Kids Creek Subwatershed Action Plan



The Watershed Center Grand Traverse Bay

June 2013

Introduction

Located in northwest Michigan's Lower Peninsula, the Grand Traverse Bay watershed drains 976 square miles and covers major portions of four counties; Antrim, Kalkaska, Grand Traverse, and Leelanau (Figure 1). The Grand Traverse Bay Watershed Protection Plan, approved by the Michigan Department of Environmental Quality (MDEQ) and Environmental Protection Agency (EPA), states that sediment and excessive nutrient loading are the two highest ranking priority

pollutants that are threatening the coldwater fishery, aquatic life, and other designated uses in the Grand Traverse Bay watershed (www.gtbay.org/ourprograms/watershedprotection-plan/). Stormwater inputs are a primary concern throughout the watershed because of the potential to contribute excessive sediment, nutrients, pathogens and toxins to the Bay and its tributaries.

Currently, a 2-mile portion of Kids Creek, a major tributary to the Boardman River which provides 30%



of the surface water to the Bay, is not meeting water quality standards and is on the State's Impaired Waters List (303(d) list) due to a poor aquatic insect community. This is mainly due to sedimentation and stormwater quality and quantity.

In 2009 TWC was awarded an MDEQ grant to work on Kids Creek to develop this Action Plan to address stormwater inputs and other water quality issues on Kids Creek. Fieldwork began in Spring 2010 and the draft plan was produced Spring 2013. In addition to describing the current conditions and sources of water quality problems for the creek, the plan has developed a list of recommendations for work to improve the health of the creek by decreasing both the input and effects of stormwater to the creek, as well as improve in-stream habitat for macroinvertebrates and fish communities. Implementing this Action Plan will ultimately help lead to the removal of Kids Creek from the Impaired Waters List.

Project Background and Current Conditions

TWC has been working in partnership with the MDEQ and the Grand Traverse Conservation District (GTCD) to develop this Action Plan to address stormwater inputs and their effects on Kids Creek, which is not meeting water quality standards and is on the State's Impaired Waters List (303(d) list) due to a poor aquatic insect community. This is mainly due to sedimentation and stormwater quality and quantity.

Concurrent to the development of the Action Plan, the MDEQ is also working with these same partners on writing the Total Maximum Daily Load (TMDL) plan for Kids Creek, which is required under the Clean Water Act for waterbodies not meeting water quality standards. The Kids Creek TMDL will identify the allowable levels of pollutants (in this case, sediment) in the water body that will result in attainment of the designated uses (meaning, how much sediment can be in the stream and still have the creek meet water quality standards). A TMDL identifies the sources of pollution and provides potential solutions. When writing the TMDL for Kids Creek the DEQ is piloting a new concept and working closely with local stakeholders (like TWC and GTCD) to receive guidance on possible ways to the TMDL findings could actually be implemented and completed. Implementation guidance has not been included in previous Michigan TMDLs that address biotic impairments such as that in Kids Creek. As such, TWC and GTCD have been an integral part of the data gathering, fieldwork, and discussions that the MDEQ have been conducting as part of the TMDL's development.

It should be noted that stormwater runoff is a major suspected pollutant to Kids Creek, but that the EPA, who oversees TMDL development as part of the Clean Water Act, does not recognize stormwater as a pollutant. Therefore the Kids Creek TMDL cannot be written for stormwater, but will be written for sediment instead. Due to delays in data collections (see next sections), the TMDL draft is expected to be available for public comment by the end of 2013.

This document will be considered a "draft" until the TMDL is finalized and results can be incorporated into this Action Plan. However, initial results are available and are being used to determine recommendations at this point.

Kids Creek drains almost 11 square miles and enters the Boardman River near its mouth at Grand Traverse Bay in Traverse City (Figure 2). The Kids Creek subwatershed is 58% urban land use, 38% natural/upland areas, 3% agriculture, and 1% water. It is spring fed by 3 major tributaries originating in Garfield Township on the southern and western watershed boundaries. The majority of the upper watershed is in Garfield Township, with the downstream portion in Traverse City. The downstream portion is the section that has been determined impaired and is almost wholly located within City of Traverse City limits, starting where the main stem crosses M-37/US-31 (Figure 2).

Kids Creek experiences severe changes in flow due to stormwater inputs during storm events. The creek exhibits signs of flashiness and causes regular flooding within the city limits. This flashiness has led to scoured stream bottoms and increased sedimentation (from eroding stream banks) within the stream. This is one of the main reasons that Kids Creek is on the state Impaired Waters List and is said to be in "nonattainment."



Summary of Fieldwork Performed

As part of both the development for the TMDL and the Action Plan, staff from the DEQ, TWC, and GTCD began meeting in March 2010 to discuss the project, subwatershed area, and details of the sampling plan. The project team discussed upcoming activities and necessary fieldwork to complete. The following are major field activities and studies conducted on Kids Creek.

Kids Creek Watershed Hydrologic Study:

A hydrologic assessment was performed for Kids Creek in 2010 by the MDEQ Hydrologic Studies Unit to better understand the watershed's hydrologic characteristics and help determine the watershed's critical areas to provide a basis for stormwater management ordinances to protect streams from increased erosion.

Monitoring of Kids Creek for TMDL Development:

MDEQ contracted with Great Lakes Environmental Center (GLEC) to address additional sampling needed in Kids Creek for stressor identification/elimination and pollutant identification for the development of the 2013 TMDL. Ten sites were sampled during wet and dry weather (baseflow) conditions for the following parameters: temperature, dissolved oxygen, pH, specific conductance, suspended sediment concentration, total dissolved solids, total suspended solids, bedload sediment, chlorides, total biological oxygen demand, Nitrate-Nitrite, total Phosphorus, hardness, Base/neutral acids, and total metals. Stage measurements were also taken to calculate discharge at each site. DEQ staff also conducted biological monitoring on fish and macroinvertebrates (aquatic insects) during the course of the TMDL development in 2010 and 2011.

Kids Creek Geomorphic Analysis:

Since one of the major suspected pollutants to Kids Creek is excess sediment, project partners performed measurements, analyzed historic data and took samples to assess if sediment from channel erosion or upland runoff was contributing to the impairment of Kids Creek and help to provide a quantitative basis for sediment load reductions to be outlined in the TMDL. The following data were collected to perform this analysis:

- 1. An assessment of historical and current land use maps and aerial photographs.
- 2. Stream channel dimensions, channel roughness, erosion potential and erosion rate, and pebble counts were measured at 8 representative study reaches throughout the Kids Creek watershed and at 3 stable reference reach locations.
- Toe pins were established at all the study sites to measure lateral erosion rates on Kids Creek and reference reaches. Bank Assessment for Nonpoint Source Consequences of Sediment (BANCS) model measurements were taken to estimate erosion rates of each stream segment monitored.
- 4. Stage recorders were placed at various locations to develop flow measurements, which will be used to confirm bankfull relationships, determine velocity and calculate sediment and other pollutant loads.
- 5. The estimated bank erosion rate from the BANCS model (noted above) will be compared to the erosion estimated to be occurring from the suspended solids and bedload measurements taken by GLEC. This sampling has not yet been completed or analyzed as of June 2013. As this data is gathered and analyzed, this report will be updated.

Streambank Erosion and Road Stream Crossing Inventory:

The GTCD also completed an updated streambank erosion and road stream crossing inventory prior to this project. Those results were summarized for moderate and severe sites in the Kids Creek watershed and are found in Appendix A.

Findings and Recommendations

At the current time the DEQ has not yet completed all its monitoring related to the TMDL development due to unforeseen complications with field data gathering. The TMDL will now be drafted in 2014 as opposed to being originally planned for 2013. Due to the delay in data gathering the DEQ was also not able to complete its geomorphic analysis on Kids Creek as well, which was a key document to the completion of this Action Plan. However, preliminary findings from this report are available and are summarized below.

Completed in 2010, the "Kids Creek Watershed Hydrologic Study" study evaluated changes in land use from 1800 to today and the resulting changes in runoff volume and rate. Specific Subbasin areas evaluated were broken up as follows (Figure 3):

- Sub-basin 1 Kids Creek from outlet at Boardman upstream to confluence with Tributary A
- Sub-basin 2 Kids Creek main branch, from Tributary A upstream to Silver Lake Road
- Sub-basin 3 Tributary A to Kids Creek main branch
- Sub-basin 4 Kids Creek main branch upstream of Silver Lake Road to US 31/M37
- Sub-basin 5 Tributary B (not on map)
- Sub-basin 6 Tributary D to mouth
- Sub-basin 7 Kids Creek main branch upstream of Tributary D to unnamed tributaries
- Sub-basin 8 Kids Creek upstream of unnamed tributary (crossing South Airport Road)
- Sub-basin 9 Unnamed tributary in Stone Ridge subdivision to Kids Creek

The hydrologic study showed increases in erosive potential from 1978 to 2005 and 2009. It also determined that protecting Kids Creek and its tributaries from both higher flows and longer durations of channel-forming flows is important to prevent further destabilizing the stream channels. The findings of the of the hydrologic study recommended critical areas of focus:

- 1. <u>Sub-basins 4 and 7</u> have the largest amount of imperviousness by percentage of the watershed and have endured the greatest amount of recent land use change. These watersheds are by far the most likely to be negatively impacted due to hydrology.
- 2. <u>Sub-basins 1, 3, and 5</u> are the next most like to be negatively impacted by hydrologic and land use changes. Sub-basin 1 has as high an imperviousness percentage as Sub-basins 4 and 7 above but other hydrologic variables did not impact that Sub-basin as negatively.
- 3. <u>Sub-basins 6, 8, and 9</u> are least likely to have been negatively affected by changes in the watershed.

<u>Recommendation: Sub-basins 1, 3, 4, 5, 7</u> -Reduce impervious surfaces and implement Best management Practices (BMPs) to reduce runoff to creek in Sub-basins 1, 3, 4, 5, and 7.



The initial evaluation of the data collected to date for the DEQ's geomorphic analysis does not indicate widespread channel instability throughout the watershed. Preliminary results from the geomorphic analysis showed that the upper portions of Kids Creek in Sub-basin 6 and Sub-basin 7 are the largest contributors of sediment load from channel erosion of the areas studied. Significant historical sediment loads from these areas due to extensive drainage channel changes, extensive development, and bank destabilization in the former buffalo farm area are now reduced as those areas stabilize. Without additional channel modifications or landuse changes, the main branch of Kids Creek here should continue to become more stable.

Headwater stream channels in Sub-basins 6, 9 and 8 are at risk of increased erosion and bank instability if proper controls are not implemented as development expands into these areas. The analysis found that the very upper reach of Tributary D (Sub-basin 6) upstream of Creekside Drive (Silver Lake Rd) is extremely unstable and contributing a large amount of sediment flow to Kids Creek. Although the cause of the initiation of the instability is not known

for certain, this may be an indication of what could occur in other upstream reaches as development and stream channel modification expand farther out into the watershed.

The channel through Sub-basin 4 upstream of Silver Lake Road to US31/M37 is also stable or stabilizing,

Recommendation: Sub-basins 6, 7, 8, 9 -

- Control land use and development to prevent further erosion, maintain current buffer (ordinance) along creek, stabilize severe/moderate erosion sites
- Make sure new culvert placements do not cause instability upstream (headcuts)
- Further investigate upstream of Creekside Road to determine cause of instability and possible actions to correct.
- Implement protective measures such as Low Impact Development and Natural Channel Design

and should continue to be stable if it is not channelized or if significant land use changes occur. The DEQ's geomorphic analysis of this reach could not determine if the channel is capable of moving the sediment load delivered to it and if this is reducing stream channel function. Although the channel dimensions here appear to be stable, additional analysis may show that some additional improvement may be obtained through construction of a wider flood plain bench or use of instream structures to move sediment through this reach.

Most of this section of Kids Creek in Subbasin 4 lacks a riparian buffer - the establishment of a buffer along the creek here would enhance shade opportunities in the stream, provide bank stabilization and create in-stream habitat.

Recommendation: Sub-basin 4 -

- Further investigate whether floodplain enhancements or instream hydrologic structures would be beneficial in this subbasin
- Install buffer

Sub-basin 5 was not evaluated in any way for DEQ's geomorphic analysis and should in the future receive some level of investigation. Kids Creek just downstream of Silver Lake Road (in Sub-basin 2) was also not evaluated and may be negatively influenced by Sub-basin 5 and the stormwater discharge from a highly developed area of Sub-basin 2 to the east which outlets at 14th Street.

The remainder of Sub-basin 2 and

Recommendation: Sub-basins 2 and 5 -

- Further investigate impacts from Sub-basin 5 on Kids Creek Main Branch in Sub-basin 2
- Further investigate the impact of stormwater from the 14th Street storm drain outlet including possible solutions to reducing stormwater getting to the creek

most of Sub-basin 1 appear to be stable and are able to move the sediment load delivered to them through the reach. Portions of Sub-basin 1 are short sediment deposition zones either because of low stream energy due to low slope or restrictions at stream crossings. The City of Traverse City removes sediment at several sand traps annually to reduce flooding.

The DEQ evaluation of the lower portion of Tributary A in Sub-basin 3 did not reveal the expected sediment loading from the upper portion of the watershed. Analysis of the upcoming bedload and suspended sediment sampling (to be completed Summer 2013) will help determine sediment loading contribution here. Like in other headwater areas previously discussed, current

ongoing land use changes are occurring here that may cause instabilities and bank erosion and protective measures such as Low Impact Development and Natural Channel Design should be implemented prevent further channel instability and sediment loading.

<u>Recommendation: Sub-basin 3</u> -Reduce impervious surfaces and implement Best management Practices (BMPs) to reduce runoff to creek

Current efforts are already underway to relocate and daylight a portion of Tributary A that was either in channelized ditches or underground. The daylighting project is on Munson Medical Center's (MMC's) campus and will remove 900 feet of underground culverts and channelized



ditches and replace it with over 1,200 feet of new meandering stream channel. This same project removed 72,000 ft² of impervious surfaces.

Birds-eye view of daylighting restoration project on Tributary A of Kids Creek on MMC Campus Photo credit: Denise Baker

Priority Tasks

Following recommendations noted in the previous section and using available data and preliminary reports, we have come up with priority tasks for Kids Creek. These tasks will work to improve the ecosystem and reduce the effects of stormwater runoff and sedimentation.

The Grand Traverse Bay Watershed Protection Plan lists a wide variety of general tasks that could apply to the Kids Creek subwatershed:

- Shoreline Protection and Restoration Tasks 3, 4, 5, 7, 8, 10
- Road Stream Crossings Tasks 1, 2
- Hydrology Task 3
- Habitat, Fish, and Wildlife Tasks 1, 2, 3
- Stormwater Tasks 5, 6, 9
- Development Tasks 1, 2, 3
- Zoning and Land Use Tasks 2, 3, 4, 5

However, this Action Plan will list only a handful of the topmost priority sites and specific activities that should be completed within the next 5 years in the Kids Creek watershed. These activities will help improve Kids Creek and begin work to remove it from the Impaired Waters List. Additionally, at the end of this section is a short discussion of priority streambank erosion sites from the GTCD's inventory listed in Appendix A.

It should be noted that while these restoration activities are being conducted it is imperative that ongoing education be conducted at the same time. Residents need to be informed of ways they can reduce stormwater impacts to the creek and the ongoing efforts of partners to restore the creek. Increased education about why Kids Creek is impaired, the impacts of stormwater runoff, and the benefits of buffers, native vegetation, and rain gardens will ultimately garner broad public support for current and future restoration efforts undertaken by TWC, MMC, the City of Traverse City and other partners.

After initial sites visits, there were some general site management BMPs that are recommended on a watershed-wide basis that should be noted (for both commercial and residential lands):

- Snow removal and parking lot sanding Winter snow maintenance in Northern MI can be
 - difficult. However, efforts should be taken to pile snow in areas away from the creek, and parking lot sanding should be kept to a minimum. If parking lot sanding is necessary, appropriate sediment collection basins should be in place, or efforts to sweep up existing sand in spring should be done to reduce sediment transport to the creek (see photo at right)
 - Lawn maintenance Improvements to Kids Creek can be made by simply following simple lawn maintenance tips: 1) Don't mow right to the edge of the creek, let a buffer grow instead, 2) Reduce fertilizer usage, use what is necessary and be careful not to let



any get into the creek, 3) Don't rake grass clipping, leaves, or other lawn debris into creek.

 Maintaining current BMPs in place - There are already a number of current BMPs in place to protect the stream and reduce sediment input to Kids Creek. However, once a BMP is installed, you cannot simply leave it be forever - a BMP is only as good as the maintenance it receives. For example, sediment settling basins must be excavated, pervious pavement systems must be periodically cleaned out and rain gardens must be weeded (during first few years).

At this time, 15 priority sites have been determined for Kids Creek (Figures 4 and 4A, Table 1). Potential sites throughout Kids Creek watershed were sought, but priority was given to sites on public or semi-public land owned by potential partners due to ease of implementation and funding availability (i.e. City of Traverse City, Grand Traverse County, Village at Grand Traverse Commons, Munson Medical Center, etc.). The BMPs listed below propose activities that will reduce upland sediment load delivery and reduce peak flows (and potentially) flow volume. These benefits were targeted because the DEQ's hydrologic and geomorphic studies indicated that they were needed. The loading analysis under development in the DEQ's geomorphic analysis (expected July 2013) will confirm that the areas where these BMPs are located are a priority, or it will identify other areas that should be investigated. Based on the hydrologic study and location of the impaired reach on Kids Creek, it is expected that the BMPs proposed for Sub-basins 2 and 3 will improve conditions in the impaired reach by reducing flow volume, reducing peak flow and reducing sediment load. BMPs at sites 9 and 10 (see below) will modify stream channel geomorphological characteristics to improve sediment transport/deposition function and reconnect the stream with its floodplain.

Based on the available information and estimates of the space available for a BMP and its project size, preliminary cost estimates were developed. These are planning level cost estimates and may vary due to site conditions, such as existing utilities, soil conditions, existing stormwater infrastructure, and the presence of wetlands. None of the estimates include costs for property acquisition or long-term maintenance and operation of the BMPs. Preliminary site plans for sites 1-10 are found in Appendix B. The sites are as follows (in no particular order):

Site 1: West Front Primary Care - Physicians Realty Group

Location: West Front Primary Care Sub-basin: Sub-basin 3, Tributary A Landowner: Physicians Realty Group (private) Estimated Cost: \$10,000

Proposed BMP Course: Reconstruct sediment forebays behind office complex. Purpose is to address snow removal and sediment management practices. The existing detention basins for stormwater runoff from the office complex are completely filled with sediment (see accompanying photo) and no

longer provides flood control or water quality benefits. Restoring and enhancing the existing basins will allow them to be retrofitted to capture or infiltrate stormwater while also providing water quality benefits. These retrofitted BMPs will require proper maintenance to remove sediment buildup to maintain their effectiveness.



Filled sediment basin behind W. Front Primary Care office

Site 1A: Parking Lot Adjacent to West Front Primary Care

Location: Parking Lot adjacent to West Front Primary Care, downhill on east side Sub-basin: Sub-basin 3, Tributary A Landowner: MMC Estimated Cost: see above Proposed BMP Course: A new basin/snow management structure at the southwest corner of

parking lot adjacent to West Front Primary Care (downhill on east side). This site should be designed to capture stormwater runoff and snowmelt prior to discharge to Kids Creek Tributary A that runs adjacent to the parking lot. This lot is on northwest corner of Brook Street and 6th Street.

Site 2: Munson Helipad Detention Basins

Location: Northwest Corner of Brook Street/Medical Campus Drive Sub-basin: Sub-basin 3, Tributary A Landowner: MMC Estimated Cost: \$31,000 Proposed BMP Course: Delineate drainage area contributing to channel/basin near Helipad

landing (south and north) and reconstruct outlet to encourage infiltration, provide for sediment capture and mitigate peak flows. This

site can reduce peak flows and sediment from several parking lots that directly drain to them. By modifying the existing outlet structures greater retention of sediment and flows can be achieved. Detention of flows will have to be carefully assessed so as not to induce localized flooding of Medical Campus Drive and Red Drive (farther south).

One of the existing detention basins near the MMC Helipad (on right)



Site 3: Cottageview and Medical Campus Drive

Location: Southwest Corner of Cottageview and Medical Campus Drive Landowner: Village at Grand Traverse Commons Sub-basin: Sub-basin 3, Tributary A Estimated Cost: \$40,000 Proposed BMP Course: Pervious pavement installation in the Southwest guadrant of

Cottageview and Medical Campus - currently an unpaved area for summer parking and snow removal. This area is compacted dirt and appears to provide sediment load to the street and drainage ditch that likely conveys the sediment to Kids Creek. This area could be converted into a Low Impact Development parking area and snow storage area. This would reduce the sediment load from the disturbed surface and provide for some infiltration of parking area and road surface area.

Site 4: Cottageview and Red Drive

Location: East of Intersection of Cottageview Drive and Red Drive Landowner: Village at Grand Traverse Commons Sub-basin: Sub-basin 2 - Tributary AA Estimated Cost: \$141,000 Proposed BMP Course: Design a rain garden for the northeast corner of Red and Cottageview Drive adjacent to parking area. The existing stormwater basin is lined

Drive, adjacent to parking area. The existing stormwater basin is lined with what appears to be an impermeable membrane. A layer of irregular shaped quarry rock lines the pond. This location is suitable for retrofit to a rain garden. Removing the membrane and replacing the rock with mulch and native plants will improve infiltration, improve nutrient uptake and improve the aesthetics of the stormwater infrastructure

Site 5: 14th Street Outfall

Location: End of 14th Street at Division and Silver Lake Roads Landowner: City of Traverse City Sub-basin: Sub-basin 2 - 14th Street outlet Estimated Cost: \$60,000 Proposed BMP Course: Improvements to the 14th Street outlet from City storm sewer would provide water quality benefits and possible peak flow and volume control. The 14th Street outlet discharges to a ditch that flows to Kids Creek. The ditch is approximately 800 ft. long, 10-20 ft. wide and has minimal slope. Water quantity and quality should be further investigated to understand the discharge characteristics of this outfall and to

to understand the discharge characteristics of this outfall and to investigate potential solutions. Appendix C provides a scope of work that describes an investigatory course that could provide useful data and information on the drainage basin that discharges at the 14th Street outfall.

Site 6: Elmwood Avenue and State of Michigan Building

Location: North side of parking area at State of Michigan Building on Elmwood Avenue Landowner: State of Michigan Sub-basin: Sub-basin 2 - Tributary AA

Estimated Cost: \$24,000

Proposed BMP Course: Install rain garden on north side of State of Michigan Building parking lot on Elmwood Ave. Provide curb cut entrance to allow water from both parking lot and Elmwood Ave to enter garden. This site provides the opportunity to treat stormwater runoff from the State of Michigan

the opportunity to treat stormwater runoff from the State of Michigan Building and some of Elmwood Avenue.

Site 7: Grand Traverse Pavilions Grassy Area

Location: Grand Traverse Pavilions Landowner: Grand Traverse Pavilions Sub-basin: Sub-basin 2 - Tributary AA Estimated Cost: \$148,000

Proposed BMP Course: Institute a riparian buffer along Tributary AA and add floodplain

excavation where needed. This small tributary to Kids Creek runs through the grassy area between the Grand Traverse Pavilions and Village at Grand Traverse Commons. The area is mowed to the creek's edge and in some areas could benefit from additional floodplain. This site would benefit from:

- A no mow zone a minimum of 10 meters (30 ft.) on either side of the Tributary. This would allow surface runoff to pass through vegetation before entering the Tributary and stabilize stream banks limiting erosion.
- Planting appropriate native vegetation along stream banks to provide habitat and bank stabilization.
- Conducting a geomorphic assessment and identifying locations where the banks are greater than bankfull and reducing bank height and re-establishing connectivity to floodplain.



Site 8: Cedar Run Road and North Long Lake Road

Location: Northwest quadrant at intersection of Cedar Run Road and North Long Lake Road Sub-basin: Sub-basin 3, Tributary A Landowner: Unknown Estimated Cost: \$22,000 Proposed BMP Course: Provide treatment and storage at north corner of Cedar Run and Long Lake Roads. The north corner of the intersection collects stormwater runoff from Cedar Run and Long Lake Roads. This area can be retrofitted with detention basins that provide treatment and infiltration.

Site 9: Meijer Parking Lot

Location: North side of parking lot at Meijer Sub-basin: Sub-basin 4, Main Branch Kids Creek Landowner: Meijer, Inc. Estimated Cost: \$15,000 Proposed BMP Course: Snow removal and sediment/trash management basin adjacent to

Creek. The Meijer store uses the area adjacent to Kids Creek for snow removal storage. This practice delivers sediment and trash to the creek

and the creek riparian area. Providing for an engineered snow storage area will allow Meijer to remove sediment and trash from the site and limit the quantity that is discharged to Kids Creek



Site 10: Kids Creek Main Branch - Meijer to Silver Lake Road

Location: Main Branch of Kids Creek from Meijer/Burger King north to Silver Lake Road Sub-basin: Sub-basin 4, Main branch Kids Creek Landowner: City of Traverse City Estimated Cost: \$300,000 Proposed BMP Course: Floodplain excavation (two-stage ditch) along Kids Creek. The section

of Kids Creek toward Silver Lake Road showed signs of incision. This area should be further evaluated using data collected by DEQ to assess whether floodplain excavation should be conducted to provide river connectivity to the floodplain.

Site 11: MMC Cancer Center

Location: MMC campus, future site is between 6th Street, Beaumont Ave, and Madison Street Sub-basin: Sub-basin 3, Tributary A Landowner: Munson Medical Center Estimated Cost: \$325,000 Proposed BMP Course: BMPs will be installed in

conjunction with construction of MMC's new Cancer Center. Potential BMPs include green roof, and rain gardens for parking lot runoff.

Site 12: MMC - Main Building

Location: MMC Main Building on Southwest corner of Elmwood Avenue and 6th Street Sub-basin: Sub-basin 3, Tributary A Landowner: MMC Estimated Cost: \$120,000 Proposed BMP Course: A portion of existing rooftop will be retrofitted as green roof.

Site 13: MMC Main Patient Parking Lot

Location: MMC parking lot, Southwest corner of Elmwood Avenue and 6th Street Sub-basin: Sub-basin 3, Tributary A Landowner: MMC Estimated Cost: \$83,000 Proposed BMP Course: Pervious pavement will be installed on east side of parking lot to infiltrate sheet runoff from lot.

Site 14: MMC - Building 29

Location: On Medical Campus Drive, west side of parking garage Sub-basin: Sub-basin 3, Tributary A Landowner: MMC Estimated Cost: \$55,000 Proposed BMP Course: Planned BMPs to handle runoff from building are: pervious pavement, rain garden, and planter boxes.

Future site for MMC's new Cancer Center (Beaumont Ave on right, 6th Street at bottom)



Site 15: MMC - Elmwood Ave Rain Gardens

Location: MMC campus Elmwood Drive between ER entrance and Medical Campus Drive Sub-basin: Sub-basin 3, Tributary A

Landowner: MMC

Estimated Cost: \$67,000

Proposed BMP Course: Retrofit existing and add new rain gardens and/or biodetention basins.

There are two existing detention basins in this area with runoff currently being piped to them. We propose to retrofit these basins as biodetention basins to improve functionality. New rain gardens will also be added in this area as well.

The sites listed above are primarily focused on reducing the sediment load and runoff quantity delivered from upland sources such as parking lots, roads, and rooftops. Sites 5 and 10 are different from the others. Site 5 calls for a more detailed investigation into the outfall at 14th Street, and site 10 suggests channel and floodplain work to reduce the incision that has occurred due to historic channel modifications. All of the proposed BMPs will lead to reduced sediment and more natural hydrology. The Proposed site for retrofitted and new biodetention basins at MMC (Elmwood Ave on right, Medical Campus Drive on bottom). Existing basins are seen at bottom of photo.



total estimated cost of these proposed BMPs is just over \$1.4 million (Table 1).

Funding for BMP implementation activities noted in Sites 11-15 has already been attained through DEQ Grant #2013-0010. Additional funding has also been attained already from the EPA's Great Lakes Restoration Initiative program for BMP implementation focused on stormwater reduction on MMC's Campus, and we anticipate including a number of the sites listed above in work for that project.

Figure 4: Site Map for Top Priority BMP Sites in Kids Creek Watershed

- <u>Site 1:</u> West Front Primary Care
- <u>Site 1A:</u> Parking Lot Adjacent to Site 1
- <u>Site 2:</u> Munson Helipad Detention Basins
- <u>Site 3:</u> Cottageview and Medical Campus Dr.
- <u>Site 4:</u> Cottageview and Red Dr.
- <u>Site 6:</u> Elmwood Ave. and State of MI Bldg
- <u>Site 7:</u> GT Pavilions Grassy Area
- <u>Site 8:</u> Cedar Run Rd. and N. Long Lake Rd.
- <u>Site 11:</u>
 MMC Cancer Center
- <u>Site 12:</u>
 MMC Main Bldg
- <u>Site 13:</u> MMC Patient Parking
- <u>Site 14:</u> MMC Bldg 29
- <u>Site 15:</u> MMC Elmwood Ave. Rain Gardens



Figure 4A: Site Map for Top Priority BMP Sites in Kids Creek Watershed

- <u>Site 5:</u> 14th St. Outfall
- <u>Site 9:</u> Meijer Parking Lot
- <u>Site 10:</u> Kids Creek Main Branch - Meijer to Silver Lake Rd



| Site Number | Site Name/Description | Design and Construction Cost |
|----------------|--|----------------------------------|
| Site 1 | West Front Primary Care - Physician's Realty Group ~ sediment forebay detention pond reconstruction | \$10,000 |
| Site 1A | Parking Lot Adjacent to West Front Primary Care ~ basin/snow management structure | See above |
| Site 2 | Munson Helipad Detention Basins ~drainage basin reconstruction - biodetention basins | \$31,000 |
| Site 3 | Cottageview and Medical Campus Drive ~Pervious parking | \$40,000 |
| Site 4 | Cottageview and Red Drive ~rain garden retrofit | \$141,000 |
| Site 5 | 14th Street Outfall ~Preliminary study | \$60,000 (scope of work cost) |
| Site 6 | Elmwood Ave and State of Michigan Building ~rain garden | \$24,000 |
| Site 7 | Grand Traverse Pavilions Grassy Area ~riparian buffer, flooplain enhancement | \$148,000 |
| Site 8 | Cedar Run Road and North Long Lake Road ~Road drainage bio-basin | \$22,000 |
| Site 9 | Meijer Parking Lot ~engineered snow removal site | \$15,000 |
| Site 10 | Kids Creek Main Branch - Meijer to Silver Lake Road ~floodplain enhancement | \$300,000 |
| Site 11 | MMC Cancer Center ~potential BMPs: green roof, rain gardens | \$325,000 |
| Site 12 | MMC - Main Building ~green roof | \$120,000 |
| Site 13 | MMC Main Patient Parking Lot ~pervious pavement | \$83,000 |
| Site 14 | MMC - Building 29 ~rain garden, pervious pavement, infiltration planters | \$55,000 |
| Site 15 | MMC - Elmwood Ave Rain Gardens ~retrofit of existing basins, new rain gardens | \$67,000 |
| | Total Cost | \$1,441,000 |

 Table 1: Summary of Top Priority BMPs for Kids Creek Watershed

Streambank Erosion and Road Crossing Inventory

The following is a summary of the current streambank erosion sites in the Kids Creek watershed, summarized by Sub-basin. Detailed information on all the sites can be found in Appendix A. As noted above, the sites in Sub-basins 6 through 9 are the most important to stabilized and should be completed first (total of \$19,500). However, at an estimated cost of just \$69,000 all moderate and severe sites could be completed within the next 5-10 years.

| Sub- basin | Severity | Cost |
|---------------|-------------|----------|
| 1 | Severe: 5 | \$10,000 |
| 1 | Moderate: 8 | \$11,000 |
| 2 | Severe: 3 | \$3,000 |
| 2 | Moderate: 1 | \$1,000 |
| 3 | Severe: 3 | \$15,000 |
| 5 | Moderate: 3 | \$3,500 |
| 1 | Severe: 1 | \$1,000 |
| 4 | Moderate: 1 | \$1,000 |
| 5 | Severe: 0 | |
| 5 | Moderate: 0 | |
| 6 | Severe: 0 | |
| 0 | Moderate: 7 | \$7,000 |
| 7 | Severe: 5 | \$4,000 |
| 1 | Moderate: 7 | \$7,000 |
| 0 | Severe: 1 | \$500 |
| 0 | Moderate: 1 | \$1,000 |
| 0 | Severe: 0 | |
| 9 | Moderate: 0 | |
| | Total Cost | \$69,000 |

Streambank Erosion Sites - Kids Creek Watershed

There are 15 noted road crossing sites in the Kids Creek watershed with problems that need to be addressed. Most of these inventoried sites are not ranked, nor do they have cost estimates (Appendix A). However, they should all be assessed in the near future to determine if any of them should be a priority to address in order to improve sedimentation and reduce the impairments in Kids Creek.

There is one severe road stream crossing site on Subbasin 2 located on an old railroad bed, now a heavily used foot trail. There is extreme erosion along the edges of the existing concrete bridge structure and it is



Kids Creek crossing at railroad grade near old Elmwood Ave

cracked and crumbling in places (see photo at right). The estimated cost to replace the bridge is between \$10,000-\$15,000 and it should be done soon. There is also a moderate-ranked crossing in Sub-basin 6 in the Kids Creek headwaters on Silver Lake Road. The estimated cost to fix is about \$25,000.

Conclusions

Unfortunately the timing for completing the TMDL and Action Plan together did not work out as originally hoped. Both organizations originally planned on having the TMDL and Action Plan developed and finalized in conjunction with one another, but complications with field data gathering have delayed the TMDL plan until sometime in 2014. This project ended June 30, 2013, and the Action Plan needed to be completed by that time to fulfill grant work plan requirements. Since data is still being collected and analyzed by DEQ staff relating to the TMDL development for the Creek, we are considering the Kids Creek Action Plan a *draft* document.

Additionally, the DEQ's geomorphic analysis report is not fully completed and only preliminary results were used to write this Action Plan. One of the general concepts in the preliminary report is the need to reduce stormwater input to Kids Creek wherever possible and that there is no widespread channel instability throughout the watershed (meaning, we can't point to a particular sub-basin and determine that's where all the sediment in the creek is coming from). Analysis of the full set of data may provide additional insight into sediment sources and the ability of the stream to move the sediment generated from the watershed. Upcoming work to be included in the final geomorphic report includes a further analysis of the sediment data and additional morphology measurements, which will help to provide better definition of the sediment movement through the Kids Creek Watershed and identify areas of excess sediment load. The report also suggests further analyses and work that needs to be completed on Kids Creek such as:

- Conducting a reconnaissance level assessment of sub-basins, tributaries and stream reaches not evaluated in the report
- Further investigation on Tributary D (Sub-basin 6), upstream of Creekside Road to determine cause of instability and possible actions to correct
- Further investigation of impacts from Sub-basin 5 on Kids Creek Main Branch in Subbasin 2
- Further investigation of the impact of stormwater from the 14th Street storm drain outlet on Kids Creek (Sub-basin 2), including possible solutions to reducing stormwater getting to the creek

Using available data and reports, the current draft of the Kids Creek Action Plan summarizes the impairment to the creek, specific locations of concern, and includes a prioritized list of BMPs (Figures 4 and 4A, Tables 1 and 2) to improve the health of the creek by decreasing both the input and effects of stormwater to the creek as well as improve in-stream habitat for macroinvertebrates and fish communities. Total cost to implement the top 15 BMPs proposed for Kids Creek is \$1.44 million. Including costs for streambank erosion sites and road stream crossings, the total cost of all proposed activities in this Action Plan is \$1.55 million.

Updates to the Action Plan will be made as more data are analyzed and reported to TWC by DEQ and we can refine our recommendations.

References

- Kids Creek Watershed Hydrologic Study Dave Fongers DEQ Land and Water Management Division - June 2012
- Monitoring of Kids Creek for TMDL Development QAPP
- Kids Creek Geomorphic Analysis DRAFT Report Ralph Reznick July 2013
- Grand Traverse Bay Watershed Protection Plan 2005
- Biological Survey of Selected Station on Kids Creek and nearby Streams in the Boardman River Watershed DEQ Staff Report May 2012

Appendix A: Kids Creek Stream Bank Erosion and Road Stream Crossing Inventory

| Site Number | Sub- basin | Stream Name | Severity | Suggested BMPs/Comments | Estimated Cost Range | Link To Online Detailed Fact Sheet |
|----------------|---------------|----------------|----------|---|------------------------------|---|
| S263 | 1 | Kids Creek | Mod | Rock riprap | <1,000 | http://www.northernmichiganstreams.org/SBE_site.asp?sdbfid=658 |
| S264 | 1 | Kids Creek | Mod | Constructed access | <1,500 | http://www.northernmichiganstreams.org/SBE_site.asp?sdbfid=659 |
| S268 | 1 | Kids Creek | Mod | Brush or ground cover plantings | <500 | http://www.northernmichiganstreams.org/SBE_site.asp?sdbfid=662_ |
| S271 | 1 | Kids Creek | Mod | Rock riprap; Cover structure | <1000 | http://www.northernmichiganstreams.org/SBE_site.asp?sdbfid=665_ |
| S272 | 1 | Kids Creek | Mod | Bank revegetation; Alternative stormwater management; Diversion berm | <500 | http://www.northernmichiganstreams.org/SBE_site.asp?sdbfid=669 |
| S273 | 1 | Kids Creek | Mod | Bank revegetation; Constructed access | <2500 | http://www.northernmichiganstreams.org/SBE_site.asp?sdbfid=670 |
| S730 | 1 | Kids Creek | Mod | Rock riprap; Cover structure; Constructed Access | <1,500 | http://www.northernmichiganstreams.org/SBE_site.asp?sdbfid=657_ |
| S758 | 1 | Kids Creek | Mod | Rock riprap; Constructed access | <2500 | http://www.northernmichiganstreams.org/SBE_site.asp?sdbfid=668 |
| S261 | 1 | Kids Creek | N/A | Direct storm flow from parking lot; Parking lot adjacent to creek floods frequently during high water events. Channel of direct flow exists from lot to the creek on upstream side of cement retaining wall. | <500 | http://www.northernmichiganstreams.org/SBE_site.asp?sdbfid=656 |
| S267 | 1 | Kids Creek | N/A | Nutrient loading from Third Street Apartments / Condos. | <2,000 | http://www.northernmichiganstreams.org/SBE_site.asp?sdbfid=661 |
| S269 | 1 | Kids Creek | Severe | Tree revetments; Constructed access | <1000 | http://www.northernmichiganstreams.org/SBE_site.asp?sdbfid=663 |
| S270 | 1 | Kids Creek | Severe | Alternative stormwater management, Diversion berm | <1000 | http://www.northernmichiganstreams.org/SBE_site.asp?sdbfid=664_ |
| S747 | 1 | Kids Creek | Severe | Bank revegetation; Cover Structure; Coir logs | <1,000 | http://www.northernmichiganstreams.org/SBE_site.asp?sdbfid=655 |
| S756 | 1 | Kids Creek | Severe | Bank revegetation; Trash cleanup; Rebuild retaining wall | <5,000 | http://www.northernmichiganstreams.org/SBE_site.asp?sdbfid=666 |
| S757 | 1 | Kids Creek | Severe | Bank revegetation; Constructed access | <2,000 | http://www.northernmichiganstreams.org/SBE_site.asp?sdbfid=667 |
| S258 | 2 | Kids Creek | Mod | Coir fiber roll; Cover structure | <1,000 | http://www.northernmichiganstreams.org/SBE_site.asp?sdbfid=652 |
| S843 | 2 | Trib-AA | N/A | No buffer through entire G.T. Pavilions property. Contact CEO about leaving a buffer strip. | <15,000 | http://www.northernmichiganstreams.org/SBE_site.asp?sdbfid=832 |
| S844 | 2 | Trib-AA | N/A | Some parking lot runoff may be | Depends on the management | http://www.northernmichiganstreams.org/SBE_site.asp?sdbfid=833 |

Stream Bank Erosion Sites

| Site Number | Sub- basin | Stream Name | Severity | Suggested BMPs/Comments | Estimated Cost Range | Link To Online Detailed Fact Sheet |
|----------------|---------------|----------------|----------|--|--|--|
| S845 | 2 | Trib-AA | N/A | Somebody is dumping sand/gravel here; Could be left over from snow removalMonitor | N/A | http://www.northernmichiganstreams.org/SBE_site.asp?sdbfid=834 |
| S744 | 2 | Kids Creek | Severe | Rock riprap; Cover structure; Bank shaping | <1,000 | http://www.northernmichiganstreams.org/SBE_site.asp?sdbfid=653 |
| S745 | 2 | Kids Creek | Severe | Rock riprap; Cover structure | <1,000 | http://www.northernmichiganstreams.org/SBE_site.asp?sdbfid=654 |
| S846 | 2 | Trib-AA | Severe | Tree revetments; Trees may fall soon. Some woody debris is helping to divert flow away from bank. | <1,000 | http://www.northernmichiganstreams.org/SBE_site.asp?sdbfid=835 |
| S838 | 3 | Trib-A | Mod | Though this site was restored a couple years ago, the entire stretch still needs additional erosion control work and a buffer. | <2,500 | http://www.northernmichiganstreams.org/SBE_site.asp?sdbfid=840 |
| S882 | 3 | Trib-A | Mod | Bank revegetation; Tree revetments; Coir fiber rolls; Comment: woody debris alone may solve the problem here. | <1,000 | http://www.northernmichiganstreams.org/SBE_site.asp?sdbfid=857 |
| S883 | 3 | Trib-A | Mod | Alternative stormwater / nutrient manaement; Comment: Drainage dtch along the south side of Cedar Run Road. Enters the main channel just upstream of S881. This ditch is not an intermittent stream, it flows constantly. The wetlands in the ditch are filling with sand from road runoff. Nutrient loading is a concern as well. | Depends on the management alternative. | http://www.northernmichiganstreams.org/SBE_site.asp?sdbfid=858 |
| \$836 | 3 | Trib-A | N/A | Remove culvert, fencing, and gate General Information Old steel, perched culvert is out in the middle of a wetland. The presence of this along with the gate and fencing indicates an old road must have gone through here at one time. All of this should be removed to allow for fish passage and natural hydraulic flow. | <5,000 | http://www.northernmichiganstreams.org/SBE_site.asp?sdbfid=839 |
| S841 | 3 | Trib-A | Severe | Bank revegetation; Rock riprap; Cover structure; Tree revetments; Comment: Typical highwater erosion between Elmwood Ave. & Kids Creek. This stretch is devoid of woody debris and habitat. Work out agreement with City to stop removing instream trees/brush. Address S841 & S842 together. | <15,000 | http://www.northernmichiganstreams.org/SBE_site.asp?sdbfid=843 |
| S842 | 3 | Trib-A | Severe | Bank revegetation; Cover structure; Tree revetments; Coir fiber rolls; See above. | See Comment | http://www.northernmichiganstreams.org/SBE_site.asp?sdbfid=844 |

| Site Number | Sub- basin | Stream Name | Severity | Suggested BMPs/Comments | Estimated Cost Range | Link To Online Detailed Fact Sheet |
|----------------|---------------|----------------|----------|--|-------------------------|--|
| S881 | 3 | Trib-A | Severe | Bank revegetation; Tree revetments; Coir fiber rolls; Active slumping, needs stabilization. | | http://www.northernmichiganstreams.org/SBE_site.asp?sdbfid=856 |
| S319-A | 4 | Kids Creek | Mod | Cover structure; Coir fiber rolls | <1,000 | http://www.northernmichiganstreams.org/SBE_site.asp?sdbfid=594 |
| S319 | 4 | Kids Creek | Severe | Cover structure; Coir fiber rolls | <1,000 | http://www.northernmichiganstreams.org/SBE_site.asp?sdbfid=593 |
| S283 | 6 | Kids Creek | Mod | Bank revegetation; Cover structure; Coir fiber rolls | <1,000 | http://www.northernmichiganstreams.org/SBE_site.asp?sdbfid=678 |
| S801 | 6 | Kids Creek | Mod | Obstruction removal; Bank revegetation; Rock riprap; Cover structure | <1,000 | http://www.northernmichiganstreams.org/SBE_site.asp?sdbfid=688 |
| S803 | 6 | Kids Creek | Mod | Bank revegetation; Coir fiber rolls | <1,000 | http://www.northernmichiganstreams.org/SBE_site.asp?sdbfid=690 |
| S806 | 6 | Kids Creek | Mod | Cover structure; Coir fiber rolls | <1,000 | http://www.northernmichiganstreams.org/SBE_site.asp?sdbfid=693 |
| S815 | 6 | Kids Creek | Mod | Obstruction removal; Cover structure; Coir fiber rolls | <1,000 | http://www.northernmichiganstreams.org/SBE_site.asp?sdbfid=702 |
| S818 | 6 | Kids Creek | Mod | Bank revegetation; Cover structure; Coir fiber rolls. Comment: If buffalo are still grazing on site, fence from stream. | <1,000 | http://www.northernmichiganstreams.org/SBE_site.asp?sdbfid=706 |
| S829 | 6 | Kids Creek | Mod | Bank revegetation; Cover structure; Coir fiber rolls | <1,000 | http://www.northernmichiganstreams.org/SBE_site.asp?sdbfid=704 |
| S032 | 7 | Trib-D | Mod | Bank revegetation; Cover structure; Tree revetments; Coir fiber rolls | <1,000 | http://www.northernmichiganstreams.org/SBE_site.asp?sdbfid=719 |
| S303 | 7 | Trib-D | Mod | Bank revegetation; Cover structure; Tree revetments; Coir fiber rolls | <1,000 | http://www.northernmichiganstreams.org/SBE_site.asp?sdbfid=723 |
| S307 | 7 | Trib-D | Mod | Bank revegetation; Cover structure; Tree revetments; Coir fiber rolls | <1,000 | http://www.northernmichiganstreams.org/SBE_site.asp?sdbfid=726 |
| S313 | 7 | Trib-D | Mod | Bank revegetation; Rock riprap; Cover structure. Comments: Outer wall of stormwater retention pond at Horizon Outlet Mall. Should be stabilized to prevent further erosion and potential breaching of the wall. | <1,000 | http://www.northernmichiganstreams.org/SBE_site.asp?sdbfid=728 |
| S314 | 7 | Trib-D | Mod | Bank revegetation; Cover structure; Tree revetments; Coir fiber rolls | <1,000 | http://www.northernmichiganstreams.org/SBE_site.asp?sdbfid=729 |
| S315 | 7 | Trib-D | Mod | Bank revegetation; Cover structure; Tree revetments; Coir fiber rolls | <1,000 | http://www.northernmichiganstreams.org/SBE_site.asp?sdbfid=730 |
| S879 | 7 | Trib-D | Mod | Bank revegetation; Tree revetments. | <1,000 | http://www.northernmichiganstreams.org/SBE_site.asp?sdbfid=868 |
| S039 | 7 | Trib-D | Severe | Bank revegetation; Cover structure; Tree revetments; Coir fiber rolls | <1,000 | http://www.northernmichiganstreams.org/SBE_site.asp?sdbfid=720 |
| S299 | 7 | Trib-D | Severe | Bank revegetation; Cover structure; Tree revetments; Coir fiber rolls | <1,000 | http://www.northernmichiganstreams.org/SBE_site.asp?sdbfid=722 |

| Site Number | Sub- basin | Stream Name | Severity | Suggested BMPs/Comments | Estimated Cost Range | Link To Online Detailed Fact Sheet |
|----------------|---------------|----------------|----------|---|-------------------------|---|
| S306 | 7 | Trib-D | Severe | Obstruction removal; Rock riprap; Cover structure; Comments: Monitor for snow removal; Car parts and tires in stream. Barbed wire and AT&T phone cables cross the river just downstream of this site. | <1,000 | http://www.northernmichiganstreams.org/SBE_site.asp?sdbfid=725 |
| S877 | 7 | Trib-D | Severe | Obstruction removal; Bank revegetation; Cover structure; Coir fiber rolls. Comments: Trees have fallen into stream, diverting flow into the bank. | <500 | http://www.northernmichiganstreams.org/SBE_site.asp?sdbfid=866 |
| S878 | 7 | Trib-D | Severe | Bank revegetation; Constructed access? Comments: Foot path from Big Boy along top of bank. | <500 | http://www.northernmichiganstreams.org/SBE_site.asp?sdbfid=867 |
| S833 | 8 | Trib-D | Mod | Bank revegetation; Cover structure; Tree revetments; Coir fiber rolls | <1,000 | http://www.northernmichiganstreams.org/SBE_site.asp?sdbfid=709 |
| S832 | 8 | Trib-D | Severe | Obstruction removal; Bank revegetation; Cover structure; Coir fiber rolls. Comments:Steep bank combined with minor foot traffic and storm flows is causing erosion. Forest is dominated by eastern hemlock and white cedar. | <500 | http://www.northernmichiganstreams.org/SBE_site.asp?sdbfid=710 |
| \$834 | 9 | Trib-D | N/A | Bank revegetation. Comments: Mowed path is an extension of the path to S835 - local subdivision access to the creek. Someone is dumping remnant coals from a firepit down the streambank. | <500 | http://www.northernmichiganstreams.org/SBE_site.asp?sdbfid=708 |
| S835 | 9 | Trib-D | N/A | Constructed access. Comments: Users need to be educated; Access point for local subdivision. | <500 | http://www.northernmichiganstreams.org/SBE_site.asp?sdbfid=707_ |

Road Stream Crossing Sites

| Site Number | Sub- basin | Stream Name | Severity | Suggested BMP's/Comments | Estimated Cost Range | Link To On-Line Detailed Fact Sheet |
|----------------|---------------|----------------|----------|---|--|---|
| S260 | 1 | Kids Creek | N/A | The creek flows west under Cedar Street and then back to the east, under the street again. Both crossings are essentially identical situations. Highwater events here cause major flooding. | Depends on management alternative | http://www.northernmichiganstreams.org/RSX_site_o.asp?sdbfid=970 |
| S746 | 1 | Kids Creek | N/A | Private Drive off Cedar Street; Condemned residence, no active use; Water level is only a couple inches below bridge deck, causes flooding in highwater, causing high water erosion upstream. | Depends on management alternative | http://www.northernmichiganstreams.org/RSX_site_o.asp?sdbfid=915 |
| S702 | 2 | Kids Creek | Severe | Replace with open bottom recreational bridge | 10,000- 15,000 | http://www.northernmichiganstreams.org/RSX_site_o.asp?sdbfid=1000 |
| S254 | 2 | Kids Creek | N/A | Culvert doesn't give enough clearance, may cause upstream flooding during high water. Storm drains enter directly into creek. Potential site for stremabank erosion. Monitor use as a public access site. | Depends on management alternative | http://www.northernmichiganstreams.org/RSX_site_o.asp?sdbfid=969 |
| S276 | 2 | Kids Creek | N/A | This section of road has been abandoned and access has been blocked by the city. The crossing is stable, and the ditches have begun to grow in. Non-motorized vehicles still have access to the area and the trails are being used daily. | Depends on management alternative | http://www.northernmichiganstreams.org/RSX_site_o.asp?sdbfid=999 |
| S847 | 2 | Trib-AA | N/A | Remove sidewalk and shorten the grade to 30 ft, rebuild exposed stream channel, shorten culvert to 40 ft.; Remove concrete dam upstream of crossing that used to hold a small pond. The pond has completely filled with sediment and the blockage is causing warming and other issues. | Depends on the management alternative. | http://www.northernmichiganstreams.org/RSX_site_o.asp?sdbfid=929 |
| <u>5848</u> | 2 | Trib-AA | N/A | If road to no longer be used, remove bridge and crossing/culvert or at least shorten culvert so that it only goes under the driveway and rebuild the new exposed stream channel | Coordinate with with Minervini's | http://www.northernmichiganstreams.org/RSX_site_o.asp?sdbfid=930 |

| Site Number | Sub- basin | Stream Name | Severity | Suggested BMP's/Comments | Estimated Cost Range | Link To On-Line Detailed Fact Sheet |
|----------------|---------------|----------------|----------|--|---|--|
| S256 | 3 | Trib-A | N/A | Fish passage issue. Urge city to replace culverts. Comment: Rock rip rap hydraulic lift was tried several years ago but failed due to movement of the rock by kids and nature. | Depends on the management alternative. | http://www.northernmichiganstreams.org/RSX_site_o.asp?sdbfid=939 |
| S837 | 3 | Trib-A | N/A | This crossing appears to be of little utility any more. If it is not necessary, it should be removed. If it needs to stay, it should be replaced. | Depends on the management alternative. | http://www.northernmichiganstreams.org/RSX_site_o.asp?sdbfid=940 |
| S816 | 6 | Kids Creek | | Perched; Working with property owner to replace yet this year. | 20,000 | http://www.northernmichiganstreams.org/RSX_site_o.asp?sdbfid=975 |
| S822 | 6 | Kids Creek | N/A | perched culvert and obstructions in river downstream of outlet. Comments: Remove old fencing from outlet, remove old silt fencing. A small trib enters this stream just above the inlet to this crossing. It comes through a perched culvert under a private drive. The small creek is silty and very slow above the private drive. This culvert should also be replaced. | Depends on management alternative | http://www.northernmichiganstreams.org/RSX_site_o.asp?sdbfid=922 |
| S823 | 6 | Kids Creek | Mod | Rock rip rap, revegetation. Comments: Bricks are holding the road together but runoff is washing through the bricks. Direction of flow off of West Silver Lake Road runs a lot of water into this driveway during rain events. This driveway should be paved. | <25,000 | http://www.northernmichiganstreams.org/RSX_site_o.asp?sdbfid=923 |
| S828 | 6 | Kids Creek | N/A | What was an old driveway crossing is now just a place for Northpointe Motors business sign. These culverts need to be removed and the sign should be relocated easily enough. | Depends on management alternative | http://www.northernmichiganstreams.org/RSX_site_o.asp?sdbfid=977 |
| S824 | 8 | Trib-D | N/A | Comments: Crossing looks good. Outlet of crossing creek flows through wetland, causing braiding. | N/A | http://www.northernmichiganstreams.org/RSX_site_o.asp?sdbfid=924 |
| S826 | 9 | Trib-D | N/A | Revegetation /buffer strip. Comments: Embankments need to not be mowed anymore. A buffer down these slopes will stop sheet flow erosion into the creek. | N/A | http://www.northernmichiganstreams.org/RSX_site_o.asp?sdbfid=926 |



Appendix B: Preliminary BMP Site Plans for Sites 1-10 Listed in Action Plan



















Appendix C: Preliminary Scope of Work for 14th Street Outfall Investigation

Introduction

Water volume, discharge rate and quality are all directly related to upstream characteristics of an outfall's drainage area. There are many ways to improve the quality and reduce the quantity of flow from an outfall, but there are some necessary steps to take before any changes are made. Performing an analysis of the outfall's drainage area and discharge characteristics ensures the best results and most efficient use of available funds. The proposed tasks for investigating the 14th street outfall are:

- 1. Flow and Quality Monitoring of Outfall
- 2. Sub-basin Delineation and Mapping of Flow Paths
- 3. Land Use Analysis and Classification
- 4. Investigation of Soils and Subsurface Conditions
- 5. Computer Modeling
- 6. Conceptual Design and Prioritization of Best Management Practices

Scope of Work

The section below describes the individual tasks listed above. These tasks are recommended to assess the quantity and quality of stormwater runoff.

Task 1: Flow and Quality Monitoring of Outfall

Monitoring flow and water quality is used to identify the type and quantity of pollutants and the quantity of water that are discharged during storm events. Sampling of the outfall should be performed during dry and wet weather. Dry weather sampling will identify if illicit connections are present. Wet weather sampling will quantify runoff volumes and pollutant loads that could be contributing to the water quality / quantity issues identified in Kids Creek. Specific activities required for this task include continuous monitoring of flow and sampling for water quality parameters. Monitoring and sampling shall be recorded during wet and dry weather. Monitoring discharge would include use of a water stage recorder to during the spring to summer months of April through June. The water stage recorder measures the stage of the water over time from which discharge can be estimated. During the period that the discharge of the outfall is being measured three wet weather flow events and two dry weather events should be sampled. The data collected as part of this task will be used to calibrate a hydrologic model (Task 5).

Task 2: Sub-basin Delineation and Mapping of Flow Paths

The 14th Street outfall needs be analyzed to determine the drainage area and important subbasins. Drainage areas help spilt up the watershed so information and flow patterns are more easily identified. Drainage areas are delineated by evaluating the topography, storm sewer network, and overland flow network. This task should be completed using ArcGIS, which is a useful tool for compiling this information to create drainage areas. The analysis described above is designed as a desk top exercise and should not require field work. Data will be imported into GIS where the drainage area can be disaggregated into functional districts for analysis. Each drainage area will have to be analyzed for area, land use characteristics, and drainage characteristics (e.g. storm sewer network or overland flow).

The drainage characteristics will include existing infrastructure. Available aerial photos, project reports and as-built plans will be reviewed to identify infrastructure data needs. It is assumed

that the City will furnish field personnel and equipment necessary to locate and document stormwater infrastructure, and to enter data collected into the City's GIS database.

Task 3: Land Use Analysis and Classification

Land use classification needs to be determined for each drainage area. Drainage areas may be divided into sub-drainage areas for further analysis (Task 2). Land use helps characterize runoff quantity and quality from each drainage area. For example, a commercial area generally contributes more runoff than a low density residential area. Land that has more development has a greater impervious area which leads to a greater flow. Land use classification is available through city records and state wide GIS layers. The magnitude of the flow quantity and quality is dependent on the land use types and presence of stormwater infrastructure within the drainage area. Parcel ownership information is important in selecting BMP locations.

The land use, imperviousness/ perviousness, and parcel ownership information will be used to identify potential locations for BMPs. This information will help to prioritize BMPs in locations where they will provide the most stormwater treatment and areas where public or institutional land ownership can be leveraged.

Task 4: Investigation of Soils and Subsurface Conditions

Infiltration rates are an important parameter to consider when siting infiltration based BMPs. Sandy soils are common to the Traverse City area, but areas of clay and high groundwater are also present. These areas need to be identified as they impact the type of BMP that can be effective at controlling stormwater runoff.

If infiltration based BMPs are being considered the presence of known areas of groundwater or soil contamination should be identified. Increasing infiltration may not be a "best practice" if it will mobilize contaminants.

Utility location information must also be determined. Relocating utilities can be expensive and may not be feasible when considering stormwater BMPs. Thus, the location of utilities is an important consideration for estimating costs.

Task 5: Computer Modeling

Data gathered in previous tasks will be used in the computer model to evaluate rainfall – runoff characteristics of the 14th Street Outfall. The flow and water quality monitoring will be used to calibrate the model. Sub-basin mapping and identification of flow paths will be used to develop the basin input data such as overland flow paths and storm sewer networks; percent impervious; infiltration rates drainage basin area and shape; and other information needed for the computer model. The model should be calibrated to storm events captured in task 1 and ran for typical design storms (such as the 1, 2, 5, 10 and 100 year design rainfall depths for northern Michigan.

Once a model of existing conditions has been calibrated it should be used to assess the impact of potential BMPs on the hydraulics of the system and be used to test different development scenarios. Evaluation of potential BMPs should be based on the following:

- Reduction of storm peak discharge of design storms
- Reduction of total volume of design storms
- Expected reduction of pollutant loads using event mean concentration data from literature and Task 1 sampling events.

In addition, the proposed BMPs should have no negative impact on the performance of the storm sewer network.

Task 6: Conceptual Design and Prioritization of Best Management Practices The conceptual design will include preliminary engineering analyses to support the preparation of conceptual-level design drawings. The conceptual design drawings are anticipated to include plan, profile and typical sections. The conceptual designs will be used to develop a conceptual cost estimate

The data collection, analysis and computer modeling will aid in the determination of causal factors contributing to the water quantity and quality issues at the 14th Street outfall. This information will be used to develop conceptual plans for BMPs that address the identified issues. Conceptual plans should be developed to a degree that the expected performance and cost can be evaluated.

Based on the expected effectiveness and cost of each BMP a prioritized list of BMPs should be developed for use as a planning level capital improvement plan.

Task 7: Reporting and Documentation

The conceptual designs and computer model should be documented in a report that describes the assumptions, data and approach used to develop the plans. The report should be formulated as a 14th Street Outfall Master Plan. As such it should establish a prioritized sequence of construction and maintenance projects and financial needs to implement the recommended actions. At a minimum the plan should include:

- A list of prioritized construction and maintenance projects with estimated costs and schedules that collectively reduce the quantity and improve the quality of the 14th Street discharge.
- Provide recommendations that are specific enough to set the direction and begin implementation, yet flexible enough to respond to input from residential homeowners, City staff and commercial property owners.
- Include implementation recommendations that are reach or catchment specific and highly graphical in nature.
- Provide a preliminary inspection and maintenance plan for the recommended improvements.
- Provide concept plans for recommended improvements.
- Provide policy recommendations for such things as stream and wetland protection and low impact development.
- Provide a plan to assess the performance of new stormwater control measures.