and project implementation.

The following projects have been identified as being in the Federal Interest and recommended to proceed into the feasibility phase:

- Brown Drain Improvement, Orion Township, MI
- Axford Drain Relocation, Orion Township, MI
- Brandon-Oxford Drain Stabilization, Oxford Township, MI
- Addison-Dryden Drain Stabilization, Addison and Dryden Townships, MI
- Paint Creek Road Crossing Improvements. Oakland Township and City of Rochester Hills, MI
- Paint Creek Riparian Buffers, Oxford Township, MI
- Indianwood Lake Habitat Enhancement, Orion Township, MI
- Independence Oaks Wetland Restoration, Clarkston, MI
- Paint Creek Dam Removal, Orion Township, MI
- Oakland County Wetland Restoration, Springfield, Independence and Oakland Townships, MI

Once a non-Federal sponsor is identified, and a LOR is received, the District will request funds to develop a PMP for each identified eligible project(s), and to initiate FCSAs.

The recommendations contained herein reflect the information available at this time and current Departmental policies governing formulation of individual projects. They do not reflect program and budgeting priorities inherent in the formulation of a national Civil Works construction program nor the perspective of higher review levels within the Executive Branch. Consequently, the recommendations may be modified before they are transmitted to higher authority for authorization and/or implementation funding.

12. Potential Issues Affecting Initiation of Feasibility Phase

Constraints represent restrictions that may make achievement of planning objectives more difficult. The constraints identified for this study that may affect outcomes include:

- Portions of the riparian corridors in the Upper Clinton River Watershed are privately owned. This can make coordination of efforts challenging. Aligning project goals and objectives across a broad range of stakeholders will ease implementation.
- The watershed encompasses multiple counties, townships, villages and cities, creating a potential for jurisdictional friction. Involving local governments in project development will ease implementation.
- The public may not fully understand the relationship between habitat restoration and associated outcomes (e.g., water quality improvements, enhanced biodiversity of fish and other aquatic organisms). Further, the public may not understand both the direct and indirect benefits of any particular project. Developing educational materials in conjunction with projects may be valuable in communicating the range of benefits associated with them.
- Inconsistent Federal funding levels may result in delays in the execution of Feasibility Studies.

13. Views of Other Resource Agencies (if known)

Sixty-eight Federal, state, regional, municipal and non-governmental agencies with an interest in water resources in the Upper Clinton River Watershed were contacted in the course of this Reconnaissance Study. The Scoping Letter template, along with responses, is included in Appendix B.

The projects recommended for Feasibility Studies were selected through a stakeholder involvement process to ensure that they are supported by local agencies. This involvement included input provided through via in-person meetings with Oakland County officials, three public workshops co-sponsored with SEMCOG, telephone and in-person conversations with various local officials (and, in some cases, their consultants), and occasional emails focused on the descriptive listing of potential projects.

14. Project Area Map

A map detailing the project area is shown in Figure 1, page 2.



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Lieutenant Colonel, U.S Army
District Engineer

MAY 22 2012

SUPPLEMENTAL APPENDICES

- A. References
- B. Source Document Abstracts
- C. Contributing Organizations and Individuals
- D. Initial Project List
- E. Project Screening Approach

Appendix A: References

Clinton River Sediment Transport Modeling Study, USACE, 2005

The Clinton River Watershed / Area of Concern Restoration Plan (RAP), Tetra Tech, 2008.

Delisting Targets for Fish / Wildlife Habitat and Population Beneficial Use Impairments for the Clinton River Area of Concern, Clinton River Watershed Council and ECT, 2009.

Effects of Urban Land-Use Change on Streamflow and Water Quality in Oakland County, Michigan, 1970-2003, as Inferred from Urban Gradient and Temporal Analysis, USGS (Stephen Aichele), 2005

Fish and Wildlife Beneficial Use Impairments Delisting Targets Report

Independence Township Vision 2020 Plan Update, Carlisle/Wortman, 2006

Michigan Department of Environmental Quality Water Bureau Measures of Success, Michigan Department of Environmental Quality, 2009

Oakland Charter Township 2010-2014 Master Plan for Parks, Recreation, Land Preservation and Trails, McKenna Associates, 2009

Oakland County Trails Master Plan, Wade Trim.

Oakland Township Master Plan, Williams and Works & Tilton Associates, 2005

Oxford Township Master Plan, Carlisle/Wortman, 2005

Strategy for Delisting Michigan AOCs, Michigan Department of Environmental Quality, 2010

Appendix B: Source Document Abstracts

<i>Title</i>		Analysis of Altered Hydrologic Regime in the Clinton River
<i>Author</i>		Bruce Halverson, Rob Nairn, Alex Brunton, and James P. Selegan
<i>Pub Date</i>		2006
General Summary (document purpose, scope, etc.)		
Alterations of hydrologic processes can increase runoff response have significant effects on erosion and sediment transport. Substantial portions of the Clinton River Watershed have undergone land use changes from primarily agriculture to urban, especially within the last 10 to 15 years. A preliminary assessment was conducted using a flashiness index, to determine if any significant changes in the hydrologic processes of the watershed have occurred over the last 30 to 40 years in response to land use change.		
Document Relevance to Reconnaissance Study		
The flashiness index was calculated for all stream gages with a minimum of 20 years of record. Results indicate a strong correlation between increasing and decreasing flashiness with changes in watershed land use. The only gage which is located within the area of interest for this reconnaissance study does not show any change in flashiness over time.		
Key Elements for Reconnaissance Study		
<i>Element</i>	<i>Pages</i>	<i>Notes</i>
Land use hydrologic trend map	4	Display of all gaging stations used in flashiness study with associated hydrologic trend over their period of record.

<i>Title</i>		Cemetery and Dollar Lake Dam Inspection Report	
<i>Author</i>		Oakland County Water Resources Commission	
<i>Pub Date</i>		2007	
General Summary (document purpose, scope, etc.)			
This document reports the findings of a dam inspection conducted by the Oakland County Water Resource Commissioners Office in 2007. The primary purpose of the inspection is to report the control structure's design specifications, condition, and capacity. It also provides information pertaining to its corresponding lake levels.			
Document Relevance to Reconnaissance Study			
This report provides some useful information pertaining to hydrology and flood control in the corresponding drainage area and would be most applicable to the flood management section. This report does not provide management conclusions. To adequately characterize the flow regime within the area of interest, all of the inspections reports should be obtained and reviewed.			
Key Elements for Reconnaissance Study (per Table of Contents)			
<i>Element</i>	<i>Section</i>	<i>Pages</i>	<i>Notes</i>
			Contains measurements and description of structure. May be useful for flood management section.

<i>Title</i>		Clinton River Area of Concern	
<i>Author</i>		United States Environmental Protection Agency	
<i>Pub Date</i>			
General Summary (document purpose, scope, etc.)			
The Clinton River Area of Concern provides background information on the Clinton River AOC beneficial use impairments, delisting targets, and significant Remedial Action Plan milestones to date. In addition, current project and outlook identify solutions to the most significant problems (i.e., stormwater management, habitat protection) in the Clinton River Watershed requiring implementation at the local level of government.			
Document Relevance to Reconnaissance Study			
The document provides a brief summary on the Clinton River Area of Concern and a general description on the progress and achievements to date. Although the report does not include detailed project and study efforts, it includes an overview of the various agencies, partners, stakeholders, and community involvement related to the Clinton River.			
Key Elements for Reconnaissance Study (per Table of Contents)			
<i>Element</i>	<i>Section</i>	<i>Pages</i>	<i>Notes</i>
4-7			Recon Report draft table of contents input for Element III. Output Analysis, Section 4.1, 5.1: On going studies information
7,8			Recon Report table of contents input for Element IV. Supplemental Appendices: General Institutional Analysis (ie., Watershed groups)

<i>Title</i>		Clinton River Watershed/ Area of Concern (AOC) Clinton River Restoration Plan	
<i>Author</i>		Tetra Tech, Inc.	
<i>Pub Date</i>		2008	
General Summary (document purpose, scope, etc.)			
The Clinton River Restoration Plan is a comprehensive Remedial Action Plan (RAP) document that updates the actions to address the beneficial use impairments (BUIs), with the primary purpose being to achieve delisting of the watershed as an AOC through restoration of the eight beneficial uses that have been classified as impaired.			
Document Relevance to Reconnaissance Study			
This most recent version of the Clinton River RAP is relevant to the Reconnaissance Study by strategically integrating specific local planning documents (i.e. subwatershed plans) with the long term goal of delisting BUIs. The study can be useful in targeting the project study area for the recon report with specific actions.			
Key Elements for Reconnaissance Study (per Table of Contents)			
<i>Element</i>	<i>Section</i>	<i>Pages</i>	<i>Notes</i>
Chapter 2	2-3,2-4	40,41	Jurisdictional and subwatershed listings specific to recon report study area
Chapter 3	3-38 through 3-50	86-101	Subwatershed characteristics for North Branch and Stony/Paint Creek
Ch. 8, Fig. 8-1	8-1	308	Urbanized areas in project area mandated by NPDES permit to implement Phase I/Phase II actions.
Ch. 8, Fig. 8-2	8-2	310	General timeline milestones for comprehensive list of action items
Ch. 8	8-39 through 8-72	345-379	BUIs of medium to high concern for Paint/Stony Creek and North Branch subwatersheds
Ch. 8	8-73 through 8-76	379-382	Prioritization of actions based on achieving 4 or more objectives for a BUI and modeling recommendation/phase II NPDES permit support

<i>Title</i>	Clinton River AOC Wetland Status and Trends Pre-settlement to 1978		
<i>Author</i>	Michigan Department of Environmental Quality		
<i>Pub Date</i>	Summer 2008		
General Summary (document purpose, scope, etc.)			
This document uses a series of maps to illustrate wetland area loss over time from pre-settlement to 1978 and provides some core statistics in terms of total wetland areas. It also provides a brief summary of the methods used for this calculation.			
Document Relevance to Reconnaissance Study			
The document is mainly comprised of maps that have been generated using GIS. Some of the maps do show the study area, however, the statistics that are reported in this document are calculated watershed wide.			
Key Elements for Reconnaissance Study (per Table of Contents)			
<i>Element</i>	<i>Section</i>	<i>Pages</i>	<i>Notes</i>
Wetlands Trends	All		Wetland maps over time.

<i>Title</i>	Clinton River East Subwatershed Management Plan		
<i>Author</i>	Macomb County Planning Department Tetra Tech, Inc. Clinton River East Subwatershed Members		
<i>Pub Date</i>	October 2006		
General Summary (document purpose, scope, etc.)			
This WMP was developed by the CREW Subwatershed Advisory Group (SWAG) to: 1) fulfill the National Pollutant Discharge Elimination System (NPDES) Phase II requirements (MDEQ's <i>General Permit No. MIG619000 for Coverage of Storm Water Discharges for Municipal Separate Storm Sewer Systems Subject to Watershed Plan Requirements</i>) for non-Phase I governmental units in the urbanized area; and 2) make all of the entities represented in the subwatershed eligible for various grant funding opportunities to implement actions for watershed improvement. The contents of this plan, including the goals and objectives and the actions to meet them, were developed cooperatively by SWAG members with consideration of the input from community leaders, residents, environmental and citizen groups, local businesses, schools, and universities. The content of this document does not include areas within the project scope.			
Document Relevance to Reconnaissance Study			
None. This management plan covers areas outside of the project scope.			

<i>Title</i>	Clinton River Greenways Opportunity Plan in Rochester and Rochester Hills		
<i>Author</i>	Oakland County Planning and Economic Development Services		
<i>Pub Date</i>			
General Summary (document purpose, scope, etc.)			
This section of the Clinton River Greenway Opportunity Plan is within Rochester and Rochester Hills, MI.			
Document Relevance to Reconnaissance Study			
None. Document not relevant to project study area.			

<i>Title</i>	Clinton River Sediment Transport Modeling Study		
<i>Author</i>	U.S. Army Corps of Engineers, Detroit District		
<i>Pub Date</i>	2005		
General Summary (document purpose, scope, etc.)			

<p>To assess potential management problems and to evaluate a wide range of best management practices, a set of computational tools was used to study watershed hydrology, soil erosion, sediment delivery, river channel hydrodynamics and sediment transport. These models provide a general understanding of the hydrologic and geomorphic behavior of the watershed, allowing the prediction of the relative effects of changing land use and the effectiveness of different Best Management Practice (BMP) strategies on subwatershed scale, soil erosion and sediment yield.</p>			
<p>Document Relevance to Reconnaissance Study</p>			
<p>A wide variety of BMP alternatives were evaluated using the Clinton River Watershed Modeling System. The large-scale effects of changing land use over time on watershed sediment yield and sediment delivery were investigated using the Soil Water Assessment Tool (SWAT) model. The large-scale effects of changing land use over time on watershed sediment yield and sediment delivery were investigated using the SWAT model. Different buffer widths and vegetative types were evaluated for different land use types surrounding the buffer zone using the Gridded Surface-Subsurface Hydrologic Analysis (GSSHA) model. Change in urban density was evaluated by changing lot sizes within the GSSHA hydrologic model.</p>			
<p>Key Elements for Reconnaissance Study (per Table of Contents)</p>			
<i>Element</i>	<i>Section</i>	<i>Pages</i>	<i>Notes</i>
Chapter 3	3.3-3.	29-47	Sediment budget, flashiness analysis, rating curve analysis
Chapter 5	5.1-5.12	79-112	Effects of urbanization, sediment traps
Chapter 7	7.2-7.3	146-150	Model comparison and recommendations for model application
Chapter 8	8.2-8.4	151-155	Impacts of BMPs, effects of changing land use

Title	Clinton River Greenways Opportunity Plan in Rochester and Rochester Hills
<i>Author</i>	Oakland County Planning and Economic Development Services
<i>Pub Date</i>	
General Summary (document purpose, scope, etc.)	
This section of the Clinton River Trail Master Plan is within Auburn Hills, Pontiac, Sylvan Lake, Rochester and Rochester Hills, MI.	
Document Relevance to Reconnaissance Study	
None. Document not relevant to project study area.	

Title	Clinton River Trail Opportunity Plan
<i>Author</i>	Oakland County Planning and Economic Development Services
<i>Pub Date</i>	
General Summary (document purpose, scope, etc.)	
This section of the Clinton River Trail Opportunity Plan begins in Waterford Township along route which passes through the city of Pontiac, Auburn Hills, and Rochester before exiting Oakland County, Michigan	
Document Relevance to Reconnaissance Study	
None. Document not relevant to project study area.	

Title	Conservation Guidelines for Michigan Lakes and Associated Natural Resources
<i>Author</i>	State of Michigan-Department of Natural Resources
<i>Pub Date</i>	March 2006
General Summary (document purpose, scope, etc.)	
This document provides recommended guidelines for a watershed approach to the protection and management of Michigan lakes, including the development of comprehensive resource assessments and management plans. It identifies general DNR goals and provides a brief description of ecosystem features found in Michigan lakes and riparian areas.	

Document Relevance to Reconnaissance Study
This document provides no direct relevance to the recon study.

Title	Criteria for Restoration of Beneficial Use Impairments to Clinton River Area of Concern		
<i>Author</i>	Clinton River Area of Concern Public Advisory Council		
<i>Pub Date</i>	April 9, 2009		
General Summary (document purpose, scope, etc.)			
This document, approved by Clinton River AOC PAC, provides criteria for restoration of BUIs for the Clinton River AOC.			
Document Relevance to Reconnaissance Study			
This document is relevant when reviewed along with the “Strategy for Delisting Michigan AOCs, January, 2010”.			
Key Elements for Reconnaissance Study (per Table of Contents)			
<i>Element</i>	<i>Section</i>	<i>Pages</i>	<i>Notes</i>
All	All	All	BUIs relevant to projects identified from the Action Table associated with the “Strategy for Delisting Michigan AOCs, January, 2010” document are identified as key elements for the Reconnaissance Report.

Title	Michigan LID Manual		
<i>Author</i>	SEMCOG		
<i>Pub Date</i>			
General Summary (document purpose, scope, etc.)			
This is a guidance document on Low Impact Development techniques used for storm water management.			
Document Relevance to Reconnaissance Study			
This document is not site-specific for engineered design utilizing LID concepts. However, it provides relevant site data required if LID concepts used in a recommended restoration project for the Reconnaissance Report.			
Key Elements for Reconnaissance Study (per Table of Contents)			
<i>Element</i>	<i>Section</i>	<i>Pages</i>	<i>Notes</i>
Chapter 3	15-31		Key determinants in using LID concepts in Michigan
Chapter 6	57-121		Non-Structural LID BMPs
Chapter 7	121-334		Structural LID BMPs
Title	Clinton River Watershed/ Area of Concern (AOC) Clinton River Restoration Plan		
<i>Author</i>	Tetra Tech, Inc.		
<i>Pub Date</i>	2008		
General Summary (document purpose, scope, etc.)			
This is a comprehensive RAP document that updates actions to address BUIs, with the primary purpose being to achieve delisting of the watershed as an AOC through restoration of the eight identified BUIs. One of the most significant findings that came out of the hydrologic modeling results was the cumulative effect of management scenarios in terms of improving water quality. Different BMPs address different issues across the landscape.			
Document Relevance to Reconnaissance Study			
This document presents a framework to facilitate the understanding and assessment of stressors (e.g., nutrients, pathogens, hydraulics) relevant to the study area.			
Key Elements for Reconnaissance Study (per Table of Contents)			
<i>Element</i>	<i>Section</i>	<i>Pages</i>	<i>Notes</i>
Chapter 4	4.4-4.44	125-172	Stressors that impact the natural environment, point source discharges
Chapter 7	7.39-7.43	273-278	Pollution prevention, water management, CSO and SSO

			control, groundwater protection
Chapter 7	7.45-7.52	279-286	Soil erosion and sediment control, stormwater BMPs
Flow data	B.1	417-443	Flow data for Clinton River Watershed
Details of Clinton River model	F.3	587-788	Assess existing pollution sources and evaluates the potential benefits of different restoration scenarios

Title			Effects of Urban Land-Use Change on Streamflow and Water Quality in Oakland County, Michigan, 1970-2003, as Inferred from Urban Gradient and Temporal Analysis
Author			USGS; Stephen S. Aichele
Pub Date			2005
General Summary (document purpose, scope, etc.)			
During 1966 – 1970 and, again during 2001 - 2003, the USGS collected a series of low-flow water-chemistry samples. This study tests the streamflow data for trends in high flows, low flows, and flashiness; and correlates 2000 land use with water-quality and streamflow. Despite substantial change in land use during 1980 - 2000, little evidence is found in the time-series data of alteration of the daily streamflow characteristics or nutrient enrichment. Although the absence of these changes may be the result of increased stormwater management requirements and changes in development patterns, it is also possible that the changes are not detectable with the data available.			
Document Relevance to Reconnaissance Study			
This report serves as a trend analysis document illustrating and analyzing changes in streamflow and water quality data specific to Oakland County. This report also summarizes anticipated changes within the watersheds of Oakland County given these current trends			
Key Elements for Reconnaissance Study (per Table of Contents)			
Element	Pages	Notes	
Changes in Streamflow and Water Quality Through Time	16-20	Five watersheds showed significant trends in low flows, one watershed showed a significant trend in peak flows, and none showed a significant trend in variability over the 33-year period. Relatively little change was observed in water chemistry, although phosphorus and sulfate concentrations were generally lower and chloride concentrations were generally higher in the 2001–2003 sampling compared to the 1966–1970 sampling.	

Title			Delisting Targets for Non-Habitat Beneficial Use Impairments for the Clinton River Area of Concern
Author			Clinton River Watershed Council Environmental Consulting & Technology, Inc.
Pub Date			April 2009
General Summary (document purpose, scope, etc.)			
The Clinton River Watershed Restoration/Delisting Target development project was initiated to define “how-clean-is-clean” for the Clinton River watershed and develop endpoints that would allow for the ultimate delisting of the watershed as an Area of Concern (AOC) under the Great Lakes Water Quality Agreement.			
Delisting targets have been developed to address the eight BUIs within the Clinton River Watershed. These criteria are generally applicable throughout the watershed. However, each of seven subwatershed areas was reviewed with the appropriate Sub-watershed Advisory Group (SWAG) to obtain input relative to the appropriateness of the BUI and respective criteria within that subwatershed. Recommendations include:			
<ul style="list-style-type: none"> • The Delisting Target needs to be incorporated into the process of goal setting in the next iteration of the subwatershed plans. • The criteria for the fish and wildlife habitat and benthos- related BUIs need to be further refined including evaluation of the existing and anticipated future habitat within the individual subwatershed areas. The final 			

criteria should reflect the variation in what can be attained relative to habitat and benthic quality. The lower reaches of the watershed that are highly urbanized cannot be restored to the same benthic and habitat quality that can be protected and restored in the rural/undeveloped areas. However, reasonable efforts should be implemented to improve the habitat/benthic quality in these lower reaches.

- The RAP update that will be initiated shortly needs to utilize the delisting target in developing the overall goals and action plans for the watershed.
- The RAP PAC should periodically review the status of restoration efforts within the watershed and determine the degree of progress toward attainment of the delisting target.
- Although not a specific BUI, it should be noted that all the BUIs are impacted by flow variations, both low-flow and high peak to low-flow ratios. Attaining delisting target will be extremely difficult within the Clinton River watershed unless these flow extremes are addressed and measures implemented to control these variables.

Document Relevance to Reconnaissance Study

This document identifies a summary of eight BUIs within the Clinton River AOC. These impairments should be cross-referenced with the applicable subwatershed management plans as a means to discern which impairments are applicable to the study area.

Key Elements for Reconnaissance Study (per Table of Contents)

<i>Element</i>	<i>Section</i>	<i>Pages</i>	<i>Notes</i>
Project Rationale	Sect. 2	4	Table provides a description of the identified impairments.
Delisting Targets for Non-Habitat BUI	Sect. 3	All	Includes an overview of the delisting targets as well as a description of the impairments.

Title	SEMCOG Regional Water Quality Survey Findings Report		
<i>Author</i>	ETC Institute		
<i>Pub Date</i>	September 2004		
General Summary (document purpose, scope, etc.)			
Survey results provide a benchmark to gauge the effectiveness of regional and local public outreach campaigns, leverage resources, and provide the opportunity to compare results from different areas of the SEMCOG region. Overall, survey results indicate that residents are concerned about the quality of rivers and lakes in SE Michigan. Most importantly, there is a willingness to make adjustments in daily household habits to protect water resources.			
Document Relevance to Reconnaissance Study			
This document provides general baseline data in gauging feedback from residents in the project study area relevant to the Reconnaissance Study. The demographic data is of limited relevance. However, the survey questions are classified by subwatershed, and results can be reviewed for relevance to the Reconnaissance Study.			
Key Elements for Reconnaissance Study (per Table of Contents)			
<i>Element</i>	<i>Section</i>	<i>Pages</i>	<i>Notes</i>
Crosstabs by Watershed	3	Tabs 1-49	Review survey response for watershed codes 6 and 13

Title	Great Lakes Restoration Initiative Action Plan		
<i>Author</i>	White House Council on Environmental Quality U.S. Department of Agriculture U.S. Department of Commerce U.S. Department of Health and Human Services U.S. Department of Homeland Security U.S. Department of Housing and Urban Development U.S. Department of State U.S. Department of the Army U.S. Department of the Interior U.S. Department of Transportation U.S. Environmental Protection Agency		
<i>Pub Date</i>	December 3, 2009		
General Summary (document purpose, scope, etc.)			
In February 2009, President Obama proposed \$475 million for a <i>Great Lakes Restoration Initiative</i> . This Action Plan describes how the Initiative will be executed from 2010 through 2014. The plan builds on the Great Lakes Regional Collaboration Strategy. It articulates the most significant ecosystem problems and efforts to address them in five major focus areas: Toxic Substances and Areas of Concern; Invasive Species; Nearshore Health and Nonpoint Source Pollution; Habitat and Wildlife Protection; and Restoration, Accountability, Education, Monitoring, Evaluation, Communication and Partnerships.			
The Action Plan identifies goals, objectives, measurable ecological targets, and specific actions for each of these focus areas. The Action Plan will be used by federal agencies in the development of the federal budget for Great Lakes restoration in Fiscal Year 2011 and beyond. As such, it will serve as guidance for collaborative restoration work with participants to advance restoration. The Action Plan will also help advance implementation of the Great Lakes Water Quality Agreement with Canada.			
Document Relevance to Reconnaissance Study			
This document outlines federal initiatives to target, fund and implement the recommendations of the Great Lakes Collaboration Strategy. It provides a five year framework for restoration efforts in the Great Lakes Basin.			
Focus Areas	Focus Areas 1-5	All	Provides a problem statement and long term goals for each of the plan's focus areas.
Title	Great Lakes Regional Collaboration Strategy		
<i>Author</i>	Great Lakes Regional Collaboration Executive Committee		
<i>Pub Date</i>	December 2005		

General Summary (document purpose, scope, etc.)

This document guides the decision making process for selecting and funding Great Lakes restoration projects. It features a discussion of the problems that have seriously compromised the environmental health of the Great Lakes. Numerous issues and stressors are addressed, and primary challenges include, among others:

- Ecological and economic damage caused from the introduction of additional aquatic invasive species;
- Sewer overflows, from past and ongoing development, that have contaminated water, compromised Great Lakes habitats in coastal areas, and adversely affected Great Lake recreation;
- Non point pollution sources that have continually impaired water quality and caused related problems; and
- A legacy of toxic contamination in sediments and fish throughout the system.

While large amounts of data and information on the Great Lakes have been collected over the years, not enough of that has been transformed into knowledge about the key indicators of the health of the ecosystem.

In conjunction with these stressors, new ones have been identified which has prompted ecosystem changes to occur rapidly and unexpectedly. As a result, there is a new sense of urgency for action on the highest priorities for restoring and protecting the Great Lakes.

This document also provides the full range of recommendations, options, and ideas generated by Collaboration Strategy Teams. Rough cost estimates to implement recommendations are included. These actions highlight the highest priorities recommended by the Teams for early implementation. Additional actions, as well as much more supplemental information, are included in the Appendices to the Strategy.

Document Relevance to Reconnaissance Study

This document focuses on the entire Great Lakes Basin and, consequently, the information provided is broad in nature and not specific to the study area. Information pertaining to fisheries, benthos, and wetlands are discussed, but specific details relevant to the Upper Clinton River Watershed are not included.

Key Elements for Reconnaissance Study (per Table of Contents)

<i>Element</i>	<i>Section</i>	<i>Pages</i>	<i>Notes</i>
Strategy Team Recommendations	All		Fisheries, benthos, and wetlands are discussed in this document, but are characterized from a Great Lakes Basin perspective.
Appendix A	All		Lists all recommendations provided in this report

Title	Independence Township Vision 2020 Update Master Plan		
Author	Carlisle/Wortman Associates		
Pub Date	2006		
General Summary (document purpose, scope, etc.)			
<p>The purpose of the Vision 2020 process was to identify goals, policies, programs, and strategies of interest to the Township and its residents. Vision 2020 involved a thorough investigation of past trends, current conditions, and alternative futures for the Township. The overall process was structured to allow for broad participation, expression of new ideas, and creation of new concepts that will carry Independence Township through the beginning of the 21st century. The Vision 2020 approach has integrated all aspects of physical development (e.g., roads, land use, recreation, utilities) in an attempt to create efficiencies, anticipate unforeseen problems, and search for multi-objective opportunities.</p> <p>Vision 2020 consists of two documents: 1) a Strategic Plan presenting broad goals and objectives, as well as background studies establish baseline conditions; and 2) a Master Plan focusing on more traditional elements considered in planning (e.g., future land use, thoroughfares, community facilities). Collectively, they:</p> <ul style="list-style-type: none"> • Provide a general statement of the Township’s goals and policies and provide a comprehensive view of the community’s desires for the future; • Define the future character of the community; • Serve as an aid to both short term and long range decision- making. The goals and policies outlined in the Plans will guide the Planning Commission and Township Board in deliberations on matters relating to land use and the physical development of the community; • Assist in establishing priorities for public improvements that provide the greatest benefit to the Township and its residents; • Serve as an educational tool to provide citizens, developers and adjacent communities with a clear indication of the Township’s direction for the future; and • Provide direction to private property owners regarding the use of their property. 			
Document Relevance to Reconnaissance Study			
This document provides an overview of background studies utilized for this report as well as narrative that characterizes current and planned land use for Independence Township. Since Independence Township is almost entirely within the area defined by the Scope of Work, this document is relevant.			
Key Elements for Reconnaissance Study (per Table of Contents)			
Element	Section	Pages	Notes
Background Studies	All	All	Provides an overview of relevant studies
Existing Land Use	All	All	Characterizes existing land use within the Township
Appendix 1	All	All	Provides

Title	Lakewide Management Plan Updates for the Great Lakes
<i>Author</i>	USEPA
<i>Pub Date</i>	2008
General Summary (document purpose, scope, etc.)	
Lakewide Management Plans (LaMPs) guide assessment, restoration, protection and monitoring efforts associated with the health of the five Great Lakes. This document provides a brief overview of lakewide management efforts in the Great Lakes including goals, progress, next steps and contacts.	
Document Relevance to Reconnaissance Study	
The document is of limited relevance, as it does not focus in detail on the Upper Clinton River Watershed.	

Title	Michigan Department of Environmental Quality Water Bureau Measures of Success		
<i>Author</i>	Michigan Department of Environmental Quality		
<i>Pub Date</i>	November 2009		
General Summary (document purpose, scope, etc.)			
The Water Bureau's mission is to make Michigan's waters safe and clean for drinking, recreating and fishing, as well as to achieve healthy aquatic ecosystems. To provide definition to this mission, the Bureau has identified five major goals: Ensure Safe Drinking Water; Protect Groundwater; Enhance Recreational Waters; Ensure Consumable Fish; and Protect and Restore Aquatic Ecosystems.			
For each major goal, measurable outcomes (i.e., measures of success) are identified. Measurements provide insights in many areas, including informed priority setting and daily decisions; identifying problems and assessing their relative importance; identifying preventable causal factors; and communicating progress and problems. Measurement reinforces the importance of a goal and managerial priorities, and helps managers gauge the success of, and modifications needed for management actions. These goals and measurements are intended to enlist external assistance, encourage cooperation across organizational boundaries, and encourage discussion about strategic adjustments and priority trade-offs.			
Document Relevance to Reconnaissance Study			
This document is a progress report on the achievement of goals embodied in the Water Bureau's mission statement. A majority of the report addresses issues outside of the study area, but is of some relevance in characterizing issues in the Upper Clinton River Watershed.			
Key Elements for Reconnaissance Study (per Table of Contents)			
<i>Element</i>	<i>Section</i>	<i>Pages</i>	<i>Notes</i>
All	Progress report on achievement of stated goals		

Title	Michigan Great Lakes Plan		
Author	Office of the Great Lakes Michigan Department of Environmental Quality		
Pub Date	January 2009		
General Summary (document purpose, scope, etc.)			
<p>This document complements the GLRC by providing specific direction within Michigan. It addresses the recommendations of the GLRC, and highlights specific needs, challenges, and strengths in the state. The fundamental premise of the plan is that the state's economy and the long-term well-being of its citizens are dependent on the health of the waters that feed the lakes and the nearshore areas that buffer the lakes. The plan identifies the following recommendations:</p> <ul style="list-style-type: none"> • Ensure that alternative energy sources are pursued and that the environmental impacts of current energy sources are minimized; • Restore and delist Michigan's 14 Areas of Concern; • Protect human health associated with fish consumption advisories and harmful algal blooms; • Restore beaches by controlling pollutants such as phosphorus, pharmaceuticals, and bacterial Contamination; • Prevent the introduction and control the spread and of new invasive species; • Update old and deteriorating infrastructure throughout the state; • Ensure effective and efficient management of urban stormwater; • Implement and share effective land use planning tools throughout the state and across county Boundaries; • Increase opportunities for the public to access the Great Lakes and inland lakes and streams; and • Protect and restore critical fish and wildlife habitat. 			
Document Relevance to Reconnaissance Study			
This document focuses on the goals outlined in the Great Lake Collaboration Strategy and discusses how these goals apply to Michigan. In addition, there is a brief write up about issues within the Clinton River Watershed that require public stewardship.			
Key Elements for Reconnaissance Study (per Table of Contents)			
<i>Element</i>	<i>Section</i>	<i>Pages</i>	<i>Notes</i>
Clinton River Area Watershed Issues	16		Brief narrative that discusses the challenges faced within the watershed.

Title	Oakland Charter Township 2010-2014 Master Plan for Parks, Recreation, Land Preservation and Trails		
Author	McKenna Associates		
Pub Date	December 8, 2009		
General Summary (document purpose, scope, etc.)			
This comprehensive plan formulates a road map for Oakland Charter Township to use in planning for parks, recreation, land preservation and trails for the next five years.			
Document Relevance to Reconnaissance Study			
Snap shot of community and action plan items relevant to water projects.			
Key Elements for Reconnaissance Study (per Table of Contents)			
<i>Element</i>	<i>Section</i>	<i>Pages</i>	<i>Notes</i>
Community Description	Ch. 1	1-9	
Action Plan	Ch. 5	76-91	Review of relevant water quantity/quality projects

Title	Great Lakes Needs Assessment: Coastal Community Development
<i>Author</i>	Great Lakes Commission NOAA – Coastal Services Center
<i>Pub Date</i>	July 2006
General Summary (document purpose, scope, etc.)	
<p>This document identifies and addresses needs, barriers, and possible solutions associated with Great Lakes coastal communities. This includes promoting efficient development of programs, products and or services in the following areas: Coastal Community Development (CCD); Data Information Integration and Distribution (DIID) ; and Ports and Navigation</p> <p>The methodology, planning, data collection, and analysis for the CCD issue area is presented for use by the NOAA Coastal Services Center in 1) establishing a Great Lakes regional presence, 2) shaping the work plan and associated activities of the Great Lakes Commission as NOAA’s regional partner. Secondary beneficiaries include other organizations (e.g., state, local, nonprofit entities) that may benefit from the needs assessment as they establish their own goals.</p>	
Document Relevance to Reconnaissance Study	
As part of this study, several organizations (including state and local governments) were surveyed with the intent to identify needs and barriers to develop efficient management strategies. The study covers a large area and primarily focuses on coastal communities. Given this, the study is of limited relevance to the Reconnaissance Study.	

Title	Oakland County Trails Master Plan		
<i>Author</i>	Wade Trim		
<i>Pub Date</i>			
General Summary (document purpose, scope, etc.)			
This plan documents the evolution of trail planning and development in Oakland County; presents the coordinated goals and vision for a connected trail system; provides short and long term actions for plan implementation; serves as a resource and reference guide for communities; and provides assistance in pursuing future grant opportunities.			
Document Relevance to Reconnaissance Study			
General community description at county level. Relevant projects in study area derived from Action Plan.			
Key Elements for Reconnaissance Study (per Table of Contents)			
<i>Element</i>	<i>Section</i>	<i>Pages</i>	<i>Notes</i>
Introduction	Ch. 1	2-21	General county description
Action Plan	Ch. 5	105-116	Review for potential projects in project study area related to watershed improvements

Title	Oakland Township Master Plan		
<i>Author</i>	Williams and Works Tilton and Associates		
<i>Pub Date</i>	January 2005		
General Summary (document purpose, scope, etc.)			
Developed with community input, this plan embraces “sustainability” as a core principle and identifies low impact patterns of development. It serves as the official, advisory policy statement for encouraging orderly and efficient use of land for residences, parklands, services, and infrastructure, and for coordinating these uses of land with each other, with streets, and with other necessary public facilities and services. It creates a logical basis for zoning, subdivision design, public improvement plans, and for facilitating and guiding the work of the Township Planning Commission, the Township Board, and other public and private endeavors relating to the physical conservation and development of the Township. It provides a means for private organizations and individuals to determine how they may relate their building and development projects and policies to official township planning policies. It also offers a means to relate the plans of Oakland Township to the plans of Southeast Michigan and the Detroit metropolitan area.			
Document Relevance to Reconnaissance Study			
Oakland Township is entirely located within the project area. The information provided in this plan is directly relevant to demographics, water and land use developments, and other characteristics of the study area.			
Key Elements for Reconnaissance Study (per Table of Contents)			
<i>Element</i>	<i>Section</i>	<i>Pages</i>	<i>Notes</i>
Natural Features	Chap. 1	All	Provides a summary of all natural features within the Township
Population	Chap. 2	All	Discussion trends and projections
Economic Development	Chap. 3	All	
Land Use	Chap. 5	All	Discussion of land use and land cover
Historic and Cultural Resources	Chap. 8	All	

Title	Oxford Township Master Plan		
<i>Author</i>	Carlisle/Wortman Associates		
<i>Pub Date</i>	July 2005		
General Summary (document purpose, scope, etc.)			
<p>This is an officially adopted document that sets forth an agenda for the achievement of goals and policies related to land use. It is a long-range statement of general goals and policies aimed at the unified and coordinated development of the Township. It promotes balanced, orderly change in a deliberate and controlled manner that permits planned growth and redevelopment. It also provides the basis upon which zoning and land use decisions are made. The Master Plan is a policy manual which provides the framework for the Charter Township of Oxford Zoning Ordinance and map. Among the most valuable tools in implementing the plan are the Zoning Ordinance and Subdivision Regulations. Additionally, the Plan considers the goals of the community and provides objectives to achieve these goals.</p>			
Document Relevance to Reconnaissance Study			
<p>Oxford Township is partially located within the project area. Information used in this report will need to be reviewed for relevance to the project area. The information provided in this plan is directly relevant to the demographics, water and land use developments, and other related sections.</p>			
Key Elements for Reconnaissance Study (per Table of Contents)			
<i>Element</i>	<i>Section</i>	<i>Pages</i>	<i>Notes</i>
Background Studies	2	All	Provides an overview of several outside studies that contributed to the plan
Land Use	4	All	Provides narrative of the Township's Land Use Plan

Title	Restoring the Flow: Improving Selective Small Dam Removal: Understanding and Practice in the Great Lakes States		
<i>Author</i>	River Alliance of Wisconsin, Trout Unlimited		
<i>Pub Date</i>	2001		
General Summary (document purpose, scope, etc.)			
<p>This report addresses general recommendations for facilitating adaptive management, project monitoring, research initiatives, and community outreach for small dam removal initiatives throughout the Great Lakes region. Provides no information specifically related to the Clinton River AOC or Reconnaissance Study geographic area.</p>			
Document Relevance to Reconnaissance Study			
<p>This document is relevant to the Reconnaissance Study as a general framework for how to approach a dam removal project. It highlights the essential components such as community outreach and environmental monitoring, among others. It does not provide information specific to the study area.</p>			
Key Elements for Reconnaissance Study			
<i>Element</i>	<i>Pages</i>	<i>Notes</i>	
Project Monitoring Data Collection Recommendations for Facilitating Adaptive Management	13	List of items to be monitored before, during, and after the dam removal project: general monitoring, socioeconomic monitoring, and biophysical monitoring.	

Title	St. Clair River and Lake St. Clair Comprehensive Management Plan		
Author	U.S. Army Corp of Engineers Great Lakes Commission		
Pub Date	June 2004		
General Summary (document purpose, scope, etc.)			
<p>Section 426 of the Water Resources Development Act (WRDA) of 1999 authorized USACE to develop a comprehensive management plan for the St. Clair River and Lake St. Clair. The legislation directed USACE to coordinate efforts with federal, state and local governments, and Canadian federal and provincial authorities, in developing a plan that:</p> <ul style="list-style-type: none"> • Identifies the causes and sources of environmental degradation to Lake St. Clair and the St. Clair River; • Addresses continuous monitoring of organic, biological, metallic and chemical contamination levels; • Provides for the timely dissemination of information of contamination levels public authorities, other interested parties and the public; and • Includes recommendations for potential restoration measures. <p>The narrative of this management plant is broken up into nine chapters that highlight the array of programs, policies and initiatives in place to build upon in implementing management plan recommendations.</p>			
Document Relevance to Reconnaissance Study			
This document is a comprehensive management plan that focuses on the entire Lake St. Clair Watershed, of which the Clinton River Watershed is one component. Due to the extensive scope of this document, the information can be used to supplement many of the topics listed in the Scope of Work. Given that the information provided in this document is a characterization of the entire St. Clair Watershed, it should be screened for relevance to the study area.			
Key Elements for Reconnaissance Study (per Table of Contents)			
Element	Section	Pages	Notes
Introduction	Chap. 1	All	Relevant topics include watershed resources, uses, impacts and resource management
Environmental Health	Chap. 3	All	Includes a discussion on point and nonpoint source discharges
Habitat and Biodiversity	Chap. 4	All	Topics include habitat loss, invasive species, and lake levels
Land Use	Chap. 6	All	Includes land use planning, nonpoint source pollution and stormwater runoff
Fisheries	Chap. 7		Topics include fisheries management, lake levels, and contaminated sediments
Monitoring	Chap.8		Some information is included about existing monitoring programs

Title	Stony/ Paint Creek Subwatershed Management Plan		
Author	Clinton River Watershed Council , Environmental Consulting & Technology, Inc., Carlisle/Wortman Associates, Inc., Applied Science, Inc.		
Pub Date	November 2005		
General Summary (document purpose, scope, etc.)			
<p>The combined Stony/Paint Subwatershed Plan was developed in partial fulfillment of the USEPA National Pollutant Discharge Elimination System (NPDES) Phase II stormwater regulations. The purpose of the Plan is two-fold: 1) to identify current sources and causes of impairment in order to determine actions necessary to restore the streams to stable conditions; and 2) to recommend actions that will prevent further degradation of Stony and Paint Creeks and their watershed resources as development advances on the landscape.</p> <p>A recurring theme in this Plan is the importance of maintaining the rural character and natural “viewsheds” that makes these subwatersheds such attractive places to live. Protection of the sub watershed’s water resources and natural features is a critical component in maintaining the high quality of life enjoyed by Stony and Paint Creek residents. A comprehensive assessment of Stony Creek was completed in mid-2003 to assess the overall conditions of the stream and riparian corridor. A similar comprehensive assessment of Paint Creek was completed in the 2004-2005 time period. Current overall conditions for both subwatersheds are summarized by the following impairments: hydrologic alterations, sediments, nutrient loading (phosphorus), bacteria, elevated temperatures, organic compounds/heavy metals, and salt.</p>			
Document Relevance to Reconnaissance Study			
<p>The Stony Creek/Paint Creek Subwatershed Management Plan focuses on watershed-based planning initiatives similar to the framework used for the Reconnaissance Report. Among others, it is noted that watershed planning needs to involve a coordinated approach by the various land management agencies within the subwatersheds. Four categories of management recommendations are presented in the areas of 1) Plans and Policies; 2) Development/ Redevelopment Regulations; 3) Design Standards and Maintenance Practices; and 4) Education and Stewardship.</p>			
Key Elements for Reconnaissance Study (per Table of Contents)			
Element	Section	Pages	Notes
Chapter 3. Existing Conditions	3.1-3.45	All	Categorized by community which can be directly pulled out for respective communities for Reconnaissance Report.
Chapter 4. Analysis of Community Plans	4.2-4.2.13	All	Provides a summary of Community Plans relevant to the Reconnaissance Report.
Chapter 5	All	All	Provides goals and objectives and specific actions for implementation within communities relevant to the Reconnaissance Report.

Title	Strategy for Delisting Michigan AOCs		
<i>Author</i>	MDEQ		
<i>Pub Date</i>	January 4, 2010		
General Summary (document purpose, scope, etc.)			
Stakeholders in the AOC program can use this document to set local priorities for actions and support local projects to complete needed actions. An “AOC Action Tracking Table” outlines the status of each BUI, criteria, support needed, status of assessment, actions required and projected timeframe. Actions are categorized as planning/design, remedial action, monitoring, and documentation/assessment.			
Document Relevance to Reconnaissance Study			
The “AOC Action Tracking Table” can be searched for projects relevant to the Upper Clinton River Watershed.			
Key Elements for Reconnaissance Study (per Table of Contents)			
<i>Element</i>	<i>Section</i>	<i>Pages</i>	<i>Notes</i>
Appendix A		All	Highly relevant to Reconnaissance Study.

Title	Water Resources in a Rapidly Growing Region		
<i>Author</i>	USGS		
<i>Pub Date</i>	2005		
General Summary (document purpose, scope, etc.)			
In 1972, the USGS published a paper titled, “Water Supply Paper 2000: Water for a Rapidly Growing Urban Community— Oakland County, Michigan” (Twenter and Knutilla, 1972). In 2001, Oakland County and the USGS initiated a cooperative project to update the 1972 study in light of changes in the county as well as advances in the field of hydrology. From 2001 through 2003, the USGS monitored stream flow and water quality, ground-water level, and lake-water quality at sites throughout Oakland County. Several recent USGS technical reports document specific aspects of the study: a data report (Aichele and others, 2004); a report describing characteristics of the glacial aquifer (Bissell and Aichele, 2004); a report describing the effects of urban land-cover change on water resources (Aichele, 2005); and a report describing the microbiological quality of rivers and streams in Oakland County (Fogarty et al, 2005). This document summarizes the results and conclusions in the above-mentioned USGS technical reports and serves as an overall assessment of the current quantity and quality of water resources in Oakland County. It also describes changes in the quantity and quality of water resources in Oakland County over the past 30 years.			
Document Relevance to Reconnaissance Study			
The information presented in this report is relevant to the existing conditions analysis component of the Reconnaissance Study. Some information may be out of scope as the report addresses the entirety of Oakland County.			
Key Elements for Reconnaissance Study (per Table of Contents)			
<i>Element</i>	<i>Section</i>	<i>Pages</i>	<i>Notes</i>
All sections	All	All	Report addresses a number of relevant topics.

Appendix C: Contributing Organizations and Individuals

Letters requesting comments and input on the Reconnaissance Study process were sent to 68 federal and state agencies, municipalities and non-governmental organizations. Four responses were received and the content considered in development of the report. These responses are included in this appendix, along with the Scoping Letter template.



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
GREAT LAKES NATIONAL PROGRAM OFFICE
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

Department of the Army
Detroit District, Corps of Engineers
Box 1027
Detroit, Michigan 48231-1027

Dear Mr. Larry Pawlus,

Thank you for giving the Environmental Protection Agency, Great Lakes National Program Office, the opportunity to identify water resource related priorities in the study area, and specific programs or projects (underway or proposed) which are important in addressing those priorities.

Within the Clinton River watershed, there are 3 Great Lakes Restoration Initiative (GLRI) funded projects. In the specific area that your agency is interested in, Oakland and Lapeer County, two of the projects are listed for Macomb county. However none of these projects are within the specific watershed area of interest. We are listing them below, as they may still impact the area that you are seeking information on:

1. Implementation Plan for Coon Creek: Michigan State University will develop a Total Maximum Daily Load (TMDL) implementation plan for *Escherichia coli* and dissolved oxygen for the East Branch Coon Creek. The TMDL implementation plan aims to reduce total suspended solid loads by at least 50 percent and improve the overall ecosystem health for the Great Lakes and its tributaries.
2. Lake St. Clair Coastal Marsh Restoration: Macomb County - lead organization - This project will restore nearly 500 acres of Great Lakes coastal marsh on Lake St. Clair. Specifically, this project will complete the steps required to appropriately restore the wetland by restoring the natural hydrology of the site; continuing ongoing efforts to control invasive Phragmites; and re-introducing native vegetation.
3. Illicit Discharge Elimination Program: Macomb County Dept of Health - lead organization - This project will use dye tests to identify and address illicit connections and failing septic systems, resulting in improved water quality throughout the project area, including the Clinton River Watershed Area of Concern.

Furthermore, sediment related projects under the Legacy Act, are working in the Lower Clinton River from Grosbeck highway to the mouth, and are further downstream than the area of interest. Additionally, there are not any planned projects in the area of interest.

We understand that the major issues in this area are agricultural runoff, lack of buffers, urban sprawl and failing septic. There are watershed plans developed for most of the area or in development that provide more detail, by the local municipalities and watershed organizations. It is our understanding that these local entities have also been contacted for more specific information, based on the feedback we discussed with your Project Manager, Charles Uhlarik.

Please contact us if you have additional questions in regard to this inquiry. Laura Evans is the Clinton River Area of Concern/Remedial Action Plan Liaison, and can be reached at 312-886-0851 or evans.laura@epa.gov, if you have more specific concerns in this area.

Sincerely,

A handwritten signature in black ink that reads "Gary Gulezian".

Gary Gulezian
Director, GLNPO
US EPA
77 W. Jackson Blvd.
Chicago, IL 60604



STATE OF MICHIGAN
DEPARTMENT OF NATURAL RESOURCES & ENVIRONMENT
LANSING



November 22, 2010

Mr. Larry Pawlus, Chief
Programs and Project Management Office
United States Department of the Army
Detroit District, Corps of Engineers
Box 1027
Detroit, Michigan 48231-1027

Dear Mr. Pawlus:

Thank you for your letter of October 28, 2010, to Director Rebecca A. Humphries, Department of Natural Resources and Environment (DNRE), concerning the reconnaissance level study of the Upper Watershed on the Clinton River and inviting the DNRE to provide information on water resource related priorities and specific programs or projects that are important in addressing those priorities in this watershed. Director Humphries has referred your letter to the DNRE's Water Resources Division (WRD) for response.

The portion of the Clinton River watershed identified in this scoping process contains a number of high quality waters and makes up a large portion of the headwaters of the Clinton River. As such, broad protections afforded to these wetlands, streams, and lakes will do well to continue to protect their water quality, the quality of biological life that depends on them and the quality of life for the citizens who live and work in this portion of the watershed. The general issues identified in the your letter are valid and important in this target portion of the Clinton River watershed, particularly as some of them relate to altered stream flows, stream flashiness, and siltation.

Much of the proposed study area appears to be covered by the Stony/Paint Subwatershed Plan and the Upper Clinton Subwatershed Management Plan. These plans both include goals and objectives that may be relevant to this scoping effort. The subwatershed management plans both call for the reduction of bacteria, nutrient, and sediment sources, as well as reducing the amount of storm water runoff to stabilize stream flow. The preservation of natural features such as channels, corridors, wetlands, and unique ecosystems is also a priority in these plans.

If not already approached, the Clinton River Watershed Council (CRWC) should be sought for input given their active and knowledgeable role in the citizen-level management of this watershed. The CRWC has developed or assisted in the development of Clinton River subwatershed plans referenced in the previous paragraph. These plans can be found on their Web site at: <http://www.CRWC.org>. As far as specific projects or programs that are important in addressing the priorities in these subwatershed management plans, we have to defer to the CRWC and the communities involved in implementing these respective plans.

Input from the DNRE, Fisheries Division, identified the following general concerns throughout the area of interest, many of which echo those already in your scoping letter:

- Legal lake level establishment and lake level control structures, particularly related to downstream impacts of their operations on flow, habitat, aquatic life, etc.
- Altered stream hydrology/increased flashiness.
- Improved public access on lakes and streams.
- Better management of riparian areas for protection.
- Restoration of wetlands.
- Maintain and improve high quality streams (e.g., Paint Creek).
- Protection of headwater areas.

It may be helpful to refer to the Fisheries Division's Clinton River Assessment, which contains, among other information, management options to improve the watershed.
(<http://www.michigandnr.com/PUBLICATIONS/PDFS/ifr/ifrilibra/Special/Reports/sr39/SR39.pdf>).

As stated in the United States Environmental Protection Agency approved 2010 "Total Maximum Daily Load (TMDL) for *E. coli* in the Lower Clinton River" document: "Monitoring data collected by the DNRE in 2008 on Paint Creek and the Main Branch Clinton River upstream of the TMDL reach ... indicate that these waters are also not attaining the (total body contact) and (partial body contact) recreation designated use, and will be proposed for inclusion in the 2012 Section 303(d) list and a TMDL scheduled if appropriate." While this TMDL doesn't specifically apply to the scoping process' area of interest, the inclusion of this information indicates concern and possible future data collection needs in reaches that are part of the proposed study area.

Additionally, there are scheduled TMDLs for Lake Orion that encompass fish tissue contaminated with mercury (scheduled for 2011), PCBs (scheduled for 2013), and chlordane (scheduled for 2017). At this point it is possible that future monitoring for chlordane in fish tissue will be conducted prior to the development of that TMDL.

If you have any further questions regarding this matter, please contact Mr. Martin Hendges, WRD, at 586-753-3769; hendgesm@michigan.gov; or DNRE, 27700 Donald Court, Warren, Michigan 48092-2793; or you may contact me.

Sincerely,



William Creal, Chief
Water Resources Division
517-335-4176

cc: Ms. Rebecca A. Humphries, Director, DNRE
Ms. Mindy Koch, Deputy Director, Resource Management, DNRE
Mr. Martin Hendges, DNRE



United States Department of the Interior

U.S. GEOLOGICAL SURVEY

Michigan Water Science Center
6520 Mercantile Way, Suite 5
Lansing, MI 48911

December 6, 2010

Larry Pawlus, Chief
US Army Corps of Engineers
Programs and Project Management Office
Box 1027
Detroit, MI 48231-1027

Dear Mr. Pawlus,

Thank you for your inquiry regarding the reconnaissance level study in the upper watershed of the Clinton River, in Lapeer and Oakland County, Michigan. In addition to the key water resource related issues you identified in your letter dated, October 28, 2010, there are several other issues I would suggest are relevant to the study.

While you have listed Combined Sewer Overflows as a prime resource issue, we think that issues of storm runoff and storm-drain discharges (non-sanitary sewer) to streams should be added to your list. The occurrence of pathogenic bacteria (in addition to fecal indicator bacteria) is also important because of the diversity of inputs (stormwater, sanitary sewer, agricultural non-point source) that the upper Clinton River receives. Storm drains also contribute directly to increasing artificial drainage patterns in the area that can result in a loss of riparian habitat due to stream channelization and hardening.

The occurrence of mercury and mercury methylation is important in the upper Clinton River. Preliminary work by the USGS National Water Quality Assessment Mercury Topical Team indicates that the primary source of mercury in the area is not wastewater treatment and combined sewer overflows. Rather, agricultural land was the biggest contributor of methylmercury, which is the form of mercury relevant to bioaccumulation.

Because it was not specifically mentioned in your letter, we suggest that the occurrence of antibiotics, antibiotic resistant bacteria, and other emerging contaminants is a potentially significant issue in the upper Clinton River. Recent USGS work in Oakland County and other

We hope that this response is helpful to you. If you would like any relevant USGS publications and data summaries, these can be found at the USGS Publications Warehouse on-line. Using Advance Search, put the words "Oakland County" or "St. Clair" in for Publications Title and a list of publications you can download should result. If you have any questions, comments, or concerns please contact me at the address above or by phone, at 517-887-8906.

Sincerely,

James R. Nicholas
Center Director, USGS Michigan Water Science Center



United States Department of the Interior

FISH AND WILDLIFE SERVICE
East Lansing Field Office (ES)
2651 Coolidge Road, Suite 101
East Lansing, Michigan 48823-6316

IN REPLY REFER TO:

December 16, 2010

MAL
27 DEC 10
Lt. Colonel Mike Derosier
District Engineer-Detroit District
U.S. Army Engineer
P.O. Box 1027
Detroit, Michigan 48231

Dear Colonel Derosier:

Please accept our recommendations on the proposed Upper Clinton River Reconnaissance Level Study. The watershed covers a highly urbanized area of Oakland and Lapeer Counties, Michigan, with much of the watershed's land-use being residential, commercial, or industrial, with increasing development pressures in the headwaters. A good reference report is

Francis, J.T., and R.C. Haas. 2006. Clinton River Assessment. Michigan Department of Natural Resources, Fisheries Special Report 39, Ann Arbor.

It provides a description, based on literature search and site visits, of fish and wildlife resources and habitats of the area (including those of some rare species).

Federally listed, proposed, or candidate species that occur in Oakland and Lapeer Counties include the Indiana bat, Eastern massassauga, and rayed bean, which the Corps is to consider in the environmental documents and Section 7 process still to be engaged in for the study.

Overall, we support the goals of the Fish and Wildlife Enhancement section of the study, but at this time, the lack of detail makes assessment of potential impacts difficult. We appreciate the summary of the 50%-completed document provided by Charlie Uhlarik of your staff. One of the proposed project sections is "Wetland Restoration Sites", and for this topic we urge the Corps to seek input from the Service's Private Lands Contacts for these counties, Lapeer: Michelle Vander Haar, Shiawassee National Wildlife Refuge, 6975 Mower Road, Saginaw, MI 48601 (989) 777-5930 x 12 and Oakland: Tom Eitniear, Ecological Services, East Lansing Field Office, 2651 Coolidge Road, Suite 101 East Lansing, MI 48823 (517) 351-6283 due to their unique local knowledge of wetland restoration in these two counties.

Please notify Bob Kavetsky, of this office, at (517) 351-5293 of any decisions regarding our recommendations and of any changes in the project plans.

Sincerely,

John V. Dingleline
Acting Field Supervisor



DEPARTMENT OF THE ARMY
DETROIT DISTRICT, CORPS OF ENGINEERS
BOX 1027
DETROIT, MICHIGAN 48231-1027

October 18, 2010

Programs and Project Management Office

Dear XXXXX,

The U.S. Army Corps of Engineers - Detroit District is undertaking a reconnaissance level study to examine the feasibility of carrying out environmental restoration projects within the upper watershed of the Clinton River. The study area includes the northeast portion of Oakland County, as well as a small area in the southeast portion of Lapeer County. (Please see attached map). Conducted under the authority of the federal Water Resources Development Act of 2007, the study will identify needs, problems, opportunities and recommended actions that might be taken by various partners and stakeholders to address ecosystem restoration objectives to be identified in the study.

We are undertaking a thorough, multi-purpose / multi-objective evaluation of the study area to integrate existing plans and studies; assess ecosystem restoration progress to date; and assist public and non-governmental organizations in identifying/planning for future restoration programs and projects.

As part of our scoping process, we invite you to identify 1) key ecosystem restoration priorities in the study area, and 2) specific programs or projects (underway or proposed) you believe are important in addressing these priorities. (Note: some key issues identified in past study efforts include Combined Sewer Overflows/Sanitary Sewer Overflows, illicit connections, failing septic systems, nonpoint source pollution, oil/ hazardous material spills, habitat restoration, invasive species, water levels, fish passage and streambank erosion, among others.)

We are interested in any concerns or comments that your agency may have at this time regarding the proposed reconnaissance study. Please direct your concerns and comments to me at the address above within 30 days to ensure discussion in the study. Any questions can be directed to Charles Uhlarik, Project Manager, at 313-226-2476 or me at 313-226-6780.

Sincerely,

Larry Pawlus
Chief, Programs & Project Management Office

Attachment

Appendix D: Initial Project List from Stakeholders

Title	Sponsor	Description	Estimated Cost	Projected Timeline	Status	General Notes
Real Time Water Distribution System Water Quality Monitoring	OCWRC	The goal of this project is to extend the existing real-time surface water quality monitoring system into 37 Public Water Supply Systems (PWSS)	\$2,000,000	TBD	Proposed	OCWRC Project # 1
Brown Drain Clean-out	OCWRC	Excavation to re-establish open ditch drain and relieve localized flooding.	\$500,000	TBD	Proposed	OCWRC Project # 12
Axford Drain	OCWRC	Comprehensive Drainage Solutions throughout District	\$2,100,000	TBD	Proposed	OCWRC Project # 30
Flow Monitoring at Lake Level Structures	OCWRC	Flow monitoring, rain gauges at lake level control structures to determine optimal lake level and flow in the rivers.	\$1,270,000	TBD	Proposed	OCWRC Project # 36
Brandon Oxford Drain Streambank Stabilization	OCWRC	Sediment removal and streambank stabilization.	\$1,000,000	TBD	Proposed	OCWRC Project # 51
Addison Dryden Drain Streambank Stabilization	OCWRC	Sediment removal and streambank stabilization.	\$500,000	TBD	Proposed	OCWRC Project # 52
Clarkston Road	Independence Twp.	Improve capacity with limited widening and intersection upgrades.	TBD	by 2020	Proposed	Referenced from Independence Twp. 2020 Vision Master Plan
Fleming Lake Road	Independence Twp.	Pave surface.	TBD	by 2020	Proposed	Referenced from Independence Twp. 2020 Vision Master Plan
Maybee Road	Independence Twp.	Improve capacity with limited widening and intersection upgrades.	TBD	by 2020	Proposed	Referenced from Independence Twp. 2020 Vision Master Plan
M-15	Independence Twp.	Improve capacity and maintain character with limited boulevard concept north of Hubbard	TBD	by 2020	Proposed	Referenced from Independence Twp. 2020 Vision Master Plan
Oakhill Road	Independence Twp.	Pave surface from Springfield Township to Sashabaw Road.	TBD	by 2020	Proposed	Referenced from Independence Twp. 2020 Vision Master Plan

Title	Sponsor	Description	Estimated Cost	Projected Timeline	Status	General Notes
Sashabaw Road	Independence Twp.	Widening from 2-5 lanes between Waldon and Clarkston, including the I-75 bridge and interchange improvements.	TBD	by 2020	Proposed	Referenced from Independence Twp. 2020 Vision Master Plan
Ray Road Paving	Oxford Twp.	The paving of Ray Road from M-24 to North Oxford Road	TBD	NA	Proposed	Referenced from Oxford Twp. Master Plan
Thomas Road Extension	Oxford Twp.	The extension of Thomas Road from Oakwood Road south to Dunlap	TBD	NA	Proposed	Referenced from Oxford Twp. Master Plan
Hummer Lake Road Extension	Oxford Twp.	The extension of Hummer Lake Road from Metamora Road to Gardner Road	TBD	NA	Proposed	Referenced from Oxford Twp. Master Plan
M-24 North Oxford Road Connector (Terraces)	Oxford Twp.	An additional connection between M-24 and North Oxford Road will be developed through the eastern portion of Waterstone.	TBD	NA	Proposed	Referenced from Oxford Twp. Master Plan
Ray Road - Lakeville Road Connector #1 and #2	Oxford Twp.	At such time as land to the northeast of the Village of Oxford is developed, additional north-south routes will be necessary to ease the burden on North Oxford Road and provide addition alternatives to using M-24 for local travel. Two connections between Ray and Lakeville Roads are proposed to accomplish this, spaced roughly 2/3 of a mile apart.	TBD	NA	Proposed	Referenced from Oxford Twp. Master Plan
Lakeville Road – Drahner Road Connector	Oxford Twp.	In order to relieve congestion on roads in the Village of Oxford (particularly Burdick and Glaspie), a by-pass route is necessary to allow travelers from the eastern and northeastern portions of the Township to avoid the Village while heading south. The possibility of extending Grampion Road farther south from Lakeville Road to Drahner Road should be explored to accomplish this.	TBD	NA	Proposed	Referenced from Oxford Twp. Master Plan
Westlake at Waterstone	Oxford Twp.	Future roads associated with Westlake at Waterstone are anticipated to provide an additional means of access to Granger Road from the Waterstone development.	TBD	NA	Proposed	Referenced from Oxford Twp. Master Plan
Police and Fire	Oxford Twp.	The capacity and location of police and fire stations should be revised relative to growth as development is experienced or anticipated.	TBD	NA	Proposed	Referenced from Oxford Twp. Master Plan

Title	Sponsor	Description	Estimated Cost	Projected Timeline	Status	General Notes
Township Offices	Oxford Twp.	The present Township hall facility is inadequate to house the various functions of local government.... At the time this Master Plan was prepared, the Township property at the northeast corner of Granger and Seymour Lake Roads was under consideration as the site for a possible new Township hall.	TBD	NA	Proposed	Referenced from Oxford Twp. Master Plan
Community Center	Oxford Twp.	In the course of gathering public input for the development of this Master Plan, many citizens suggested the need for a community center. Such a facility could provide indoor swimming facilities, meeting rooms, space for seniors programs, as well as other recreational programming to supplement that which is already available to Township residents.	TBD	NA	Proposed	Referenced from Oxford Twp. Master Plan
Safety Paths	Oxford Twp.	The Open Space and Greenway Master Plan calls for the extension of safety paths along several roads within the Township.... many of the safety path segments ... require only the connection of existing small segments. In some cases, however, existing but deteriorated lengths of path may require replacement.	TBD	By 2010 (ideally)	Proposed	Referenced from Oxford Twp. Master Plan
Ortonville-Oxford Connector (Greenway)	Oxford Twp.	This greenway segment, connecting the Village of Oxford with the Village of Ortonville via a north Detroit Edison Utility Corridor, has been identified as a critical element of the North County Trail Loop by Oakland County Planning and Economic Development Services. It was also identified as a valuable connection in the Southeastern Michigan Greenway Vision prepared in the nineties.	TBD	By 2010 (ideally)	Proposed	Referenced from Oxford Twp. Master Plan
Paint Creek Aquatic Corridor (Greenway)	Oxford Twp.	...the small portion of the Paint Creek located along the southern edge of the Township should be buffered to the extent possible to protect this valuable waterway.	TBD	By 2010 (ideally)	Proposed	Referenced from Oxford Twp. Master Plan
Potential Conservation/Natural Areas	Oxford Twp.	These areas of the Open Space and Greenway Plan can be treated in several ways. First, these areas can be the object of conservation-oriented land acquisition activities. Secondly, these areas can be the focus of open space preservation required within individual land development projects. Lastly, these areas highlight property whose owners should be the target of conservation education and natural areas registry efforts.	TBD	By 2010 (ideally)	Proposed	Referenced from Oxford Twp. Master Plan

Title	Sponsor	Description	Estimated Cost	Projected Timeline	Status	General Notes
Woodland Network Opportunity	Oxford Twp.	The identified tree rows, when contained within a proposed development, should be preserved to the greatest degree possible.	TBD	By 2010 (ideally)	Proposed	Referenced from Oxford Twp. Master Plan
Open Space within Developments	Oxford Twp.	Open space provided within developments should be designed to achieve one or more of the following objectives: □ Coordination with adjacent open spaces to provide contiguous expanses of open area; Preservation of areas identified as “potential conservation/natural areas;” Preservation of buffers along internal or adjacent watercourses, lakes, or wetland areas; Preservation of existing tree rows and woodlots representing a “woodland network opportunity;” or, Buffering or screening of development from view along rural or scenic roadways.	TBD	By 2010 (ideally)	Proposed	Referenced from Oxford Twp. Master Plan
Natural Features	Oakland Twp.	Inventory and record significant natural features and open spaces within the Township. Collaborate efforts and partner with communities around Oakland Township, the MDNR and the Huron Metropolitan Authority to preserve natural systems.	TBD	By about 2030	Proposed	Referenced from Oakland Twp. Master Plan
Natural Features	Oakland Twp.	Establish on-going systems to monitor the viability of significant natural features.	TBD	By about 2030	Proposed	Referenced from Oakland Twp. Master Plan
Natural Features	Oakland Twp.	Establish and continually strengthen a community consensus to support the preservation of natural features.	TBD	By about 2030	Proposed	Referenced from Oakland Twp. Master Plan
Natural Features	Oakland Twp.	Preserve and encourage the establishment of natural and wooded easements along rural roadway sections.	TBD	By about 2030	Proposed	Referenced from Oakland Twp. Master Plan
Natural Features	Oakland Twp.	Design dark skies protection measures and define outdoor lighting standards for all development projects.	TBD	By about 2030	Proposed	Referenced from Oakland Twp. Master Plan
Managed Growth Opportunities	Oakland Twp.	Apply critical habitat areas to protect important natural features and environmentally sensitive areas from development.	TBD	By about 2030	Proposed	Referenced from Oakland Twp. Master Plan
Managed Growth Opportunities	Oakland Twp.	Provide non-motorized transportation facilities to support the minimal use of automobiles in favor of those that advance pedestrian and bicycle transportation.	TBD	By about 2030	Proposed	Referenced from Oakland Twp. Master Plan

Title	Sponsor	Description	Estimated Cost	Projected Timeline	Status	General Notes
Managed Growth Opportunities	Oakland Twp.	Direct new growth to areas currently served by or adjacent to community water, wastewater, storm water and drainage control.	TBD	By about 2030	Proposed	Referenced from Oakland Twp. Master Plan
Character, Design and Aesthetics	Oakland Twp.	Develop standards to qualify and make recommendations for maintenance and engineering of rural roadways.	TBD	By about 2030	Proposed	Referenced from Oakland Twp. Master Plan
Character, Design and Aesthetics	Oakland Twp.	Natural easements that preserve a natural buffer from the viewshed of the roadway.	TBD	By about 2030	Proposed	Referenced from Oakland Twp. Master Plan
Recreation	Oakland Twp.	Support the Parks and Recreation Commission in their efforts to plan for and expand the park and recreational facilities in the township.	TBD	By about 2030	Proposed	Referenced from Oakland Twp. Master Plan
Housing and Neighborhoods	Oakland Twp.	Establish and continually encourage the design of compact and livable communities that preserve open space.	TBD	By about 2030	Proposed	Referenced from Oakland Twp. Master Plan
Transportation and Traffic	Oakland Twp.	Investigate additions to the Natural Beauty Roads designation.	TBD	By about 2030	Proposed	Referenced from Oakland Twp. Master Plan
Transportation and Traffic	Oakland Twp.	Research options and develop safe passage points for wildlife.	TBD	By about 2030	Proposed	Referenced from Oakland Twp. Master Plan
Safety Paths	Independence Twp.	The main goal of the program has been to provide a safe and efficient means of non-motorized travel between major activity centers.	TBD	by 2020	Proposed	Referenced from Independence Twp. 2020 Vision Master Plan
Greenways	Independence Twp.	The Greenways Plan is designed to reduce visual and habitat fragmentation within the landscape by encouraging connections between distinct tracts of open space so as to form a network.	TBD	by 2020	Proposed	Referenced from Independence Twp. 2020 Vision Master Plan
Lower Clinton/Deer Lake	Independence Twp.	Restoration of degraded habitat in this area is a central management technique in order to create connections in a fragmented landscape.	TBD	by 2020	Proposed	Referenced from Independence Twp. 2020 Vision Master Plan
Sashabaw Creek	Independence Twp.	Acquisition of open space will protect these large tracts of undeveloped land. New development in this area should be designed in a cluster layout to minimize impervious surfaces and protect natural features.	TBD	by 2020	Proposed	Referenced from Independence Twp. 2020 Vision Master Plan

Title	Sponsor	Description	Estimated Cost	Projected Timeline	Status	General Notes
Upper Paint Creek	Independence Twp.	Much of this smaller wetland system area is built-out; however, coordination of open space and maintenance of the tree-canopied street with its hedgerow-like wildlife habitat will maintain visual and wildlife connections.	TBD	by 2020	Proposed	Referenced from Independence Twp. 2020 Vision Master Plan
Waldon/Spring Lake	Independence Twp.	Excellent opportunities for pedestrian linkage exist in this area with the safety path system on the periphery and the Central Detroit Edison Utility Corridor bisecting the area.	TBD	by 2020	Proposed	Referenced from Independence Twp. 2020 Vision Master Plan
Fire Prevention Water Main	Springfield Twp.	Due to a lack of central public water supply, the Township should develop a plan to provide public sources of water for fire suppression to serve both existing and new development.	TBD	By about 2030	Proposed	Referenced from the Springfield Twp. Master Plan
Recreation	Springfield Twp.	A significant asset of Springfield Township is the availability of quality parks and recreation facilities, as well as an abundance of open space. Every effort shall be made to protect and enhance the system of open space and recreation.	TBD	By about 2030	Proposed	Referenced from the Springfield Twp. Master Plan
Recreation	Springfield Twp.	In recognition of the increased utilization of non-motorized transportation, and the need to provide a safe way for residents to walk or bicycle through the Township, the Township will plan for a Pathway System. The pathway system will link local recreational and open spaces areas, as well as residential areas, schools and other community facilities, and shopping areas within the Township.	TBD	By about 2030	Proposed	Referenced from the Springfield Twp. Master Plan
Dixie Highway Improvements	Springfield Twp.	The improvement of Dixie Highway is a high priority. It is the Township's intent to encourage physical improvements to Dixie Highway roadway in such a way as to facilitate the smooth and safe flow of traffic, improve vehicular and pedestrian safety, and help to promote the image of Dixie Highway as an entryway into the Township.	TBD	By about 2030	Proposed	Referenced from the Springfield Twp. Master Plan
Roadway Aesthetics	Springfield Twp.	Positive roadway aesthetics will guide the design of roadway improvement and features within the right-of-way, and the adjacent land uses' site design.	TBD	By about 2030	Proposed	Referenced from the Springfield Township Master Plan

Title	Sponsor	Description	Estimated Cost	Projected Timeline	Status	General Notes
Pathways	Springfield Twp.	Within the Township, paths will have greatest utility if they link residential areas, parks, schools and other community facilities, and shopping areas. The development of a system of paths for pedestrians and bicyclists which is completely separate from the street system is safest and most desirable.	TBD	By about 2030	Proposed	Referenced from the Springfield Twp. Master Plan
Public Roadway Improvements (Dixie Hwy and Deerhill Road)	Springfield Twp.	Improve intersection area on Dixie Highway at Big Lake Road and Deerhill Road on the Springfield/Independence Township border.	TBD	By about 2030	Proposed	Referenced from the Springfield Twp. Master Plan
Public Roadway Improvements (Tindall Road Paving)	Springfield Twp.	Pave Tindall Road from Davisburg to Rattalee Lake Road.	TBD	By about 2030	Proposed	Referenced from the Springfield Twp. Master Plan
Public Roadway Improvements (Road Drainage Improvement)	Springfield Twp.	Improve road drainage throughout the Township.	TBD	By about 2030	Proposed	Referenced from the Springfield Twp. Master Plan
Public Roadway Improvements (Gravel Road Improvements)	Springfield Twp.	Improve gravel roads throughout the Township.	TBD	By about 2030	Proposed	Referenced from the Springfield Twp. Master Plan
Green Infrastructure Project	Springfield Twp.	In 2007, Oakland County initiated a project called the “Green Infrastructure Visioning Project,” which focused on identifying an interconnected network of green spaces that conserve natural ecosystem values and functions, guide sustainable development, and provide economic and quality-of-life benefits to communities within the County. The resulting interconnected network of green spaces is made up of hubs, sites, and links.	TBD	By about 2030	Proposed	Referenced from the Springfield Twp. Master Plan
Clinton River Subwatershed Plan	Springfield Twp.	Implement soil erosion and sedimentation control ordinances or standards; Cooperate with the County, other Clinton River watershed groups, or agencies to identify, prioritize, and implement projects to construct, restore, and enhance wetlands; Cooperate with the County, other Clinton River watershed groups, and agencies to identify, prioritize, and implement projects to restore and enhance in-stream habitat.	TBD	By about 2030	Proposed	Referenced from the Springfield Twp. Master Plan

Title	Sponsor	Description	Estimated Cost	Projected Timeline	Status	General Notes
Indianwood Lake Walleye Spawning Habitat Enhancement Project	Orion Twp.	Enhance walleye spawning habitat near the Indianwood Lake inlet. Project result of findings from critical fishery habitat studies conducted from 2006 to 2008. Project involves feasibility study, habitat assessment and permitting and construction	\$20,000	2011	Proposed	Referenced from Indianwood Lake Improvement Board Critical Fishery Habitat Studies and Fishery Habitat Enhancement Reports
Indianwood Lake Woody Habitat Enhancement Project	Orion Twp.	Placement of woody structure in Indianwood Lake to improve fishery refuge and yellow perch spawning habitat. The proposed project is a result of findings from critical fishery habitat studies conducted from 2006 to 2008. The project involves GPS structure locations, permitting and construction and installation.	\$5,000	2013	Proposed	Referenced from Indianwood Lake Improvement Board Critical Fishery Habitat Studies and Fishery Habitat Enhancement Reports
Paint Creek Trail Non-Recurring Capital Improvement Projects	Paint Creek Trailways Commission	Connect with the Polly Ann Trail (residential connection).	\$10,000	2009	Proposed	Referenced from the Paint Creek Trailways Master Plan
Paint Creek Trail Non-Recurring Capital Improvement Projects	Paint Creek Trailways Commission	Atwater Site Development	\$25,000	2009	Proposed	Referenced from the Paint Creek Trailways Master Plan
Paint Creek Trail Non-Recurring Capital Improvement Projects	Paint Creek Trailways Commission	Pedestrian Bridge over Paint Creek, south of Gallagher, connecting the Trail to Trail office and rest areas.	\$100,000	2009	Proposed	Referenced from the Paint Creek Trailways Master Plan
Paint Creek Trail Non-Recurring Capital Improvement Projects	Paint Creek Trailways Commission	Connect with the Polly Ann Train (commercial connection).	\$100,000	2010	Proposed	Referenced from the Paint Creek Trailways Master Plan
Paint Creek Trail Non-Recurring Capital Improvement Projects	Paint Creek Trailways Commission	Trail Recycle Bin Program	\$500	2011	Proposed	Referenced from the Paint Creek Trailways Master Plan
Paint Creek Trail Non-Recurring Capital Improvement Projects	Paint Creek Trailways Commission	Connect with Polly Ann Trail - Bald Mountain State Recreation Area Connection.	\$100,000	2011	Proposed	Referenced from the Paint Creek Trailways Master Plan
Paint Creek Trail Non-Recurring Capital Improvement Projects	Paint Creek Trailways Commission	Art Project in Orion Township	\$15,000	2012	Proposed	Referenced from the Paint Creek Trailways Master Plan

Title	Sponsor	Description	Estimated Cost	Projected Timeline	Status	General Notes
Paint Creek Trail Non-Recurring Capital Improvement Projects	Paint Creek Trailways Commission	Native Landscaping screening/buffer in selected areas	\$10,000	2013	Proposed	Referenced from the Paint Creek Trailways Master Plan
Paint Creek Trail Non-Recurring Capital Improvement Projects	Paint Creek Trailways Commission	Connect with Polly Ann Trail - Addison Township Connection.	\$250,000	2013	Proposed	Referenced from the Paint Creek Trailways Master Plan
Paint Creek Trail Recurring Capital Improvement Projects	Paint Creek Trailways Commission	Side parcel acquisition for parking and trail access	\$125,000	recurring	Proposed	Referenced from the Paint Creek Trailways Master Plan
Paint Creek Trail Recurring Capital Improvement Projects	Paint Creek Trailways Commission	Side parcel acquisition for interpretive side trail and sites	\$125,000	recurring	Proposed	Referenced from the Paint Creek Trailways Master Plan
Paint Creek Trail Recurring Capital Improvement Projects	Paint Creek Trailways Commission	Development of interpretive side trails, sites and materials	\$13,000	recurring	Proposed	Referenced from the Paint Creek Trailways Master Plan
Paint Creek Trail Recurring Capital Improvement Projects	Paint Creek Trailways Commission	Acquisition of historic resources related to the transportation theme of the trail	\$100,000	recurring	Proposed	Referenced from the Paint Creek Trailways Master Plan
Paint Creek Trail Recurring Capital Improvement Projects	Paint Creek Trailways Commission	Install drinking fountains along the trail, where appropriate, in each community	\$10,000	recurring	Proposed	Referenced from the Paint Creek Trailways Master Plan

Appendix E: Initial Project Screening

General Information

Existing reports (e.g., Township Master Plans, County and Regional Recreation Plans, AOC-related documents) prepared by (or for) numerous entities (e.g., Michigan DNR, local planning organizations, OCWRC, Lapeer Drain Commissioner, Clinton River AOC groups, Clinton River Watershed Council) were reviewed. Projects identified in these reports with prospective relevance to the Upper Clinton River Watershed, based upon criteria presented in the USACE Scope of Work, were entered into a project screening table.

Role of Project Screening in Reconnaissance Study

The project screening table facilitated the comparison of candidate projects in light of their relevance to USACE criteria, the extent of potential benefits for environmental restoration, and estimated cost. Additional criteria considered included improved water quality, recreation, and flood minimization.

Expected Outcome of Initial Project Screening

The screening process elicited a list of candidate projects based on an evaluation consistent with the above-mentioned criteria. This list includes projects determined to best meet the criteria based upon magnitude of benefits, stakeholder support, cost effectiveness, and other benefits to the watershed.