

# **BIGELOW CREEK HABITAT ASSESSMENT & IMPROVEMENT PLAN**



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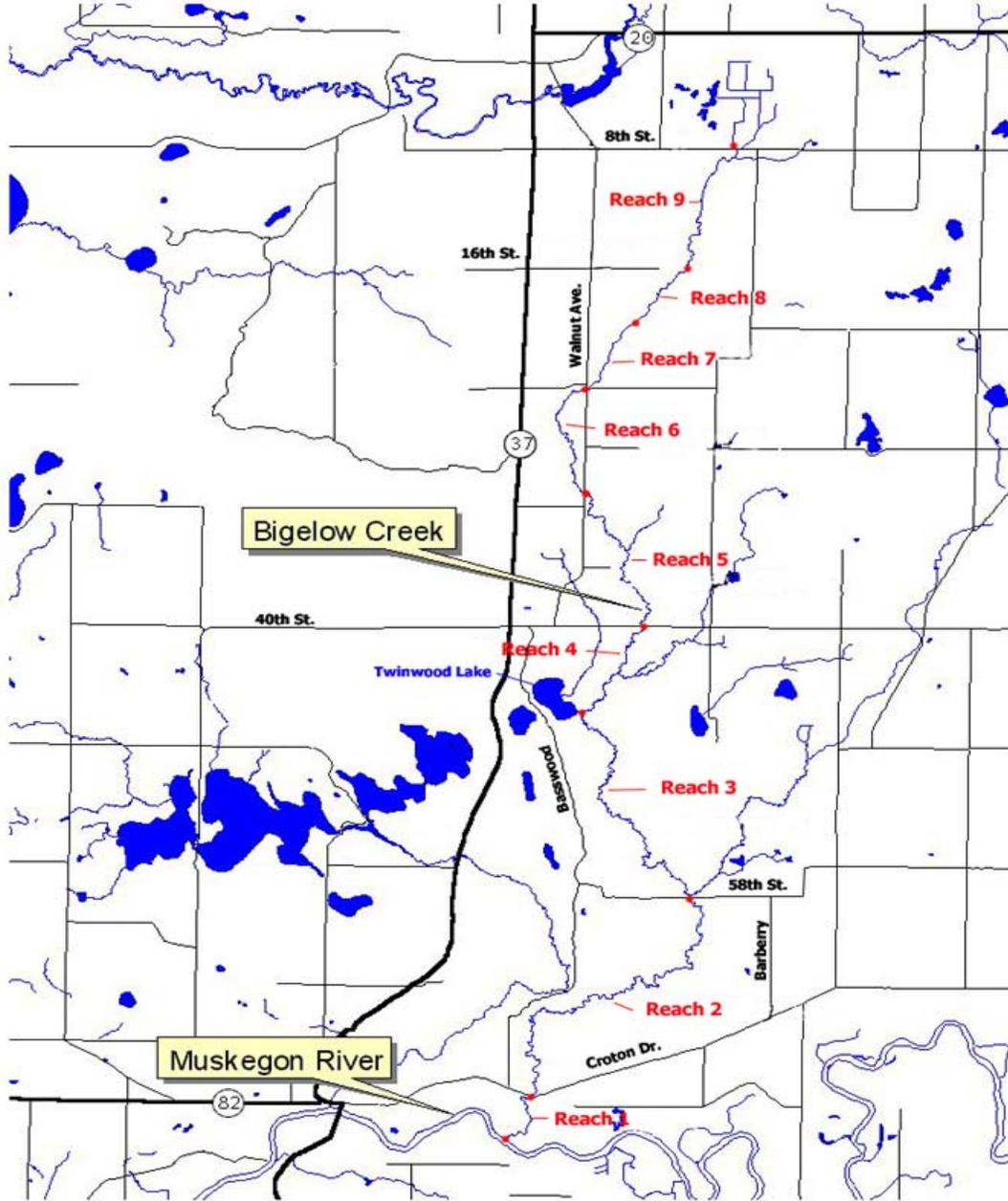
*Reference Key for Codes and Definitions*

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*Raw Data Spreadsheets*

*Stream Pictures & Bank Erosion Inventory Sheets*

# Map



## ***Executive Summary***

*Overall Bigelow Creek stream habitat is in good shape. This project has identified key reaches that would benefit from habitat improvements and would help maintain Bigelow as a viable trout stream. It has also established a base line data set as a reference to future land use change effects on Bigelow.*

***Reach 1*** *Because of the difficulty and cost of utilizing structures to increase pool habitat in this reach, efforts would be better spent in other reaches.*

***Reach 2*** *has had numerous stream habitat improvements installed in the past 5 years with additional ones scheduled for 2003 and beyond. A few landowners have denied access for stream improvements to their land. Those areas will not have a major adverse affect to the stream as a whole. Future contacts will be made in an effort to acquire access.*

***Reaches 3 and 4*** *make up 27% of the total stream length and are in the most need for improvements. This is primarily a brown trout area and needs shade, cover, sand movement to expose more gravel and a reduction of glide habitat and an increase in pool/riffle habitat.*

***Reach 5*** *has sufficient amounts of gravel and cobble. It needs overhead cover, additional woody debris and some bank erosion control.*

***Reach 6*** *needs increased pool area, increased cover and tree planting to diversify the riparian vegetation.*

***Reaches 7 and 8*** *are primarily brook trout waters. There is a good mixture of riparian vegetation that provides shade. It needs a reduction in glide area and an increase in pool/riffle area, sand movement to expose more gravel and more cover in the form of root masses and logs.*

***Reach 9*** *has numerous blowdowns across the stream, which results in this reach having the most square feet of fish cover per linear foot of stream in the Bigelow system. This is a valuable fish area at present. Due to its use as a legal drain this reach is subject to future cleanouts for drain maintenance, which is not conducive for the longevity of stream improvement projects.*

***Coolbough Creek*** *(main tributary to Bigelow Creek) is primarily brook trout water. There is a good mixture of riparian vegetation that provides shade. It needs a reduction in glide area and an increase in pool/riffle area, sand movement to expose more gravel and more cover in the form of root masses and logs.*

## ***Introduction***

*The Muskegon River is located in north-central Michigan and is 212 miles long, with a 575 ft. drop in elevation between the source and the mouth at Lake Michigan. The Muskegon River watershed encompasses over 2,350 square miles of land. Agricultural and urban development in the watershed is moderate, but the use of floodplains for development and agriculture is significant in some areas. Erosion of sediment into streams occurs in the uplands and water withdrawal for irrigation is significant in some tributaries. Major tributaries in the watershed include West Branch of the Muskegon River, Clam River, Middle Branch River, Hersey River, Little Muskegon River, Bigelow Creek, Brooks Creek, and Cedar Creek (O'Neal 1997).*

*The channel of the Muskegon River and some of its tributaries have been adversely altered. Most of the high gradient stream reaches on the mainstem have been impounded, many tributaries have been dredged and straightened, and the removal of riparian vegetation throughout the watershed has led to less woody debris in streams. All of these factors have led to less diverse stream channels that are much less favorable to aquatic communities than diverse stream channels (O'Neal 1997).*

*There are five major impoundments on the mainstem of the Muskegon River (O'Neal 1997) with the furthest downstream impoundment being Croton Dam. Croton Dam blocks fish passage by both resident and migratory fish species. Only three of the major tributaries in the watershed, Bigelow Creek, Brooks Creek, and Cedar Creek, occur below Croton Dam and provide habitat for fish migrating out of Lake Michigan to spawn.*

*Bigelow Creek originates in a cedar swamp just southeast of White Cloud, Michigan. It supports a good brook and brown trout fishery that is enhanced by natural reproduction. Brook trout are more prevalent in the upstream reaches of the creek, whereas brown trout are more prevalent in the downstream reaches. The Michigan DNR conducted fishery surveys at four sites in Bigelow Creek in 1994. Estimates for brook trout were 29/mile, brown trout 340/mile, steelhead parr 104/mile, and Chinook salmon 22/mile (O'Neal 1997). Estimates of Chinook salmon smolts are probably low because collection occurred in the summer (Carl 1980).*

*The Michigan Department of Natural Resources (DNR) Fisheries Division identified excessive sediment bedload, removal of riparian vegetation, and lack of instream habitat as three areas of concern in their Muskegon River Watershed Assessment (O'Neal 1997). The assessment states that the area between Croton and Newaygo is a prime spawning area for walleye, steelhead, Chinook salmon, and Lake Sturgeon. This section of river produces the highest number of natural Chinook salmon smolts in the State of Michigan and Bigelow Creek is one of the main trout tributaries in this section of the river.*

*"A Fisheries Management Guide to Stream Protection and Restoration" (Gaylord Alexander 1995) emphasizes the importance of vegetation management and sediment control in the stream corridor as vital parts of stream protection and restoration. Improvements to tributaries contribute to the overall health of the main river fisheries, riparian wildlife and general water quality. This leads to the need for tributary improvements in order to affect an overall improvement in the Muskegon River system.*

*Biologists feel that stream systems first need to have an assessment of existing conditions to determine if habitat improvements would be beneficial. If it were determined that habitat improvements would be beneficial a maintenance and improvement plan can be developed from the assessment. Bigelow Creek was selected as a focus point for a stream habitat assessment to identify potential improvements that would benefit the overall Muskegon River system.*

# ***Project Goal and Objectives***

*This Project was developed to evaluate the existing conditions of the stream habitat in Bigelow Creek and establish recommendations for future stream improvement projects.*

**Project Goal:** *To enhance the fisheries, riparian wildlife and general water quality in the Bigelow Creek ecosystem.*

**Objectives:**

- 1. Assess the current instream and riparian habitat and identify specific areas of concern.*
- 2. Analyze habitat data and identify improvements needed.*
- 3. Install needed improvements*

**Methodology:**

*In order to accomplish this task, the project was divided into three phases. This report represents the completion of Phase 2.*

**Phase 1** *was the detailed field assessment (mapping and photographs) of the existing instream and riparian habitat and any specific areas of concern, such as sediment from stream banks. This was compiled for use in planning needed improvements. This phase covered 87,253 feet of Bigelow Creek main stream and 8,946 feet of Coolbough Creek, a main tributary to Bigelow.*

**Phase 2** *is the analysis of the data to determine a course of action for the improvement of the fishery, riparian habitat and areas of adverse impacts. Partial analysis was done during the collection of the data but the major improvement plan development was done following data collection.*

**Phase 3** *will be implementation of the needed changes identified in Phase 2. This would involve improvements such as: stream-side vegetation planting, bank stabilization, brush bundles for trapping sediment, instream deflectors, cover logs, cover platforms, increased woody debris, increases in pool/riffle areas, sand movement to expose gravel and other practices and management techniques for improved fish/wildlife habitat and water quality.*

## ***Data Collection (Phase 1) and Analysis (Phase 2)***

*A method similar to the basin-wide inventory developed by Hankin and Reeves (1988) was used to collect habitat information on Bigelow Creek. Individuals walked the entire length of Bigelow Creek and its main tributary, Coolbough Creek for the collection of field data. Another tributary, Cold Creek, was also examined, but it was found to have extremely low water levels and it was determined that it was not a viable fish stream at that time so habitat data was not collected. Data collection was from August 2001 – July 2002.*

*The data collection was done by Kanouse Outdoor Restorations, owned and operated by Shawn Kanouse. Measurements were taken starting at the stream mouth and progressed upstream. Each time the habitat type changed a separate set of assessment data were recorded for that habitat type. Length and width measurements were taken with a Walktax Distance Measurer (Hip Chain). Depths were taken with a survey rod. Fish cover in square feet was measured in the beginning until the data collectors obtained a feel for the sizes and later amounts were estimated. Substrate percentages were visually estimated and shade was a visual estimation of the cover percentage from the riparian vegetation directly over the stream. The overall rating was estimated from the field observation of all parameters collectively. Pictures were taken with a digital camera and locations were identified with GPS coordinates.*

Data was entered into excel spreadsheets and analyzed using simple spreadsheet functions for sorting.

The Bigelow main stream was broken into nine reaches for easier data analysis.

**Reach 1 – Mouth of stream at Muskegon River upstream to Croton Road**

**Reach 2 – Croton Road to 58<sup>th</sup> Street**

**Reach 3 – 58<sup>th</sup> Street to Twinwood Lake entrance**

**Reach 4 – Twinwood Lake entrance to 40<sup>th</sup> Street**

**Reach 5 – 40<sup>th</sup> Street to Walnut Street**

**Reach 6 – Walnut Street to North Crossing of Walnut Street**

**Reach 7 – North Crossing of Walnut Street to private bridge**

**Reach 8 – Private Bridge to Private Bridge at 16<sup>th</sup> Street**

**Reach 9 – Private Bridge at 16<sup>th</sup> Street to 8<sup>th</sup> Street**

## **Reach Summary and Recommendation**

Terminology definitions and detailed data for these summaries are included in the Appendix under (Reference Key for Codes and Definitions, Data Summary Tables & Charts and Raw Data Spreadsheets).

**Reach 1 – Mouth of stream at Muskegon River upstream to Croton Road.**

- ◆ This reach is 3,744 feet long (4% of the total stream length) and has an area of 95,600 square feet (5 % of the total stream area).
- ◆ The habitat type is 88% riffle and 12% large woody debris complex. There are no pool or glide habitat types.
- ◆ The riparian vegetation is 92% northern hardwoods and 8% lowland hardwoods and provides an average of 69% shade.
- ◆ In-stream fish cover consists of 74% large woody debris, 18% undercut banks and 5% boulders. Overall there is 1.8 square feet of cover per linear foot of stream.
- ◆ This reach has the largest percentage of cobble (50%) and the second largest percentage of gravel (21%).
- ◆ There is a lack of pool area and juvenile fish habitat in this reach; however, the large amount of large woody debris does provide some cover.
- ◆ The amount of cobble and clay content of this reach make it difficult for the installation of in-stream improvements.

**Recommendation** – Because of the difficulty and cost of utilizing structures to increase pool habitat in this reach, efforts would be better spent in other reaches.

**Reach 2 – Croton Road to 58<sup>th</sup> Street**

- ◆ This reach is 23,953 feet long (28% of the total stream length and has an area of 649,821 square feet (34% of the total stream area).
- ◆ It has good habitat diversity, 60% riffle, 30% glide, 9% pool and 1% large woody debris complex.
- ◆ The riparian vegetation is 86% northern hardwoods and 12% tag alder and provides some shade at an average of 46%.
- ◆ In-stream fish cover consists of 46% large woody debris, 24% undercut banks, 14 % man made structures and 13% overhanging brush. Overall there is 2.1 square feet of cover per linear foot of stream.
- ◆ This reach has the largest percentage of gravel at 29%.

*This is the longest reach of the stream system and has had the most stream improvement work completed in recent years. Stream habitat improvements have been completed on private lands in the first 3,000 feet above Croton Road. Brush bundles with log outlines and log structures have been used to restore banks, provide fish cover, fix minor bank erosion problems and reduce stream width and increase water velocity that moves sand bedload increasing gravel exposure. Upstream of this work, additional stream improvements on private landowner and Forest Service lands are being planned for the next two years. There are private parcels in this stream reach that have bank erosion, lack of overhead cover from the clearing of riparian vegetation and lack pool habitat. Timberland RC&D has approached the landowners for access, but to this point the landowners have been uncooperative.*

*Stream improvements have been installed on Forest Service land below 58<sup>th</sup> Street and downstream on private lands. The improvements were log cover structures, triangle deflectors for moving sand and restoring gravel exposure and brush bundles and small deflectors to protect banks and create pool areas. The stream improvements currently installed and the new ones planned in the near future, excluding the landowners denying access, provide outstanding habitat for the fishery in this stream reach.*

**Recommendation** – *Work currently planned in this reach should be continued, but in the future other reaches should be prioritized to complement work in this area.*

### **Reach 3 – 58<sup>th</sup> Street to Twinwood Lake entrance**

- ◆ *This reach is 16,613 feet long (19% of the total stream length) and has an area of 508,719 square feet (27% of the total stream area).*
- ◆ *It has poor habitat diversity with 90% glide, 9% pool and 1% riffle. There is no woody debris complex habitat type.*
- ◆ *The riparian vegetation is 80% tag alder and 17% northern hardwoods providing little shade at an average of 17%.*
- ◆ *In-stream fish cover is limited but some cover consists of 28% aquatic vegetation, 26% large woody debris and 24% overhanging brush. Overall there is 1.8 square feet of cover per linear foot of stream.*
- ◆ *This reach has the largest percentage of silt at 20%.*
- ◆ *Some habitat improvement in the form of brush bundles and log cover structures has been done on 435 feet of stream on private lands in 2000.*

**Recommendation** - *This is primarily a brown trout reach. It lacks gravel for spawning, pool habitat, shade and cover in the form of riparian vegetation, large woody debris and undercut banks. Reduce the glide area and increase pool/riffle area through the use of additional woody debris structures. Bank planting of trees can be done to increase the riparian vegetation diversity from tag alder. There are two significant areas of bank erosion that need to be stabilized to minimize sediment input into the stream.*

### **Reach 4 – Twinwood Lake entrance to 40<sup>th</sup> Street.**

- ◆ *This reach is 6,946 feet long (8% of the total stream length) and has an area of 116,652 square feet (6% of the total stream area).*
- ◆ *It has poor habitat diversity with 90% glide, 7% pool and 3% riffle. It has no large woody debris complex habitat type.*
- ◆ *It has a large percentage of sand substrate (83%).*
- ◆ *The riparian vegetation is 80% tag alder and 17% lowland hardwoods and provides little shade at an average of 29%.*

- ◆ *In-stream fish cover is in the form of undercut banks (66%) and large woody debris (30%), but there is a need for more cover in this stream reach. Overall there is 1.0 square feet of cover per linear foot of stream.*

*Some habitat improvement in the form of brush bundles, mid-stream logs for cover, log cover structures and minor diverters has been done in 2000 and 2001 for 1,385 feet of stream on private lands. Additional improvement work is scheduled for installation in the next two years.*

***Recommendation*** – *This is also primarily a brown trout area similar to reach three and recommendations are the same. Woody debris structures should be used to uncover gravel for spawning and create scour pools with cover. Bank planting of trees can be done to increase the riparian vegetation diversity from tag alder. There are a number of braided channels that need to be made into a single main channel to move sand bedload and maintain water depth and temperature.*

#### ***Reach 5 – 40<sup>th</sup> Street to Walnut Street.***

- ◆ *This reach is 10,228 feet long (12% of the total stream length) and has an area of 149,472 square feet (8% of the total stream area).*
- ◆ *It has good habitat diversity with 67% riffle, 26% glide and 7% pool. It has no large woody debris complex habitat type.*
- ◆ *This reach has the second largest percentage of cobble at 16% and the third largest percentage of gravel at 20%.*
- ◆ *The riparian vegetation is 62% lowland hardwoods, 25% tag alder and 12% northern hardwoods and provides some shade at an average of 43%.*
- ◆ *In-stream fish cover is present in the form of undercut banks (50%), large woody debris (46%) and boulders (4%). Overall there is 0.9 square feet of cover per linear foot of stream.*

***Recommendation*** – *This reach is in need of overhead cover (riparian vegetation and in-stream cover) for shade and increase in the quantity of fish cover per linear foot of stream. It needs the addition of woody debris to direct the flow into a single channel, some bank erosion control and reconfiguration of a few rock dams to reduce the channel width and increase water depth.*

#### ***Reach 6 – Walnut Street to North Crossing of Walnut Street.***

- ◆ *This reach is 8,166 feet long (9% of the total stream length) and has an area of 121,750 square feet (6% of the total stream area).*
- ◆ *It has fairly good habitat diversity with 80% glide, 16% riffle and 4% pool habitat. It has no large woody debris complex habitat type.*
- ◆ *It has a substantial amount of silt substrate (14%).*
- ◆ *The riparian vegetation is 85% tag alder, 8% lowland hardwoods and 7% northern hardwoods and provides some shade at an average of 43%.*
- ◆ *In-stream fish cover is present in the form of undercut banks (52%) and large woody debris (43%). Overall there is 0.5 square feet of cover per linear foot of stream.*

***Recommendation*** - *There is a fair amount of gravel (5%) and cobble (2%) in this reach. The pool area needs to be increased through the use of woody debris structures. Cover needs to be increased in the form of riparian vegetation, large woody debris and undercut banks to increase the amount of fish cover per linear foot of stream. Bank planting of trees can be done to increase the riparian vegetation diversity from tag alder.*

**Reach 7 – North Crossing of Walnut Street to private bridge.**

- ◆ This reach is 5,958 feet long (7% of the total stream length) and has an area of 86,727 square feet (5% of the total stream area).
- ◆ It has poor habitat diversity with 94% glide, 6% pool and no riffle or large woody debris complex habitat types.
- ◆ It has a large percentage of sand substrate (84%).
- ◆ The riparian vegetation is 57% lowland hardwoods, 36% tag alder, and 7% northern hardwoods and provides some shade at an average of 51%.
- ◆ In-stream fish cover is present in the form of undercut banks (50%) and large woody debris (49%). Overall there is 0.8 square feet of cover per linear foot of stream.

**Recommendation** - This is primarily a brook trout area. There is a good mixture of riparian vegetation. It is in need of additional cover in the form of large woody debris and undercut banks, a reduction in the glide area and an increase in the pool/riffle area through the use of additional woody debris structures. The placement of log structures and brush bundles will assist in sand movement and expose more gravel areas. More root mass and numerous logs are needed to increase the complex cover needed for brook trout.

**Reach 8 – Private Bridge to Private Bridge at 16<sup>th</sup> Street.**

- ◆ This reach is 3,528 feet long (4% of the total stream length) and has an area of 47,305 square feet (3% of the total stream area).
- ◆ It has poor habitat diversity with 92% glide and 8% pool. There are no riffle or large woody debris complex habitat types.
- ◆ It has a large percentage of sand substrate (84%).
- ◆ The riparian vegetation is 97% lowland hardwoods and 3% northern hardwoods and provides some shade at an average of 58%.
- ◆ In-stream fish cover is in the form of large woody debris (61%) and undercut banks (39%). Overall there is 1.2 square feet of cover per linear foot of stream.

**Recommendation** - This is primarily a brook trout area. There is a sufficient amount of shade and riparian vegetation. Reduce the glide area and increase pool/riffle area through the use of additional woody debris structures. The placement of log structures and brush bundles will assist in sand movement and expose more gravel areas. More root mass and numerous logs are needed to increase the complex cover needed for brook trout.

**Reach 9 – Private Bridge at 16<sup>th</sup> Street to 8<sup>th</sup> Street.**

- ◆ This reach is 8,117 feet long (9% of the total stream length) and has an area of 116,692 square feet (6% of the total stream area).
- ◆ It has poor habitat diversity with 94% glide, 6% pool and <1% riffle. There is no large woody debris complex habitat type.
- ◆ It has the largest percentage of detritus substrate (18%) and a large percentage of silt substrate (15%).
- ◆ The riparian vegetation is 55% lowland hardwoods, 24% marsh, 10% lowland conifer and 10% tag alder and provides a small amount of shade at an average of 30%.
- ◆ In-stream fish cover is in the form of large woody debris (51%), aquatic vegetation (27%) and undercut banks (22%). Overall there is 3.2 square feet of cover per linear foot of stream.

**Recommendation** - This reach is a designated County Drain and could be petitioned for future cleanouts, which is not conducive for the longevity of stream improvement projects. This is a valuable fish area due to the large amounts of woody debris from storm blowdowns.

**Coolbough Creek – Main tributary to Bigelow Creek (mouth is at Twinwood Lake)**

- ◆ It is 8,946 feet long.
- ◆ It has fair habitat diversity with 92% glide, 6% riffle, 1% large woody debris complex and <1% pool.
- ◆ It has 47% sand, 24% detritus and 14% each of silt and gravel.
- ◆ The riparian vegetation is 66% northern hardwoods and 17% lowland hardwoods and provides some shade at an average of 53%.
- ◆ In-stream fish cover is in the form of aquatic vegetation (83%) and large woody debris (15%). Overall there is 6.1 square feet of cover per linear foot of stream.

**Recommendation** - This is primarily a brook trout area. There is a sufficient amount of shade and riparian vegetation. Reduce the glide area and increase pool/riffle area through the use of additional woody debris structures. The placement of log structures and brush bundles will assist in sand movement and expose more gravel areas. More root mass and numerous logs are needed to increase the complex cover needed for brook trout.

## ***Justification of Recommended Treatments***

The U.S. Forest Service has performed substantial habitat improvements on reach 2 and some improvements to reach 3 on the sections of Bigelow Creek they manage. For monitoring purposes, a test section (where improvements were made) was established in reach 2 just below 58<sup>th</sup> Street. Upstream and downstream control sections (no improvements in these areas) were established to maintain baseline information. The test section showed a 1 percent decrease in sand substrate and small increases in muck and cobble substrates. Pool habitat and quality (depth) increased while glide habitat decreased. Manmade structure increased substantially because they were used for improvements. The results of this were startling. Trout populations in the test section increased 300%. There were no changes to habitat or fish populations in the upstream control section. The downstream control section showed a slight increase in sand substrate (1%) yet there was a slight increase to fish populations. It should also be noted that there was an increased occurrence of large woody debris in the downstream control section. This had to be naturally occurring, as no manmade additions were made in this area. The results, of the changes to the downstream control, were the increase in fish population despite the fact that sand substrate increased in this section. The improvements recommended in this document are similar to those used in the Forest Service test section and will dramatically improve aquatic habitat.

## ***Conclusion***

Partner funds were used to complete Phase 1 and 2 of this project. During Phase 1 and 2 some site improvements were completed but the majority of site improvements will be done in Phase 3.

The U.S. Forest Service with the Michigan Wildlife Habitat Foundation and the Muskegon/White River Chapter Trout Unlimited has been installing and maintaining habitat improvement measures since 1990. Stream improvements of 3,761 feet have been completed on federal land below 58<sup>th</sup> Street.

*Timberland RC&D with partner assistance from Fremont Area Community Foundation (\$5,000), U.S. Fish and Wildlife Service (\$9,000), Michigan Department of Natural Resources Fisheries Division (\$8,000) and Grand Valley State University students (labor) have installed stream habitat improvements on Bigelow Creek since 1999.*

*Stream habitat improvements:*

<b>YEAR</b>	<b>FEET OF IMPROVEMENT</b>	<b>FEET OF STREAM AFFECTED</b>
1999	807	3,000
2000	863	2,600
2001	200	1,110

*The improvements we propose to do in phase 3 will complement US Forest Service, Trout Unlimited and Michigan Wildlife Habitat Foundation habitat work in adjacent portions of the stream. Based on current applications, an initial cost estimate of \$304,944 will be needed to implement the needed improvements.*