KEARSLEY CREEK
WATERSHED MANAGEMENT PLAN

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INTRODUCTION

Rapid change of land use within the Kearsley Creek watershed has required the Genesee County Drain Commissioner (GCDC) and local governmental entities to manage increased development in the watershed. Their goal is to minimize property damage related to storm water, while trying to maintain or enhance water quality and natural resources of Kearsley Creek and its watershed. To identify and address existing and anticipated water quality and quantity problems, the GCDC initiated the creation of a watershed management plan.

This watershed management plan was created as a result of a collaborative effort between the GCDC, local units of government, business owners, and concerned citizens. The plan uses results of hydrologic, physical and biological assessments, along with professional recommendations to achieve the goals of maintaining and improving the function and quality of Kearsley Creek. This plan is intended to provide a comprehensive framework to be used in directing future activities within the Kearsley Creek watershed. This plan is a preventative measure to ensure that future developments have as little impact as possible on the water quality of Kearsley Creek.

Genesee County is under phase two regulation with the MDEQ and will address ordinance development as part of their phase two plan.

STAKEHOLDERS GROUP

An initial step in the development of this watershed management plan was identifying a stakeholders group consisting of individuals and organizations with a common long-term interest in improving the water quality of Kearsley Creek. The group includes:

- Genesee Township
- Davison Township
- Brandon Township
- Atlas Township
- Brandon Township Natural Areas Task Force
- Trout Unlimited
- Flint River Watershed Coalition
- Village of Goodrich
- Village of Atlas
- City of Davison
- Michigan Department of Natural Resources, Fisheries Division
- Michigan Department of Environmental Quality (MDEQ), Land and Water Management Division
- MDEQ, Water Bureau
- Natural Resources Conservation District (NRCS)
- Michigan State University Extension Service
- Michigan B.A.S.S. Chapter Federation
- Saginaw Bay Watershed Initiative Network (WIN)
- Flint Area Chamber of Commerce
- Oakland County Road Commission
- Genesee County Road Commission
- University of Michigan, Center for Applied Environmental Research (CAER)
- North Oakland Headwaters Land Conservancy
- Jeff Wright, Genesee County Drain Commissioner

This stakeholders group includes an assemblage of elected officials, community leaders, volunteers and individuals who work in, reside in, or have a general interest in the Kearsley Creek watershed. The formation of this group brought a historic knowledge of the creek and its watershed, along with a number of site-specific concerns. Several letters of commitment are included in Appendix A.

In addition to this stakeholders group, opportunities exist for other individuals and organizations to participate in the planning and implementation of the watershed management plan. Opportunities will also be available through the information and education plans.

STEERING COMMITTEE

The GCDC took responsibility for guiding the direction and focus of the watershed management plan and assembling a technical committee to assist in its preparation. The GCDC is qualified to lead the steering committee due to its overall understanding of concerns regarding water quality within the Kearsley Creek watershed. They also have the responsibility of administering the soil erosion control program. Although Kearsley Creek is not an established county drain, seven tributaries and numerous underground tiles that outlet to the creek are established drains under the authority of the GCDC.

Members of the steering committee include:

- Trout Unlimited
- U-M CAER
- Representative of Oakland County Road Commission
- Representative of Genesee County Road Commission
- Flint Area Chamber of Commerce
- North Oakland Headwaters Land Conservancy
- Brandon Township, Supervisor
- Genesee Township, Supervisor
- Davison Township, Supervisor
- Atlas Township, Supervisor
- Village of Goodrich, Supervisor
- City of Davison, Manager
- Jeff Cooper, MDEQ, Water Bureau
- Joe Leonardi, MDNR, Fisheries Division
- Jim Gerth, GCDC

TECHNICAL COMMITTEE

The Technical Committee includes members with various areas of expertise, to be used in advisory roles. The Technical Committee is comprised of:

- Genesee County Drain Commissioner (GCDC)
- Wetland and Coastal Resources, Inc. (WCR)
- Spicer Group, Inc. (Spicer)
- University of Michigan (Flint), Center for Applied Environmental Research (CAER)

The technical team was contracted to assist with hydrological analysis, storm water management, physical and biological assessments of the creek, stream bank erosion, aquatic habitat assessment, biota and adjacent wetland functions, public education current and future land use designations and Best Management Practices (BMP's) related to aquatic habitat, fisheries, erosion, and water quality and quantity.

INITIAL WATERSHED CONCERNS

The initial water quality concerns identified by the stakeholders and steering committee included:

- Sediment load
- Erosion
- Managing development in watershed
- Protection of existing stream, especially upper reaches

Additional concerns related to degradation of the creek included:

- Adequate fisheries and aquatic life habitat
- Wildlife use
- Aesthetic impacts
- Resident use/access

GEOGRAPHIC SCOPE OF THE WATERSHED

The Kearsley Creek watershed is comprised of 115 square miles of land located primarily in the southeast corner of Genesee County with watershed in portions of Oakland and Lapeer Counties. The Kearsley Creek watershed is depicted in Appendix B. Kearsley Creek is approximately 23 miles in length, measuring from the headwaters in northwest Oakland County to the mouth at the confluence with the Flint River.

DESCRIPTION OF WATERSHED

Land Use and Hydrology

Kearsely Creek has been adversely impacted by increasingly intense land usage. New housing start rates in Genesee County communities have increased consistently through the 1990's. The increase went from 231 starts in 1991 to 943 starts in 1999 according to data compiled by Genesee County Metropolitan Planning Commission. Based on discussions with community officials, this trend appears to be continuing. The 2001 existing land use is depicted in Appendix C.

Typical of this growth is increased concentrated runoff, loss of shallow ponding areas that reduce runoff, increased impervious area that causes greater runoff and shorter runoff concentrating times, lag times and peaking times, translating into a more flashy runoff response.

Similar to many watersheds in southern Michigan, the Kearsley Creek watershed is expected to continue to undergo significant land use change. Unless steps are taken, changes in land use will result in altered hydrology that often have profound effects on channel morphology, overall water quality and in-stream habitats. Therefore, it is important to predict and understand land use change and potential impact on hydrology.

Land use, within the watershed, as identified in 2001 was predominately open, natural and agricultural lands, though development pressure was increasingly prevalent near the communities of Davison, Goodrich and Ortonville, and along the main travel corridors (Appendix C). In general, development pressure seems to be driven by increasing commuter numbers from Flint and Oakland County, as well as a strong local/ community economic growth.

Future land use projections show greater expansion of developed lands near the villages, especially southwest of Davison (Appendix D). This development has potential to significantly impact hydrology unless steps are taken to manage runoff rates as the lands

are developed. Without on-site and regional detention or retention, these new development areas are expected to experience increases in flow rate (cfs) and runoff volume (acre-ft) on a sub-district scale, resulting in substantial overall increase in flow rate along the length of Kearsley Creek (Appendix E). Overall, the one percent recurrence (100-year) flow rate is projected to increase ranging from 18.3% (2523 cfs to 2981 cfs) at the lower end of the Kearsley Creek (analysis point A in sub-district 10) to over 19.2% (597 cfs to 688 cfs) at the upper end (analysis point H in sub-district 3).

As shown on the "Basis of Sub-Basin and Creek Hydrology" map (Appendix E), the land use changes that are currently allowable are in fact "Planned" land change for the watershed. These land changes are going to result in increases in storm water runoff flow, volume, and increased adverse impacts to many areas along the Kearsley Creek that have been classified as critically erodible, due to soils, vegetation and high flows over extended durations. The map shows that flow increases at full build out are not equal across all Sub-basins. This is understandable due primarily to variation in soils and ponding across the watershed and also due to the differences in land use planning throughout the various communities.

Hydrologic Analysis

The existing hydrologic conditions have been assessed with simple modeling techniques for the sole purpose of directing the focus at those areas that may be more prone to sediment transport concerns. These methods included the use of existing hydrology estimates, which will be discussed later, and a process using multiple physical parameters and the tractive force method (based upon momentum) to identify soils and cover types existing along the drain that have potential to undergo soil particle detachment. The outcome of this analysis was either validated during the physical inventory or found to not correlate with field conditions. Under existing conditions, stream crossings were evaluated for producing scouring/erosive velocities acting upon the stream corridor downstream of the crossings. It was identified that under existing flood conditions,

several road crossing structures (as outlined later in BMP's) had erosive velocities that scour the channel and adversely impact the downstream corridor.

Spicer performed a hydrologic analysis of the Kearsley Creek Watershed, the planned land use change and the impacts they will have on the hydrology of the watershed. This hydrologic analysis was conducted by reviewing the 2001 existing land use map of the watershed. It was determined from the policy and ordinance review of the communities' existing master plans. From this data the impacts of projected community development full build out conditions were determined (Appendix D). The methodology used in this analysis is consistent with the means and methods used in the initial baseline assessment and discussed and reviewed in detail with the MDEQ Hydrologic Studies Unit.

Rainfall characteristics

The MDEQ Small Un-gauged Watershed (modified SCS) method was used to determine sub-district watershed characteristics, peak flows and runoff volumes for various storm events. Kearsley Creek is located in the Flint River watershed, which has an associated adjusted rainfall amount for the 10, 50 and 100-year storm events of 3.13, 3.98 and 4.36 inches, respectively.

Topography

The upstream reach of the watershed south of Goodrich, is characterized by moderate relief with over 50 feet of change in elevation. In the middle portions of the watershed near I-69, the topography is gently sloping with 10-20 foot contour changes. In the downstream portions of the watershed, the lands are relatively flat with less than 10 feet of change in elevation. Lands away from the Kearsley Creek valley have up to 50 feet of maximum elevation change, per mile, from hilltop to valley. Topographical information was obtained from the United States Department of Interior Geological Survey quadrangle Digital Raster Graphics files processed by the Center for Geographic Information, which originates from 7.5 minute quadrangle maps.

Morphology and Physical Description

Beginning from its headwaters to its mouth at the Flint River, Kearsley Creek can be characterized by three morphological types. The first type, which includes the reach from the headwaters downstream to Goodrich Millpond and the reach from Atherton Road downstream to Lippincott Boulevard, was formed through natural processes and is somewhat pristine and scenic. Much of the stream has a meandering pattern and natural bed features including riffles, pools, and runs. Extensive forested floodplains cover most of this area.

Much of the lower one-third of the creek, downstream of Lippincott Boulevard, and the area between Goodrich Millpond and Atherton Road has been altered by past dredging activities. From the For-Mar Nature Center, which is located on the northeast corner of Genesee and Davidson Roads, downstream to the Flint River, the creek loses its natural appearance. The creek is a deep, wide ditch with little or no access to the floodplain due to high banks and incised channel.

The last morphologic type includes four impoundments on the main branch of Kearsley Creek, three of which are located within the upper one-third of the watershed. These three impoundments are Lake Louise and the Goodrich and Atlas Millponds. Lake Louise is located near Ortonville and the Goodrich and Atlas Millponds are located at the Villages of Goodrich and Atlas, respectively. The fourth Genesee County impoundment, Kearsley Impoundment, is located upstream of the mouth of Kearsley Creek at the Flint River.

Soil types

The Genesee County USDA Soil Survey was used to describe the general soil types found within the Kearsley Creek watershed. The dominant soils in the floodplain and lowlands, from County Line Road to the Flint River are Markey (Mk), Spinks-Oakville (SvA), Cohoctah (Co), Ceresco (Cn), Sloan (Sm), Lupton muck (Lu) and Landes (Ld). These soils flood in early spring and during heavy precipitation events and slopes range

from 0-2%. The Spinks-Oakville (SvA) and Landes (Ld) soils drain when spring floods recede, but lack sufficient moisture during dry periods for crop production.

The primary soils outside of the floodplain include Conover loam (CvA), (CvB), which is nearly level, the Selfridge loamy sand (SdA), which is somewhat poorly drained, and Miami (MoB), (MoC), (MoD), (MoE), Celena (CmB), and Celena-Conover (ClB) loams, which are all well drained and level to steeply sloping. The Miami series loams that are located on the side slopes of the floodplains have shallow gullies and drainage ways, which if actively eroding can contribute extensive sediment to the creek. Where the Miami and Celena-Conover soils are gently sloping, they are used extensively for crop production. The steeper sloped areas within these soil units generally remain as pasture or forest. The erodability of these soils is depicted in Appendix F, NRCS Soils Survey.

Significant natural resources

The primary natural resources in the watershed include wetlands, floodplains and stream features associated with Kearsley Creek and it tributaries and the open space consisting of forests in the middle and upper watershed. These features are critical to the protection of the water quality. Among other things, these resources help stabilize hydrology by providing flood storage, filtering sediment and nutrients, and providing habitats for aquatic and terrestrial organisms. The farmlands and open spaces need to be evaluated for significance and function in meeting water quality protection and enhancement. The majority of these significant natural resources exist in the upper two-thirds of the watershed, though For-Mar Nature Center harbors many natural features with undeveloped lands unique to the lower portion of the watershed.

Wetlands and Streams

Remote sensing techniques, including the use of aerial photography, soil surveys and National Wetland Inventory (NWI) maps, were used to identify all water bodies and wetlands within the Kearsley Creek watershed. Four general types of wetland were identified including emergent, wet meadow, scrub-shrub and forested. These wetland

types occur both separately and together within larger complexes adjacent to Kearsley Creek and its tributaries (Appendix G).

Forested wetlands line large portions of the upper creek. Additional lands that may have substantial natural resource value are the wetlands and agricultural lands (flood storage) between Lapeer Road and I-69, and the forested wetlands downstream of the Grand Trunk Western railroad tracks near I-69.

Numerous forested, wet meadow, emergent and scrub-shrub wetlands pockets remain in the middle and upper portions of the watershed. Some of the highest quality wetlands are concentrated along the middle and upper reaches of the Kearsley Creek corridor. As previously mentioned, these wetlands are essential to maintain stable flows within the creek. It is recommended that a detailed assessment of these wetlands be conducted, and a strategy for identifying and protecting the most valuable of these wetlands be implemented.

Wetland Regulation

In accordance with Part 303 of NREPA, wetlands within the Kearsley Creek watershed are regulated if:

- Contiguous to an inland lake, pond, river, or stream.
- Located within 500 feet of an inland lake, pond, river or stream.
- Non-contiguous wetlands greater than 5 acres in size.
- The MDEQ has determined that these wetlands are essential to the preservation of the state's natural resources and has notified the property owner.

State law requires that persons planning to conduct any of the following activities in regulated wetlands apply for and receive a permit from the state before beginning the activity:

- Deposit or permit the placing of fill material in a wetland.

- Dredge, remove, or permit the removal of soil or minerals from a wetland.
- Construct, operate, or maintain any use or development in a wetland.
- Drain surface water from a wetland.

The main stream portions of Kearsley Creek and its tributaries are also regulated under Part 301, Inland Lakes and Streams of NREPA. Under this part, "Inland lake or stream" means a natural or artificial lake, pond, or impoundment; a river, stream, or creek which may or may not be serving as a drain as defined by the drain code of 1956, 1956 PA 40, MCL 280.1 to 280.630; or any other body of water that has definite banks, a bed, and visible evidence of a continued flow or continued occurrence of water, including the St. Mary's, St. Clair, and Detroit Rivers. Inland lake or stream does not include the Great Lakes, Lake St. Clair, or a lake or pond that has a surface area of less than 5 acres

Kearsley Creek and its tributaries contain features and hydrology that meet the definition of a stream as indicated above. Permits for work within portions of streams that meet the above definition are required from the MDEQ for the following activities:

- Dredge or fill bottomland.
- Construct, enlarge, extend, remove, or place a structure on bottomland.
- Erect, maintain, or operate a marina.
- Create, enlarge, or diminish an inland lake or stream.
- Structurally interfere with the natural flow of an inland lake or stream.
- Construct, dredge, commence, extend, or enlarge an artificial canal, channel, ditch, lagoon, pond, lake, or similar waterway where the purpose is ultimate connection with an existing inland lake or stream, or where any part of the artificial waterway is located within 500 feet of the ordinary high-water mark of an existing inland lake or stream.
- Connect any natural or artificially constructed waterway, canal, channel, ditch, lagoon, pond, lake, or similar water with an existing inland lake or stream for navigation or any other purpose.

However, portions of Kearsley Creek's tributaries are legally established drains under the control of the GCDC. Permits are not required by the Genesee County Drain Commission under Part 301 for activities associated with maintenance and improvement of drains legally established or constructed prior to January 1, 1973, pursuant to the drain code of 1956, Act No. 40 of the Public Acts of 1956, being sections 280.1 to 280.630 of the Michigan Compiled Laws.

Maintenance work conducted by the Genesee County Drain Commission (GCDC) incorporates BMPs and SESC measures to minimize sediment input and impacts to the receiving water. These BMPs include construction of two-stage channels, reconnecting function floodplains and maintaining high quality sections of drains.

The floodplain of Kearsley Creek and tributaries that contain more than 2 square miles of drainage area are also regulated under Part 31, Water Resource Protection of NREPA. Grade alterations within the regulated floodplain will require a permit from the MDEQ. However, reviews are required for development activities by the township (detailed later in this plan) that impact land use change, new development or work in the floodplain and watercourses. Likewise, the federal government does not currently have a direct role in regulation of these resources. The Federal Clean Water Act does provide for regulation over these waters; however, the State of Michigan has assumed this authority for inland waters through a memorandum of understanding with the Federal Government.

Community profile

Demographics

Kearsley Creek and its tributaries flow through several townships; therefore, changes and growth occurring within the townships directly affects the watershed. The 2000 U.S. Census report for the townships within the Kearsley Creek watershed revealed a continual growth in population over the years. More than half of the residents in these townships live in detached units. Some townships have up to 15% of the housing units comprised of mobile homes, which provide a high coefficient of runoff from very high-

developed areas. New construction will require on-site detention or retention to limit runoff to the pre-development rate. Median home values range from $50K to over $150K in the upstream portion of the watershed.

CRITICAL AREAS

The critical areas were identified (Appendix G) based upon input from the Stakeholders Group, the Steering and Technical Committees, and results of the assessment of the watershed. The critical area was defined as:

- The mainstream and adjacent floodplain upstream of Maple Road to the county line.
- Black Creek
- The downstream section of the watershed from Belsay Road to Genesee Road, and specifically along the channel near For-Mar Nature Center

Criteria used to identify critical areas include:

- Potential for water quality protection
- Sedimentation due to streambank erosion and lack of riparian buffers
- High priority for stabilization (See pg 21 for further explanation)

The mainstream and adjacent floodplain upstream of Maple Road to the county line.

This portion of the Kearsely Creek watershed contains the highest percentage of land available for development. This critical area had a low number of stations because it was identified as being the least impacted and most uniform in morphology habitat quality. This section also has the greatest potential for water quality protection.

Black Creek

Black Creek is almost entirely dredged and contains very few natural features. The creek is straight, deep, wide and shallow and has very limited floodplain access. Streambank erosion is prevalent and bottom substrates are composed primarily of fine sands, silts and clays. In addition to the eroded streambanks, large amounts of sediment appear to be entering the creek from adjacent agricultural fields where fields are cultivated to the banks of Black Creek. Large portions of the creek have minimal buffer between the creek

and the adjacent farm fields. It is recommended that local communities and farmers develop a partnership with the Department of Agriculture's Natural Resources Conservation Service (NRCS) to re-establish buffers along Kearsley Creek.

The downstream section of the watershed from Belsay Road to Genesee Road, and specifically along the channel near For-Mar Nature Center

This section of Kearsley Creek and particularly below the For-Mar Nature Center is channelized and incised, thus eliminating the natural stream meanders, associated habitats and access to the floodplain. Streambank erosion is a significant problem. The upstream areas that have a functional floodplain have substantially less erosion than areas where the floodplain has been separated from the creek such as the critical area. Hard substrates found upstream of Lippincott Boulevard are relatively scarce downstream to the Flint River, except at some roadway crossings where the stream velocity through the crossing structures has scoured the bed and removed the fine materials.

Physical Stream Features

The physical inventory of Kearsley Creek began at each road crossing within the county. A detailed inventory for a minimum of 600 feet both upstream and downstream of each crossing was conducted and in several cases, more than 2,500 feet of stream had a detailed inventory conducted. Reservoirs along the Kearsley Creek watershed were also assessed. 100% of the downstream section of the creek from Lippincott Boulevard to the confluence of the Flint River was assessed, as well as 80% of Black Creek. Upstream of Maple Rd to the County line, the creek was walked, however, stations were not as abundant because of the quality of the stream. Kearsley Creek and portions of Duck Creek were also inventoried in Oakland County to Wolf Rd.

The physical condition of the Kearsley Creek is generally better in the less developed, upstream section of the creek. The stream has moderate sinuosity with a well developed riffle-pool sequence and gravel and cobble substrates are common in much of the upstream and central portions of the watershed. However, portions of streambed are covered with fine sediment. At County Line Road, where Kearsley Creek enters Genesee

County from the south, the creek is sediment laden with accumulations of sand more than one foot deep. The creek is lined with multi-tiered vegetation consisting of herbaceous, shrub and forested areas. This vegetation has stabilized the banks and provides cover and habitat for a variety of aquatic and terrestrial organisms. However, even in the upper portions of the watershed where housing density is low, there are anthropogenic impacts. Many riparian property owners have removed the deep-rooted vegetation from the streambank to install lawn, which has destabilized the banks and caused erosion and sedimentation in Kearsley Creek.

Duck Creek

Duck Creek is a unique feature within the watershed yet it was not identified as a critical area. The reason for not selecting Duck Creek, and its surrounding area was because the headwater areas are small, lightly developed and contain significant wetland buffers, floodplains and a well vegetated riparian corridor. Site development and pressures as evidenced in the identified critical areas have not expanded into the headwater stretch nor is it anticipated in the near future.

Erosion Assessment

The purpose of this part of the study was to document and prioritize areas of erosion along Kearsley and Black Creeks. The locations to conduct the erosion assessments were selected based on modeling results, which incorporated soil type, channel slope and radius of curvature.

Based on this information, specific stretches of Kearsley Creek were classified as Highly Critical Area, Moderately Critical Area or Low Critical Area. After the classification was completed, WCR selected sites to assess within each of the classification types. Due to the size of the watershed and similarity between many of the stream reaches, intensive erosion assessments were not conducted over the entire length of the stream. A total of 52 stations were surveyed over a distance of approximately 20,000 feet, including left and right banks (Appendix H). Results from assessment of the 52 stations were extrapolated to provide an estimate of the total number of eroded sites along the entire length of

Kearsley Creek. Of the 52 stations, 24 of were located within the Critical Areas. Additional stations, beyond those selected, were not necessary within the critical area from Atherton Road to the county line because of the similar nature of Kearsley Creek throughout this area and the relatively natural state of the creek.

The methodology used to evaluate erosion areas for Kearsley Creek was based on a modified rating system developed by the Natural Resources Conservation Service (NRCS). The methodology includes the following metrics:

Bank Condition was rated based on location of erosion on the bank. Erosion was determined through visual inspection. A numerical value of 1, 3, or 5 was assigned, with 5 being the most severe condition.

Percent Vegetation on the bank slope was also determined through visual inspection. A value of 1, 3, or 5 was assigned, with 5 having the least amount of vegetation, and 1 the most vegetation.

Cause of the erosion required a determination of whether erosion had resulted through natural processes, was caused by humans (either directly or indirectly), or by a road stream crossing structure. A numerical value of 1, 2 or 3 was assigned, depending on the determined cause. Cause of erosion was valued since man-made point impacts had specific fixes in defined locations. A road stream crossing structure received the highest value.

Bank Side Slopes were measured using a clinometer and survey rods. Steeper slopes received higher numerical values, with 1 being the lowest and 5 the highest.

Length of the erosion area was measured using either a measuring tape or an electronic measuring device. A value of 1, 3, or 5 was assigned based on length of the eroding bank.

Height of Eroded Bank and River Depth was measured using survey rods. The greater the stream bank's height or river depth, the larger the numeric rating assigned. A Numerical

value of 1, 3, or 5 was used for height or eroded bank, and a value of 1 or 2 was assigned based on river depth.

Current Speed was measured in feet per second at base flow conditions. A numerical value of 1, 2, or 3 was assigned, depending on current speed. Faster currents were assigned higher ratings.

Soil Texture, or bank lithology, was physically inspected and grain size determined. Depending on lithology, a numerical value of 1 to 4 was assigned as follows: Gravel = 1; clay = 2; organic, silt or stratified (sand and clay) = 3; and sand = 4. In some areas where the creek had been dredged, several soil strata were visible, making these areas difficult to categorize. If the upper layer consisted of organics and silt, with a value of 3, and was underlain by clay with a value of 2, a numerical value of 2.5 was assigned for purposes of the rating scale.

Access was determined by evaluating the site's proximity to roads, and physical characteristics and limitations with respect to the surrounding area. If the site was accessible, it was assigned a value of 3; if inaccessible, a value of 1 was assigned. If site access would be easy and cause little disruption to the natural resources, a high value was assigned since little disturbance would occur from site stabilization.

Erosion Rating

Upon completion of data collection, numerical values for each erosion station were totaled to arrive at a final rating (Appendix I). The following rating scale was used to determine severity of erosion:

Severe Erosion = Greater than or equal to 30

Moderate Erosion = 23 to 29

Minor Erosion = Less than or equal to 22

Each erosion station was then prioritized, using the above rating scale and professional judgment. Each area was assigned a priority rating of high, medium or low. High priority areas are erosion stations that should be given first consideration for corrective action. In

some cases, a particular area may have scored high on the rating scale but a "no action" alternative recommended based on the location of the site within the watershed.

Results depicted in Appendix J showed that approximately 10,000 linear feet of stream channel has a moderate or high priority for stabilization. However, not all high priority sites were included in the critical areas because some were small, isolated areas with a low cumulative impact on the stream when compared to other sites. Another factor which affected the rating system was accessibility. Many of these small isolated sites were located at bridge crossings and due to easy accessibility they received higher priority.

The majority of the erosion problems identified in the study were located along areas where deep-rooted riparian vegetation had been removed for installation of lawn, downstream of specific road crossings and where log jams and downed timber had redirected flows toward the banks causing erosion.

Load calculations for the 52 erosion stations indicate that a total of 252 tons of sediment per year could be prevented from entering Kearsley Creek with properly installed BMPs (Appendix J). The area contributing the most sediment is near the For-Mar Nature Preserve. Sediment loading was calculated by assigning specific BMPs from Table 5 to each erosion area. While Table 5 includes several possible BMPs for each site and they could all be used, those shown in Table 7 were selected for the purpose of calculating sediment loads.

Bridge Erosion

There are 22 bridges along the study area of Kearsley Creek. Of these bridges, 7 have a velocity less than 4 feet per second during a 100-year storm event. These bridges will have little or no scour occurring. Eleven bridges have a velocity between 4 and 7 feet per second. The end area of these bridges should be increased when major reconstruction work is scheduled on them. The remaining 4 bridges (located at Ray, Kipp, Atlas and Court) have a velocity greater than 7 feet per second. These bridges are scheduled to be replaced as soon as capital outlay funds are available. Scour protection should be

designed and installed as soon as possible to reduce erosion. The BMP will consist of hard armoring the structure at the erodible sites listed below. It will be the responsibility of the Genesee County Road Commission for implementing these BMPs, replacement of bridges and future maintenance. This will insure that the workload, responsibilities and costs for improving the water quality within the watershed are shared among the agencies in Genesee County.

Kearsley Creek Crossings Velocity Analysis

Road Crossings	Type of Structure	Height (ft)	Width (ft)	Open End Area (sq ft)	Flow Rate (cfs)	Velocity (ft/sec)
Oakwood Rd.	2-CMPA multi plate elliptical culverts	8.30	12.50	162.97	1000	6.14
Ray Rd.	2-CMPA multi plate elliptical culverts	7.60	11.00	131.32	1100	8.38
Kipp Rd.	concrete bridge	6.40	23.70	151.68	1200	7.91
Henderson	concrete bridge	6.90	29.00	200.10	1200	6.00
State St. (M-15)	elliptical concrete pipe	10.00	28.20	221.48	1400	6.32
Green Rd.	steel bridge	7.65	33.80	258.57	1275	4.93
Hegel Rd.	concrete bridge deck spillway/dam					
Dutch Rd.	steel bridge	10.42	24.70	257.37	1400	5.44
Perry Rd.	concrete spillway, multi plate CMP					
Jordon Rd.	concrete bridge	7.40	36.40	269.36	1500	5.57
Atlas Rd.	concrete bridge	5.00	35.80	179.00	1600	8.94
Bristol Rd.	steel bridge	10.00	37.10	371.00	1650	4.45
Atherton Rd.	concrete bridge	16.20	40.40	654.48	1700	2.60
Atlas Rd.	concrete bridge	8.00	40.30	322.40	1775	5.51
Irish Rd.	concrete bridge	7.70	40.70	313.39	1850	5.90
Lippincott Rd.	concrete bridge	10.80	36.70	396.36	1750	4.42
Lapeer Rd.	concrete bridge	8.00	60.70	485.60	1850	3.81
Court St.	concrete bridge	5.95	45.00	267.75	2050	7.66
I-69 EB	concrete bridge	10.14	75.00	760.50	1950	2.56
I-69 WB	concrete bridge	8.57	75.70	648.75	1950	3.01
Davison Rd.	concrete bridge					
Belsay Rd.	concrete bridge	8.82	67.00	590.94	2250	3.81
Genesee Rd.	concrete bridge	12.00	44.50	534.00	2250	4.21
Richfield Rd.	concrete bridge	11.98	50.25	602.00	2250	3.74

Key	
	Low Velocities, no scour protection design required.
	Medium Velocities, design scour protection and identify floodplain.
	High Velocities, design scour protection and identify floodplain.

Water Chemistry

Water quality sampling was conducted by the MDEQ during August 2003 at County Line, Atherton and Belsay Roads on Kearsley Creek, and on Black Creek. Water chemistry samples at each station indicated relatively low nutrient concentrations (MDEQ 2004). The County Line Road station had low ambient nutrient concentrations and the lowest concentrations of soluble reactive phosphorus (SRP) and total phosphorus (TP). The Belsay Road station had the highest levels of SRP and TP. Black Creek had similar levels of SRP and TP to the Belsay Road station, even though it receives effluent from the City of Davison. Water chemistry sampling on Black Creek, upstream of the City, showed that nutrient concentrations were slightly elevated with a 2:1 TP:SRP ratio. Cladophera sp. was common, suggesting that elevated nutrients may be present (MDEQ 2004). All sampling stations had relatively low levels of total suspended solids (TSS), ranging from non-detectable (ND) to 14 mg/l.

The water quality of Kearsley Creek is considered good, with low levels of total phosphorus and soluble reactive phosphorus measured at the sampling stations. Nutrient levels almost doubled from Kipp Road to Belsay Road, but remained low when compared to levels within the mainstream of the Flint River, and where NPDES discharges enter tributaries. The chemical analysis of the river showed that the levels of nutrients and chemicals were not high enough to have an impact on the biological community (see page 30 for chemical and biological comparison.)

Biological and Aquatic Habitat Assessments

Assessment of the biological and physical habitat of Kearsley Creek and its tributaries was found necessary to characterize the quality of the watercourse and its contributing water sources, and to assist in making recommendations for improvements. Existing physical and biological assessments, performed by state agencies, were reviewed and their findings evaluated. However, these data did not include sufficient information to assess all areas within the watershed.

Additional physical and biological assessments of Kearsley Creek and its tributaries were conducted to supplement existing data. Information collected from these assessments was used to assess water quality and stability of the creek and its tributaries. Based on these assessments, and information gathered by others, recommendations have been developed to improve water quality and aquatic resources of the creek.

Macroinvertebrate and Aquatic Habitat Assessments

Macroinvertebrate and habitat sampling was conducted on Kearsley Creek by the MDEQ in 1998 and 2003 using protocols set forth in The Great Lakes Environmental Assessment Section, Procedure # 51 (Procedure 51) (MDEQ 1997 and MDEQ 2002). The results of these were determined to be sufficient to characterize the macroinvertebrate communities and habitats associated with Kearsley Creek. Therefore, additional sampling was not conducted on Kearsley Creek.

MDEQ 1998 Assessment

The MDEQ, Surface Water Quality Division (currently Water Bureau) conducted biological surveys of the Flint River and selected tributaries including two locations on Kearsley Creek; one at Atherton Road and another at Kipp Road (Walterhouse 2001). Macroinvertebrates and habitat conditions were sampled on July 30, 1998 to assess point and non-point source pollution.

Macroinvertebrate sampling at the Atherton and Kipp Road crossings resulted in scores of excellent and acceptable, respectively. However, both stations received overall habitat scores of fair (moderately impaired). The report did not include discussions relating habitat conditions to macroinvertebrate community health.

The low habitat scores at both stations are a reflection of low individual scores for embeddedness, bottom substrate/available cover, bottom deposition, and bank vegetative stability. Based on these results, sedimentation and subsequent loss of preferred substrates appears to be the primary impact to water quality at these stations.

MDEQ 2003 Assessment

The MDEQ Surface Water Quality Division, Great Lakes Environmental Assessment Section performed biological surveys and habitat assessments at four stations on Kearsley Creek and two stations on its tributaries from June 30 to August 8, 2003. The four stations on Kearsley Creek were located at the crossings of County Line, Kipp, Atherton and Belsay Roads.

Macroinvertebrate communities were rated as acceptable at the Kipp, County Line, and Belsay Road stations and excellent at Atherton Road. The Atherton Road station produced the highest number of total taxa and the highest number of mayfly, stonefly and caddisfly taxa of all stations sampled in the Kearsley Creek watershed.

Habitat assessments at the County Line and Belsay Roads stations resulted in scores of marginal (moderately impaired) at both stations. The MDEQ reported macroinvertebrate densities were somewhat depressed at County Line Road due to lack of hard substrate from excessive embeddedness caused by sand deposits. Some sedimentation was also found at the Belsay Road station, but primary reasons for the impaired rating were related to low scores for bank stability, vegetative protection, and riparian zone width.

The Atherton and Kipp road stations received higher habitat scores of good (slightly impaired) and excellent (non-impaired), respectively (Cooper 2004). Kipp Road was rated as a glide/pool stream and the Atherton Road station was rated as a riffle/run system. Both stations had minimal amounts of sediment deposition and scores of good to excellent for riparian and bank structure metrics.

The creek at stations downstream of the Goodrich and Atlas Millponds, (Atherton and Belsay Roads) is wider, shallower, slower, and warmer than stations upstream of the impoundments (Kipp and County Line Roads). Averaging data from the two stations downstream of the impoundments, the creek averaged 35 feet wide and 1.4 feet deep, with surface velocities and temperature averaging 0.45 ft/sec and 68.5°F, respectively.

At stations upstream of the impoundments, the creek averaged 17.5 feet wide and 0.75 feet deep, with surface velocities averaging 0.9 ft/s and temperatures averaging 62.5°F.

Two tributaries of Kearsley Creek were also sampled by the MDEQ 2003; Duck Creek at Wolf Road and Black Creek at Oak Road. Sampling at Duck Creek resulted in a habitat score of marginal (moderately impaired). The stream bottom was dominated by silt, with little hard substrate present for use by macroinvertebrates. The lack of preferred substrate was reflected in a macroinvertebrate community rating of poor, with only a few mayflies and caddisflies collected. However, the MDEQ considered this stream to be in overall good condition, stating that nearby wetlands and low gradients within this section of stream intrinsically prevent flushing flows and sources of large woody debris that could otherwise provide habitat were lacking at the sample station.

The MDEQ characterizes Black Creek as a heavily modified agricultural drain, with soft substrates composed of fine sands, silts and clays, minimal gradient, and low flow velocities. The creek at Oak Road was not recently channelized, but still received a low habitat score (marginal) due to poor quality substrates and poor bank and riparian characteristics. The macroinvertebrate community was rated as acceptable, with Chironomidae listed as the dominant taxa.

WCR 2004 Assessment

The 1998 and 2003 sampling conducted by the MDEQ was determined to be sufficient to characterize the macroinvertebrate communities and habitats associated with Kearsley Creek. However, additional sampling on the Black Creek and Duck Creek was conducted by WCR to supplement existing MDEQ data. The tributaries were sampled on September 16, 2004 using Procedure 51 methodology (MDEQ 2002).

Black Creek was sampled for macroinvertebrates and habitat was rated along a 110-foot reach of stream, beginning approximately 120 feet downstream of Irish Road. This location was chosen to characterize the downstream portion of the stream (approximately

4 miles downstream of the MDEQ 2003 Oak Road station), near its confluence with Kearsley Creek.

At the sample site, Black Creek is linear with evidence of past channelization and heavy deposits of fine materials. Habitat surveys resulted in a score of marginal (moderately impaired) due to sediment deposition, unstable flows (flashiness) and lack of sinuosity. The macroinvertebrate community rating was poor reflecting the lack of hard substrates. No mayflies or stoneflies were collected at this station and only 3 caddisflies were collected out of a total of 86 individuals.

The sample station on Duck Creek included a 100 foot section beginning 100 feet downstream of Wolf Road. The stream at this location had a flow velocity of 1.4 ft/s and hard bottom substrates, which vary significantly from the Duck Creek station sampled by the MDEQ in 2003.

Macroinvertebrate and habitat sampling resulted in scores of acceptable and good (slightly impaired), respectively. Two mottled sculpin (*Cottus bairdi*) were incidentally captured during macroinvertebrate sampling, suggesting that fish community is in good health at this station. Minor sedimentation was present but scores remained high for in-stream cover and epifaunal substrate. Riparian and bank structure metrics received the lowest habitat scores due to lack of vegetation on the left bank, where a homeowner has removed the high quality vegetation and maintained a lawn to the top of bank.

Fisheries Assessments

Kearsley Creek is described by the MDNR and MDEQ as coolwater system with headwaters beginning as a series of coldwater streams in northern Oakland County. The upper portion of the creek (upstream of M-15) has a moderate gradient with groundwater inputs resulting in cool water temperatures and stable flows that provide conditions to support a cool water fishery (Leonardi and Gruhn 2001). The upper reach and associated

tributaries have been managed for brown trout (*Salmo trutta*) since the 1920's (Leonardi 2002).

The upstream portions of Kearsley Creek support a brown trout fishery through an annual stocking program by the MDNR. A total of 5000 yearling brown trout were stocked within the Kearsley Creek watershed in 2001 with stocking locations at Granger, County Line, Kipp, and Henderson Roads. Fisheries assessments have documented survival of stocked yearlings, although survival has often fluctuated significantly from year to year. Natural reproduction of brown trout also occurs, but at low levels (Leonardi and Gruhn 2001).

Sampling efforts conducted in 1997 by the MDNR at Kipp Road found 14 fish species, with the catch dominated by mottled sculpin, brown trout, and central mudminnow (*Umbra lima*). Leonardi 2001 reports that the upper area of Kearsley Creek is the only area within the Flint River watershed where mottled sculpin are found. Stock assessments conducted in 2001 at the Kipp Road site produced 21 brown trout, 7 to 11.8 inches in size. Fin clips on the trout caught indicate all fish originated from 2000 and 2001 stocking efforts.

Duck Creek is a coldwater tributary to upper Kearsley Creek that has been managed for brook trout (*Salvelinus fontinalis*) through stocking programs since the 1920's. Stocking on the creek has not occurred since 1967 (MDNR 2002); however, past surveys by the MDNR have documented wild brook and brown trout populations (Leonardi 2001). Trout populations on Duck Creek have declined recently due to loss of habitat from beaver dams and bank erosion (Leonardi 2001). The present fish community is dominated by mottled sculpin, white sucker (*Catostomus commersoni*) and creek chub (*Semotilus artomaculatus*). Brown trout and brook trout are still present in the stream, but are not considered dominant species (Leonardi 2001).

The downstream reaches of Kearsley Creek (north of M-15 at Goodrich Millpond) have warmer water temperatures than the upper reaches. In the 1920's and 1930's, the creek

was fragmented by four impoundments (Lake Louise, Goodrich Mill Pond, Atlas Mill Pond, and Kearsley Reservoir) resulting in alterations to flow and temperature regimes. These reaches lack conditions for survival of trout and currently support a warmwater fishery.

Fisheries surveys conducted in 1997 between the Atlas Mill Pond and Kearsley Impoundment document the lack of coldwater fish species, with the catch dominated by cyprinid, catostomid, and centrarchid species. Northern hogsucker (*Hypentelium nigricans*), blackside darter (*Percina maculata*), creek chub, hornyhead chub (*Nocomis biguttatus*) and bluntnose minnows (*Pimephales notatus*) comprised the majority of the species found within this reach (Leonardi 2001).

The mill ponds and impoundments in Kearsley Creek also support warmwater fisheries. Bluegill (*Lepomis macrochirus*), pumpkinseed (*Lepomis gibbosus*), black crappie (*Pomoxis nigromaculatus*), largemouth bass (*Micropterus salmoides*), northern pike (*Esox lucius*), brown bullhead (*Ameiurus nebolusus*), yellow bullhead (*Ameiurus natalis*), white sucker and common carp (*Cyprinus carpio*) are the primary species found within the Goodrich and Atlas Millponds and Kearsley Reservoir. A self-sustaining channel catfish (*Ictalurus punctatus*) population is also found in Kearsley Reservoir (Leonardi 2001).

Historic Creel Data

Historic creel data from the MDNR indicates that the following species were harvested from Duck Creek, Lake Louise, Goodrich Mill Pond, Atlas Millpond, Kearsley Creek and Kearsley Impoundment from 1929-1964 (Appendix J): brook trout, black crappie, yellow perch (*Perca flavescens*), northern pike (*Esox luscius*), bullhead, sucker, smallmouth bass (*Micropterus dolomieu*), rock bass (*Ambloplites rupestris*), bluegill and pumpkinseed.

Chemical and Biological Comparison				
Station	**Chemical Results**	**MDEQ's Biological Results (2003)**	**WCR's Biological Results (2004)**	**Relationship Chemical/ Biological Data**
County Line	Low ambient nutrient concentration	Macroinvertebrates rated acceptable to depressed (due to lack of substrate)	WCR found that MDEQ sampling determined to be sufficient to characterize macroinvertebrates and habitats	Chemical results do not impact the Macroinvertebrates. Limiting factor of Macroinvertebrates is habitat
	Lowest concentration of soluble reactive phosphorus (SRP) and total phosphorus (TP)	Habitat assessment scored marginal (moderately impaired)		
	Low levels of total suspended solids (TSS) from non-detectable (ND) to 14 mg/l	Creek is narrower, deeper, faster and colder than Atherton and Belsay sites		
Atherton Rd	Low nutrient concentration	Macroinvertebrates rated excellent	WCR found that MDEQ sampling determined to be sufficient to characterize macroinvertebrates and habitats	Chemical results do not impact Macroinvertebrates.
	Low levels of TSS ranging from ND to 14 mg/l	Highest number of total taxa, and taxa of mayfly, stonefly and caddisfly of all stations		
		Creek is wide, shallow and slow and warm		
Belsay Rd	Low nutrient concentration	Macroinvertebrates rated acceptable	WCR found that MDEQ sampling determined to be sufficient to characterize macroinvertebrates and habitats	Chemical results do not impact Macroinvertebrates. Limiting factor of Macroinvertebrates is habitat
	Highest levels of SRP and TP	Habitat assessment scored marginal (moderately impaired)		
	Low levels of TSS from ND to 14 mg/l	Creek is wide, shallow and slow and warm		
Black Creek	Low nutrient concentration	Macroinvertebrates rated acceptable. Chironomidae - dominant taxa	Macroinvertebrate rated acceptable. Linear with past channelization and deposits	Chemical results do not impact Macroinvertebrates. Limiting factor of Macroinvertebrates is habitat
	High levels of SRP and TP similar to Belsay Rd.	Low habitat score due to Heavily modified agricultural drain with soft substrates and low flow velocity	Habitat assessment scored marginal (moderately impaired)	
	Nutrient concentration slightly elevated with 2:1 TP:SRP ratio; Cladophera sp. was common		Linear with past channelization and deposits	
	Low levels of TSS from ND to 14 mg/l			

The viability of the macroinvertebrates at these sampling stations appears to be related to the quality of the habitat and the amount of bottom substrate, cover and bank vegetative stability. Those stations with poorer habitats (moderately impaired) had reduced macroinvertebrate richness. In no case does the water quality in Kearsley Creek appear to affect the macroinvertebrates. No water quality toxicity issues were identified at the sampling stations.

USES, POLLUTANTS, SOURCES, AND CAUSES

Designated Uses

The watershed was reviewed in relation to each designated use and its ability to meet that use. Determinations of impairment are based on water quality standards, known and suspected pollutants and sources of those pollutants. A summary of the designated and desired uses, as they relate to water quality, is provided in Table 1. The primary impediments to meeting the designated use are sediments and temperature.

Agriculture

Water quality in Kearsley Creek is acceptable for use by agricultural operations. No known pollutants are present that would inhibit agricultural use. Agricultural use is not considered to be impaired or threatened.

Industrial Water Supply

There are at least 11 active permitted industrial discharges along Kearsley Creek and 9 MS4 urban stormwater discharges (MDEQ 2004). There are currently no known pollutants or concerns associated with the water quality of Kearsley Creek that would impact the use as an industrial water supply and, therefore, this use is not considered impaired of threatened.

Public Water Supply

The waters of Kearsley Creek are not presently, nor are they anticipated to be, used as a public water supply. This designated use does not apply.

Navigation

Kearsley Creek does not support any commercial navigation and recreational navigation is limited to the impoundments. The base flows of the creek are not sufficient to allow for movement of floating vessels. This use does not apply to Kearsley Creek except where the creek is impounded by the dams.

Coldwater Fishery

Kearsley Creek changes from a coldwater to a warmwater stream at M-15. The upstream stretches of Kearsley Creek currently support a coldwater fishery, although it is somewhat degraded. This use is threatened due to sediment pollution.

Warmwater Fishery

Downstream of M-15, Kearsley Creek supports a warmwater fishery, although it is somewhat degraded. This use is threatened due to sediment and water temperature.

Other Indigenous Aquatic Life and Wildlife

Pollutants affecting the warmwater fishery also impact other aquatic organisms in Kearsley Creek. Many macroinvertebrate species, which are favored as fish food and are indicative of high water quality, require stable flows, coarse substrates, lower temperatures and higher dissolved oxygen levels. This use is threatened due to sediment.

Partial Body Contact Recreation

The primary uses of Kearsley Creek that involve human contact focus on fishing and passive recreation (nature walking). There are no known pollutants that would directly impact partial body contact. This is considered an applicable use of the watershed, and is not impaired or threatened.

Total Body Contact Recreation (May 1-October 31)

Swimming is not known as a use of the creek except in the impoundments. At one public meeting, the GCDC was informed that there was a concern with potential leaks in septic systems within the watershed. The Genesee County Health Department is following up on this contaminants issue. This use is not identified as impaired or threatened.

Desired Uses

The watershed was reviewed in relation to each desired use and its ability to meet that use. Determinations of impairment are based on water quality standards, known and suspected pollutants and sources of those pollutants. A summary of the designated and desired uses, as they relate to water quality, is provided in Table 1.

Natural Flood Storage

Downstream portions of Kearsley Creek are incised and effectively separated from the floodplain due to channel excavation in placement of spoil berms. Anticipated land use change within the upper watershed will require on-site stormwater management or expected an increase in frequency and magnitude of flood flows.

Protect Stream Corridor from Further Degradation

Few county or township ordinances or regulations exist to protect Kearsley Creek or its tributaries from continued degradation. Similarly, all land use planners have not considered the effects of increased development on the stream corridor. Current protection measures are considered to be inadequate. Updates of zoning ordinances and information are necessary. An exception to this is Davison Township's Natural Feature's setback ordinance and open space preservation efforts.

Pollutants, Sources, and Causes

Pollutants, along with their sources and causes, were prioritized for each impaired and threatened use based on significance of the impact to the watershed and uses, the amount of pollutant input, and the designated uses impacted or potentially impacted (Table 2).

Hydrology (Cause)

Hydrologic change and stream flashiness will become a cause of pollution with the potential to impact the warmwater fishery and other indigenous aquatic life and wildlife, if changes do not occur in requirements regarding stormwater discharge. Future land use change, including urbanization and improper management of vegetation, among others, will result in increases in flashiness, peak flows, frequency of flooding and flow velocities if not managed to maintain runoff at a predevelopment rate and minimize the loss of riparian vegetation. Township zoning to protect the riparian vegetation will be one component of stream stabilization/restoration.

Sediment (Pollutant)

Sediment has been identified as the major pollutant affecting the cold and warmwater fisheries and other indigenous aquatic life and wildlife. Survival, reproduction and growth of all desirable aquatic organisms have been impaired by excess sediment. Sediment increases turbidity of the water, thereby affecting feeding success, respiration of fish and macroinvertebrates and incubation of eggs, among others. Sediment also affects habitat diversity by covering coarse substrates and woody debris. These areas are known to contain a lower diversity of organisms and taxa, which are more tolerant to pollution. Many macroinvertebrates require coarse substrates and wood for attachment and feeding sites, cover and reproduction. Many fish also require these habitats for reproduction, cover from predators, and as a source of macroinvertebrates for food.

Sources and Causes of Sediment Pollution

The majority of sediment entering the creek appears to be coming from stream bank erosion, which is caused by improper management of riparian vegetation and altered

morphology. Improperly designed or installed bridges and culverts, agricultural fields along Black Creek, and runoff from gravel roads have also been identified as sources of sediment.

Water Temperature (Potential Pollutant)

There is a concern with the potential for increased water temperatures in the lower portions of the Kearsley Creek watershed. Temperature is not currently an impairment to Kearsley Creek, however, given land use, temperature was identified as a potential source which could threaten water quality in the future.

Potential Sources and Causes Water Temperature Pollution

Impoundments, lack of vegetation and channel alteration could all be contributors to increasing water temperature. There are a total of four impoundments on Kearsley Creek, all of which provide water to the creek. In addition, the removal of streambank vegetation throughout the watercourse allows sunlight to reach the water surface which could increase temperatures. Increased water temperatures may result in reducing the quality by lowering dissolved oxygen levels, which potentially can increase respiration rates in fish and many invertebrates.

GOALS AND OBJECTIVES

The threatened designated uses were identified and goals were developed for the Kearsley Creek watershed based on maintaining, enhancing, restoring and protecting the designated and desired uses (Table 3). Objectives were developed based on the primary goals established. Table 4 lists the objectives identified for each goal as they relate to designated and desired uses. Brief descriptions of each objective are provided at the end of this section.

Goal: Maintain Coldwater Fishery

Objectives:

- Reduce Sedimentation from Stream Bank Erosion
- Reduce Sedimentation at Bridges and Culverts
- Reduce Sedimentation from Gravel Roads

Goal: Maintain Warmwater Fishery

Objectives:

- Reduce Sedimentation from Stream Bank Erosion
- Reduce Sedimentation from Farm Fields-Black Creek
- Reduce Sedimentation at Bridges and Culverts
- Reduce Sedimentation from Gravel Roads
- Re-establish Riparian Zones to Reduce Water Temperature

Goal: Maintain Other Aquatic Life and Wildlife

Objectives:

- Reduce Sedimentation from Stream Bank Erosion
- Reduce Sedimentation from Farm Fields-Black Creek
- Reduce Sedimentation at Bridges and Culverts
- Reduce Sedimentation from Gravel Roads
- Re-establish Riparian Zones to Reduce Water Temperature

Goal: Protect the Stream Corridor

Objectives:

- Implementing the information and educational plan identified within this watershed management plan.
  - Obtain easements or purchase lands for those areas identified as critical.
  - Township and County governments adopting ordinances to protect natural resources.
  - Educate the public on the resource values of Kearsley Creek.

BEST MANAGEMENT PRACTICES, TASKS, TIMELINES AND ESTIMATED COSTS

Best management practices, tasks, timelines, and estimated costs for each objective are identified below and summarized in Table 5. Sites requiring stabilization within the Critical Area were determined by ranking results of erosion station surveys to severity of erosion within the Critical Area. Systematic implementation of these BMPs is critical to overall success of the watershed management plan. Priority should be given to high-hazard areas where existing infrastructure is threatened or substantial loss of land is occurring.

Reduce Sedimentation from Stream Bank Erosion

One of the objectives of this watershed study is to reduce sediment input from eroding banks. To determine the most appropriate methods of stabilization, representative areas from the county line to the Flint River and on Black Creek, were assessed by WCR. A total of 52 sites were evaluated and 50 sites were identified as requiring some level of stabilization. Site-specific BMPs were selected for each of the areas identified for stabilization. Selected BMPs include: armoring banks with revetments or gabion baskets; bank tapering; installing live stakes; planting shrubs; placement of biolunkers, log revetments, riffle zones, cross vanes, and J-hooks, channel modification and most importantly reestablishing a riparian buffer. In addition to installation of BMPs, removal of log-jams and beaver dams will also be required in several areas. Specific BMPs and approximate locations for installation are provided in the Kearsley Creek Erosion Rating Chart in Appendix I. Maps showing the erosion survey stations are provided in Appendix I.

One area identified as high priority for stabilization is within the golf courses on Kearsley Creek. Much of the riparian zone on Kearsley Creek within the property limits of these golf courses is mowed and has no overhanging vegetation. These areas have been identified as high priority for reestablishing a riparian buffer. Besides reducing stabilizing banks and reducing sedimentation, the use of

vegetative buffers also reduces and regulates water temperature and reduces nutrient input by removing nutrients before they enter the creek. Reestablishing the riparian vegetation at both of the golf course and where stream banks have been impacted by home owners will help improve the warm water fishery and aquatic habitat for other aquatic organisms and wildlife.

Implementation of the BMPs will be completed in both short and long-term time frames. Within the golf course, implementation should occur immediately as on other high priority erosion areas. Erosion areas that can be restored most cost effectively will be completed as soon as possible. In some cases, it may be necessary to place hard structures along with vegetation to ensure long-term bank stability. Those areas requiring a substantial budget are prioritized and targeted for completion when funds become available. The lower and moderate priority areas will likely occur in the long-term.

Protecting vegetation in areas impacted by riparian homeowners can be completed through ordinance development and implementation of the Information and Education Plan. The process of developing and adopting ordinances is considered long term, but beginning the process along with implementing the Information and Education Plan is short term and has potential to minimize long term costs. Establishment of greenbelts along Kearsley Creek, strict regulation of building construction within the 100-year floodplain and local regulation of other development and use within the 100-year floodplain needs emphasis by the local governmental entities within the watershed.

The BMPs identified for each erosion area were divided into two categories: 1) items that can be installed by hand and 2) items that require heavy machinery for installation. It is recommended that volunteers, stakeholders, and concerned citizens within the watershed carry out portions of the BMPs that do not require heavy machinery, such as planting vegetation and construction of biolunkers.

Because of the number of areas identified as requiring stabilization, installation of BMPs is seen as occurring in both long and short-term time frames. Areas identified as having the most severe erosion or greatest sediment input, are recommended to be completed immediately, while less severe areas may be stabilized in the longer term.

Reduce Sedimentation at Bridges and Culverts

The Kearsley Creek Erosion Rating Chart identifies specific BMPs to stabilize selected erosion sites around bridges and culverts. The BMPs include placement of armor, construction of dissipation devices and installation of drop structures. Location of the bridges and culverts to be stabilized are located in the Kearsley Creek Crossings Velocity Analysis table on page 22.

Local Agencies

The Genesee County Drain Commission (GCDC) and Genesee County Road Commission (GCRC) will be involved in restoration of roadside discharges with the GCRC taking the lead. The GCDC will be responsible for stabilization of erosion caused by their bridges and culverts and for alterations to bridges and culverts that were identified as causing severe erosion and scour of the stream.

These tasks should be completed in the short term because of relatively easy access.

Reduce Sedimentation from Farm Fields

On Black Creek, sediment inputs from farm fields, results in sediment deposits affecting the aquatic habitat in the Creek. Recommended BMPs include installation of buffer strips along farm fields adjacent to the creek. The National Resource Conservation Service (NRCS) can provide assistance to the property owners along the creek on installing buffers.

These tasks should be completed in the short term because of relatively easy access.

Reduce Sedimentation from Gravel Roads

Physical assessments conducted by WCR revealed large volumes of sediment entering Kearsley Creek from Oakland County. The source of some of this sediment was identified as runoff from gravel roads. The recommended BMPs include installing check dams and roadside bank stabilization.

These tasks should be completed in the short term because of their relatively easy access and high degree of impact on the water quality of Kearsley Creek.

Stabilize Hydrology

Throughout the downstream portion of the creek, north of I-69, portions of the floodplain adjacent to Kearsley Creek have been separated from the creek due to incision of the channel. Even during large storm events, flood flows cannot access the floodplain.

Protection of floodplains is critical for maintaining water quality, limiting flashiness, reducing water temperatures and providing valuable habitat and resources within the watershed. Any loss of floodplain will eliminate runoff storage and, in turn, compound peak rate increases. To assist in identifying the impact of floodplain on hydrology, some losses have been estimated in the hydrologic analysis assuming that regulated wetlands will be protected. If the existing floodplain of the creek corridor and the contiguous wetlands are not protected, the resulting adverse hydrologic impacts will be more severe than these results predict. Protection of the flood plain, stream corridor and contiguous wetlands needs to occur at the local level.

Resolving adverse hydrologic impacts include a variety of solutions. One option is to change the communities' land use policies to reduce impacts from land changes in the watershed and protection of existing floodplain areas. Further solutions

include regional storm water detention or retention, wetland detention or retention systems, rain gardens and treatment for sub-basins where zoning does not compensate for the increased rates of runoff at build out.

On-site wetland detention or retention basins for stormwater must be incorporated into future developments to reduce adverse impacts that any future land development will impose. These basins would need to be designed to contain the calculated change in volume for the one percent recurrence (100-year) flood (Appendix E) outside of the Kearsley Creek 100-year flood plain to allow for additional flood storage. They should, in addition, be designed to attain other targeted water quality goals such as first flush polishing and nutrient removal.

Specific sites have not been identified for regional detention/retention. However, future detention or retention needs within each sub-watershed have been potentially identified (Appendix E). As a first step, specific areas should be identified for regional detention/retention. Once these areas are located, property can be acquired or easements obtained.

Implementation of these tasks will be completed in the long-term because of the substantial time, effort and cost associated with identifying the sites, completing engineering analysis and obtaining properties.

LOCAL PROJECTS, PROGRAMS, AND ORDINANCES

Overview – Local Government Water Quality Impact

Within the Kearsley Creek watershed, there are 11 individual municipal authorities making land use decisions. Individuals, county planning organizations, and road and drain commissions are also making land use decisions that directly or indirectly impact water quality. Therefore, it is important that these decisions be coordinated and based on a common environmental goal for the protection of Kearsely Creek.

Multi-jurisdictional Planning

Nearly every environmental problem has a land use origin and most resource management decisions are tied to a series of existing or potential land use decisions. Without careful consideration, land use decisions may unintentionally serve to undermine environmental protection objectives. Thus, governments at all levels must share common goals for a quality environment and equitable use and protection of natural resources. Because of this, the Technical Committee determined it necessary to characterize the current and future land use within the watershed and its potential impact on the water quality of the stream. In this analysis, several factors were considered including the intended future land use based on master plans and a review of existing zoning ordinances in the watershed communities.

The Matrix

The matrix (Table 8, Appendix N) consists of a table that has specific environmental policies listed along rows and the individual townships listed in columns. Townships were scored based on policies and ordinances. When a township's ordinance did not contain a policy they were warded zero points. If a township simply had the policy they were awarded one point. If a township's ordinance had the policy and it was clearly articulated the township received two points. Once the matrix was completed and the townships scored, the columns and

rows were totaled. The sum of the columns offer insight about the strength of individual township's ordinances related to water quality while the sum of the rows reflects the presence and strength of an individual policy across the watershed. The percent of watershed area made up by a specific township is included with its name in the chart. This percentage was not factored into the matrix, but should be considered when prioritizing specific actions within the watershed.

Future Land Use Based on Master Plans

Upon review of the 11 master plans for the watershed communities, it became apparent that they varied greatly and showed little evidence of coordination among municipalities, thereby making management of the resource more difficult. A land use classification system was developed to assist in preparing a theoretical future land use map for the watershed.

Matrix Findings: Township and County Ordinances

Review of current ordinances within the Kearsley Creek watershed revealed that most attention to water resources followed traditional zoning concerns, such as density and open space.

The GCDC does not have jurisdiction over non-county drains, nor do they have an ordinance regulating stormwater from developments. Instead, they have recommended Storm Sewer Design Parameters (Appendix K) to assist local units of government with managing stormwater. Drain regulations in Genesee County are determined by individual townships. Ordinance BMPs will be focused on Atlas, Davison and Genesee townships because of the high percent of watershed located in these three townships. All other townships within the watershed will be invited to participate in ordinance development. Atlas, Burton, Davison and Genesee Townships are also the only townships with a current ordinance regulating water quality issues (Table 8, Appendix N). Since each township's ordinance varies, it is a recommendation of this plan that a common water quality ordinance be developed for the 11 watershed communities within Kearsley Creek to address protection of

existing wetlands, floodplains, riparian corridors and requiring retention systems, rain gardens and wetland detention areas for all new developments.

The focus of current ordinances related to storm water is primarily concerned with quantity of runoff, rather than quality of runoff. Ordinances appear to moderately support improvements to parking lot design and usage. Davison Township is the only township within the watershed that requires activities directly adjacent to surface waters or wetlands to be setback so as to not negatively impact the natural feature.

The Genesee County Drain Commissioner's office held an introductory meeting with township officials within the county to discuss ordinance development to protect water quality and manage stormwater quantity within the watershed. It is recommended that the ordinances address low impact development techniques such as rain gardens, porous pavement designs, greenway corridors, designated greenbelts, water quality management within storm water basins, on site detention or retention and implementation of regional detention or retention within the sub-watersheds where required. Establishment of township or local government ordinances for riparian and wetlands protection is strongly recommended. These ordinances will be more effective if they are accompanied by an information and education campaign. This will insure community support for the ordinance, as well as the necessary tools to enforce it. The Genesee County Drain Commissioner's office will lead both the information and education program as well as providing technical assistance on developing new ordinances.

Local Organizations

The Flint River Watershed Coalition (FRWC) has taken a strong interest in assisting in the implementation of the Kearsley Creek Watershed Management Plan. They have indicated to the Genesee County Drain Commissioner that they are willing to provide volunteer labor, where feasible. In addition, it is anticipated that a local group may form upon completion of this plan. Such a group could also

provide volunteer labor to help with implementation of BMPs and participate in follow-up educational and monitoring activities. Additional assistance is anticipated from several members of the Stakeholders Group as this project moves forward.

Summary of Matrix Findings and Ordinances

The need for ordinances and local organizations for ordinance implementation is crucial for the protection and preservation of water quality in the Kearsley Creek.

Ordinance development, zoning and information and education activities within the phase II area will be the responsibility of the regulated community. All ordinance efforts relating to stormwater discharge will be handled by Phase II of the NPDS permit. The Phase II Program pertains to all public entities such as municipalities operating separate storm sewer systems within urban areas.

INFORMATION AND EDUCATION

Potential Partners for the Community Outreach and Educational Plan

- Wetland and Coastal Resources
- Spicer Group, Inc
- Genesee County Drain Commissioner
- University of Michigan (Flint)
- University of Michigan, Center for Applied Environmental Research
- Flint River Watershed Council
- Natural Resources Conservation District
- Genesee County Road Commission
- Genesee Institute
- County Equalization Data
- Conservation District

This section of the watershed management plan is the first BMP tool that will be implemented for each objective by source. These BMPs are organized as part of Table 5 (Appendix N). An effective community outreach and education plan is key to implementing the Kearsley Creek Watershed Management Plan. A successful education plan is important because reducing the pollutants affecting water quality in Kearsley Creek will require voluntary behavior changes on the part of residents, decision makers and the community as a whole. The Kearsley Creek Watershed Education plan goals focus on promoting watershed awareness through watershed education and the encouragement of stakeholders to take actions to improve water quality. To accomplish these goals the Kearsley Creek education plan consists of the following components:

1. A review of existing watershed education activities
2. Kearsley Creek plan goals, objectives and actions to implement the plan
    - Prioritization of target audiences and pollutants targeted in education activities
3. Watershed education tool kit

1.) Existing watershed education efforts

Currently there are several watershed education efforts taking place in the Kearsley Creek Watershed and/or its adjoining watersheds. A brief discussion of these programs is provided here to identify opportunities for collaboration and to minimize duplication of efforts.

The Genesee County Drain Commissioners (GCDC) office has been working with the municipalities of Genesee County to develop a Public Education Plan (PEP) as required under Phase II of the NPDES program. The focus of this broad campaign is on basic watershed education topics including defining a watershed and illustrating the impacts of storm water pollution. The plan also covers topics needing action steps required under the NPDES program including:

1. The encouragement of people to report the presence of illicit discharges or improper disposal of materials into storm water systems
2. Education of the public regarding the proper disposal of household hazardous waste, travel trailer waste, chemicals, grass clippings, leaf litter, animal wastes and motor vehicle fluids
3. Acceptable application and disposal of pesticides and fertilizers
4. The use of preferred cleaning materials and procedures for car washing
5. Education of the public regarding the final discharge point and potential impacts of separate storm water drainage systems serving their place of residence
6. Stewardship of local watersheds
7. Education of the public regarding management of riparian lands to protect water quality

The implementation of the Phase II public education program will use a number of methods and techniques to educate the public concerning the topics outlined above. These formats will include radio and television announcements, speaker's circuits, billboards, newspaper articles and other mass media promotions. The

implementation of the Phase II Stormwater Education program is scheduled to begin in 2006.

The Phase II Program provides many of the basic elements required for the implementation of a public education program for the Kearsley Creek Watershed. Details of this plan are available at the Genesee County Drain Commissions Phase II webpage www.cleargeneseewater.org. The education activities associated with the Phase II programs unfortunately, however, do not address specific issues identified as affecting designated uses within the Kearsley Creek Watershed. The program outlined here will complement the Phase II program by providing specific education activities based on target audiences and specific pollution problems identified in the planning process.

Other Existing Watershed Education Activities

In addition to the activities underway as part of the Phase II storm water program, other complementary education activities will also be underway in the Swartz Creek and Gilkey Creek Watersheds. These watersheds are currently undergoing watershed planning and watershed education plan development. Efforts should be made to continue coordination between the sub-watershed management plans to ensure that learning and collaboration can continue over the course of the projects.

2.) Kearsley Creek Education Plan

The Kearsley Creek Planning Team developed the following campaign to focus on specific problems identified in the physical, hydrologic and policy analysis conducted during the planning phase. Focusing education efforts will provide a long-term solution to the problems associated with non-point source pollution in the Kearsley Creek Watershed. This program targets the specific pollutants, sources and causes that are impacting water quality in the Kearsley Creek Watershed.

The Kearsley Creek Watershed Education Plan will focus on three primary categories of activities including increasing stakeholder's awareness of the

watershed, educating them about the watershed, and finally motivating them to actively participate in protecting, preserving and restoring the watershed. In order to be successful in implementing the plan a set of goals, objectives and specific activities was developed. Using a goal, objective and action framework ensures focus in the education plan and provides a means for evaluating the success or failure of the education efforts. The team also identified responsible parties and recommendations on how to evaluate the success or failure of implementing each action item identified.

Listed below are the three goals recommended by the Kearsley Creek Steering Committee. Each of the goals is followed by a detailed description of objectives, actions and measures of success.

Goals, objectives and actions to implement the Kearsley Creek Education Plan

1. Build and retain stakeholder awareness of Kearsley Creek Watershed.

2. Educate stakeholders about the link among human activity, NPS and water quality in the Kearsley Creek Watershed

3. Motivate individuals, governmental agencies and organizations to take actions to protect, preserve and restore water quality in the Kearsley Creek Watershed.

Goal 1. Build and retain stakeholder awareness of the Kearsley Creek Watershed

The first goal of the plan focuses on general awareness of the Kearsley Creek and the condition of water quality in the Watershed. The objectives detailed under this goal will ensure that watershed stakeholders become familiar with the Kearsley Creek Project, the physical location of the watershed and the NPS issues facing the watershed.

Objective 1.1 Raise awareness of Kearsley Creek Watershed planning efforts

Actions :

a. Develop logo to brand Kearsley Creek Watershed planning and implementation activities
b. Conduct presentations to local groups (Rotary, Optimist, etc) about findings of project
c. Distribute media releases and kits / letters to editors on findings of Kearsley Creek Watershed project
d. Present findings to planning and elected officials in the watershed

Measures:

1. Logo developed
2. Presentations conducted
3. Letters/articles published

Tools: Brochure, Slide Library, Kearsley Creek Logo, Water Quality Report

Objective 1.2 Build awareness of the geographic location of the Kearsley Creek Watershed

Actions:

a. Conduct watershed tours for Township Trustees, Planning Commissions Municipal Councils to identify drainage divides, BMP's implementation sites and important landmarks within the watershed
b. Develop and distribute watershed map series to various audiences including municipal officials and interested residents
c. Place signage on major roads around drainage divide welcoming drivers to Kearsley Creek Watershed

Measures:

1. Maps produced, distributed, and displayed in local government offices and public locations
2. Tours conducted and evaluation forms completed gauging value of event and knowledge gain
3. Signage placed in watershed

Tools: Map Series, Watershed Signs, Watershed Tours

Objective 1.3 Build awareness of the effects of landuse and non-point source pollutions water quality in Kearsley Creek

Actions:

a. Conduct storm drain stenciling program (to be completed under Phase II)
b. Write articles about specific landuse topics impacting Kearsley Creek to be used in newsletters and other educational resources with specific emphasis on maintaining riparian vegetation to reduce erosion
c. Produce and distribute user friendly "water quality report" that identifies local stretches of streams that would benefit from expanding riparian vegetation

Measures

1. Number of drains stenciled
2. Meeting attendance/evaluations
3. Issue focused articles produced
4. Water quality report produced distributed

Tools: Storm Drain Stencils, Water Quality Report, Stakeholder List

Goal 2. Educate stakeholders about the linkage between human activity and water quality in the watershed.

The focus of goal two is to provide more specific information about the non-point source issues facing the stakeholders of the Kearsley Creek Watershed. Emphasis will be placed on voluntary implementation and maintaining of buffers. This goal focuses on specific target audiences such as riparian property owners and causes of pollution identified in the planning process. Goal two also includes objectives that promote the benefits of personal stewardship and responsibility of municipal officials in protecting water quality. The Information and Education BMPs will focus on Atlas, Davison and Genesee townships because of the high percent of watershed located in these three townships. All other townships within the watershed will be invited to attend meetings.

Objective 2.1 Educate target audiences about specific sources and causes of water quality reduction in the Kearsley Creek Watershed.

Sources	Target Audiences	Specific Target Audiences	Specific Activity	Priority
Stream bank erosion	Property owners	Adjacent property owners to Kearsley Creek – residential, and commercial.	Promote and conduct riparian landowner workshop that features benefits of landscaping alternatives Distribute riparian stewardship information	1
	Genesee County Road Commission	Engineers designing replacement structures – culverts, bridges, etc.	Hold conference on culvert bridge design policy and repair	
	Agricultural agencies	Natural Resources Conservation Service (NRCS), Soil Conservation District (SCD)	Emphasize benefits of implementing buffer strips	
Stormwater input & Unstable hydrologic flow	Developers, Township officials	Site plan designers & Township zoning administrator and supervisor	Conduct one on one and public meetings regarding alternative site plans for water quality Conduct one on one meetings with municipal officials regarding alternative zoning options	2
Development	Developers	Those responsible for soil erosion and stormwater discharge plans	Conduct soil/sed education programs for violators of soil/sed policies	3

*Activity should be coordinated with other education programs or watershed plans

Measures:

1. Number of riparian stakeholder workshops held
2. Amount and type of riparian stewardship info distributed

3. Meetings held and policy adopted regarding road crossing design
4. Site plan and zoning education activity conducted
5. Soil and sedimentation violators attended education programs

Tools Stakeholder Lists, Riparian Stewardship Brochure, Filing the Gaps**,** Ordinance policy matrix

Objective 2.2 Educate residents about the benefits of personal stewardship of the Kearsley Creek Watershed

Actions:

a. Coordinate and conduct river cleanup for Kearsley Creek Watershed
b. Promote the physical and psychological benefits of using Kearsley Creek as recreation resource and education tool
c. Produce articles for community newsletters that discuss the benefits of watershed planning for future generations and economic viability of communities (to be completed under Phase II)

Measures:

1. Clean ups conducted and number of participants
2. Riparian workshops held and evaluations collected
3. Newsletters produced
4. Project Green sampling of Creek
5. Amount of riparian buffers installed

Tools Prepared Newsletter Articles, Riparian Stakeholder Brochure

Goal 3. Motivate individuals and government agencies to take action to protect, preserve and restore water quality in Kearsley Creek Watershed

Active involvement in watershed protection by a diverse group of stakeholders is the key to sustainable water resource protection. Goals one and two set the basis of our education plan and facilitate the achievement of goal three. This goals

objectives focus largely on assisting citizens and decision makers in implementing voluntary BMPs, policy changes and participating in stewardship activities.

Objective 3.1 Encourage participation in FRWC by KCW stakeholders

Actions:

a. Focus annual membership drive in target areas of KCW
b. Provide complementary one year memberships to strategic KCW Stakeholders including municipalities, potential business partners, and riparian residents
c. Develop and advertise a Kearsley Creek/"Adopt a Creek" Committee within FRWC
d. Target volunteering monitoring program participation in Kearsley Creek watershed

Measures:

1. Track number of Kearsley Creek residents in FRWC
2. Track # of returning Kearsley Creek Residents in FRWC after one year membership
3. Kearsley Creek/"Adopt-a-Creek" committee formed and actively meeting
4. Increased number of volunteer monitoring sites and participants in KCW

Objective 3.2 Conduct education programs about benefits of land preservation and value of buffers with land conservancies and the NRCS

Actions :

a. Contact potential conservation land owners to gauge interest in land conservation
b. Schedule meetings between land preservation specialists from local land conservancy

c. Facilitate support to educate landowners on benefits of participating in riparian protection programs and land preservation for natural flood storage
d. Schedule meetings between NRCS and farmers to develop new buffers and maintain existing ones

Measures:

1. Landowners contacted
2. Meetings held between landowners and local land conservancy
3. Land preservation successfully implemented on several priority sites in watershed
4. Meetings held between farmers and NRCS agents

Tools Stakeholder lists

Objective 3.3 Work with municipal officials to adopt water quality related ordinances

Actions:

a. Conduct one-on-one and public meetings to present the policy review findings (to be completed under Phase II)
b. Work with municipal officials and developers to identify sites to implement alternative building/development designs (one in each of the three largest municipalities) (to be completed under Phase II)
c. Conduct focused education on the uses of watershed plans in other community planning activities (master planning, parks and recreation, etc) (to be completed under Phase II)
d. Stormwater detention ordinance to reduce stream flashiness and to remove pollutants (to be completed under Phase II)

e. Riparian protection ordinance to improve water quality and stabilize stream banks (both 319 and Phase II)

Measures

1. One on one and public meetings held
2. Number of changes made to local ordinances or new ordinances adapted to protect water quality
3. Identify Watershed management plan recommendations included in master plans, zoning decisions and parks and recreation plans

Tools Ordinance/policy review matrix

3.) Watershed education tools

Information Brochure: A brochure that contains general information about the watershed (Location, definition of watershed, BMP's) will be developed to use with various audiences. The brochure will include graphic of a hypothetical watershed, the Kearsley Creek Watershed Logo and contact information about the project.

Riparian Stewardship Brochure: Riparian residents were identified as a primary target audience during the physical inventory of the KCW. A brochure will be developed that focuses on retaining and restoring vegetative buffers, improving shoreline habitat, and reducing run-off pollution from the landscape.

Riparian Stakeholder list: A riparian stakeholder list will be generated using a Geographic Information System. This GIS system will inexpensively produce a mailing list of residents who own property adjacent to Kearsley Creek. These stakeholders were identified in the physical inventory as a primary target audience. This list will provide an effective way to disseminate information to this key target audience.

Business Stakeholder List: Including business in the implementation of the watershed management plan will be important to the success of the education plan. A list can be divided into two categories including a general business group and those that directly impact water quality.

General business: This list will provide several potential assets to the Kearsley Creek Project for information dissemination and for potential sponsorship of education activities such as Project Green Adopt-A-School. These locations will generally consist of businesses that require individuals to wait for a service such as Dr. Offices, Barber shops, Oil change locations, restaurants, etc. Disseminating information at these locations will provide increased chance of individuals reading the information while they wait for services.

Direct Impact List- This List will identify those businesses that are engaged in activities that have the potential to positively or negatively impact water quality directly. These could include business such as septic companies, fertilizer retailers, auto repair, local nurseries, car washes etc. Partnerships should be developed between local watershed advocates and these businesses to promote the responsible use of their products.

Watershed Tours: A series of tours of the Kearsley Creek watershed will be conducted for local planning and elected officials. The purpose of these tours will be to familiarize local officials with the geographic location, physical appearance and water quality of various parts of the watershed. These tours will also provide opportunities for stakeholders to visit various BMP implementation sites.

Watershed Maps: the ability to identify ones location within a watershed is fundamental to understanding individual impacts on the watershed and the impacts the watershed has on individuals and communities. A series of simple maps will be

generated that identify the location of municipal boundaries, watershed divide, and cultural landmarks such as township offices, historical locations etc.

Kearsley Creek Watershed Display: A permanent display about the watershed including information about general watershed principles and Kearsley Creek specific problems and solutions. This permanent display will be use on a rotating basis at school, libraries and public spaces such as shopping centers.

Kearsley Creek Stewardship Certificate/Seal: Use the Kearsley Creek Watershed logo in the development of a certificates/seal to present to governments.

Ordinance Policy Matrix- During the planning process, a review of local ordinances was conducted. The results of this review are presented in a matrix that identifies the degree to which individual municipalities have policies in place to protect water quality. This matrix also illustrated the individual policies that are being or not being implemented across the watershed. This matrix will allow decision makers to understand how their municipality is "doing" with regards to water resource protection and identify the ways in which they may improve their policies.

Filling the Gaps- Filling the Gaps is a document produced by the Michigan Department of Environmental Quality to assist local governments in protecting their natural resources. This document provides a comprehensive overview of relevant enabling legislation, example ordinances and case studies of their application.

Slide Library- A power point slide library will contain a wide variety of slides that can be used to develop presentations that can be used with various target audiences. These slides will include a wide range of topics and will incorporate the Kearsley Creek Watershed logo.

Watershed Signage – These signs will be designed and developed in coordination with the Genesee County Road Commission and be placed around the watershed to increase identification of the Kearsley Creek Watershed.

QAPP, EVALUATION AND MONITORING

In the initial review stage of the project, the MDEQ determined that monitoring and sampling using MDEQ Procedure 51 would not provide additional information useful for stream evaluation. The MDEQ had already sampled using Procedure 51 and based on the results, Procedure 51 was not precise enough to discern the required differences before and after analysis. The same conclusion was reached for water quality samples. Therefore, Procedure 51 was used to provide background data at stations that were not sampled by the MDEQ. Based on the review of the hydrologic data and the sub watersheds, there are no erosion conditions at the present time that are related to hydrology. With the implementation of local requirements of on-site detention for future developments, and stormwater discharge at the pre-development rate, future hydrology problems will be minimized. The overall master plan for Kearsley Creek will require the analysis for time of concentration of flood waters from the sub-watersheds. This will insure that erosion and scour velocities do not increase under build out conditions to an extent that causes erosion of the stream banks and river system. The monitoring that is appropriate is to re-do the erosion assessment at a later date to determine if the local measures are working.

Monitoring and evaluation will be focused on measuring success of the physical efforts including streambank stabilization and other erosion control (Appendix J; Table 6). Load reductions can be verified through these assessments. All monitoring and evaluation will use the same methodology as used in assessment of Critical Areas and monitoring sites will correspond to sites initially assessed. Consistency in assessment methods will provide for accurate long-term measurements of the success of the restoration and enhancement efforts.

If P51 macroinvertebrate scores decrease for two consecutive years, the site will be identified as needing further analysis to determine the cause of the observed reduction.

New construction projects will be evaluated to verify that stormwater storage volume is sufficient to maintain pre-development rates of runoff. Visual observations and calculations will be used to evaluate the storage necessary for future developments to maintain a predevelopment runoff rate.

On-site observations using stream widths and water depths at restored sites will be recorded and followed up on an annual basis during low flows. Photographs of each restoration area will be taken. Local residents and volunteers will be involved with monitoring. Data observations will be reported to the GCDC steering committee. This approach will reduce costs and increase public involvement. Trained experts will conduct technical monitoring issues and procedures as identified in Table 6.

Focus group meetings will also be conducted. Public perception and satisfaction will be determined based on input from these meetings. The success of the restoration efforts, access development, and creek corridor protection will be discussed and documented in meeting minutes.

Monitoring is expected to begin with implementation of the watershed management plan. Construction methods will be assessed during implementation to assess success, costs, and identify problems that may occur. This information will be utilized in future implementation.

WATER QUALITY SUMMARY

Designated Uses

Kearsley Creek Watershed has three designated uses that have been identified as threatened:

(1) Warmwater Fishery
(2) Coldwater Fishery
(3) Other Aquatic Life and Wildlife

Project Goals for Designated Uses

1. Re-establish and enhance the warmwater fishery

The warmwater fishery is threatened due to sedimentation, which has covered much of the downstream channel. A total of 52 areas of erosion were directly assessed and 50 of these sites were eroding. These results were extrapolated to the portions of the stream that were not directly assessed and an estimated 107 sites were determined to require remedial action. Unless adequately addressed, hydrologic flows will impact Kearsely Creek at full build-out if construction of on-site and regional detention or retention does not occur within each of the sub-watersheds. The warmwater fishery will be protected by:

(a) Stabilizing eroding banks. (107 sites)
(b) Stabilizing culvert inverts. (8 sites)
(c) Stabilizing bridges. (16 sites)
(d) Stabilizing hydrology by constructing/enhancing wetland areas at locations within the watershed to provide flood storage and natural resources.
(e) Establishing vegetative buffer zones along approximately 7 miles of stream at golf courses, along agricultural fields and residential lots.

(f) Creating regional detention or retention systems in each sub-watershed, as required.

2. Re-establish and enhance the coldwater fishery

The coldwater fishery is threatened due to sedimentation. At County Line Road, the coarse substrate and woody debris is covered with sediment. The primary source of this sediment was identified as bed load from runoff upstream of County Line Road. The coldwater fishery will be protected by:

(a) Decreasing sediment input from gravel roads.
(b) Stabilize eroding shorelines.

3. Re-establish other indigenous aquatic life and wildlife

Other indigenous aquatic life and wildlife is threatened due to sedimentation. The indigenous aquatic life and wildlife will be protected by:

(a) Stabilizing eroding banks (107 sites).
(b) Stabilizing culvert inverts (8 locations).
(c) Stabilizing bridges (16 locations).
(d) Stabilizing hydrology by constructing/enhancing wetland areas at locations within the watershed to provide flood storage and natural resources.
(e) Establishing vegetative buffer zones at golf courses, along agricultural fields and residential lots.
(f) Creating regional detention or retention systems in each sub-watershed and re-establish functional floodplain.

Desired Uses

Kearsley Creek Watershed has two desired uses that have been identified as threatened:

(1) Protect stream corridor from further degradation

(2) Restore fisheries habitats (cold and warmwater)

Project Goals for Desired Uses

1. Maintain floodplain functions

The function of a floodplain as it relates to hydrology is to store water during storm events. In Kearsley Creek, this function has been impacted by channel alteration and incising of the creek at some of the downstream sections. Floodplain functions will be protected by:

(a) Create stormwater/wetland detention or retention basins within each of the sub-watersheds, as required.

(b) Placement of grade control structures.

(c) Requiring predevelopment runoff rates for new developments within the watershed.

2. Protect Stream Corridor

The Kearsley Creek stream corridor, including the creek and adjunct floodplains are likely the most significant natural resources within the Flint area. It is critical that these resources be preserved to protect those resources along with resources associated with the Flint River. Protection of the corridor will be accomplished by:

(a) Implementing the information and educational plan identified within the watershed management plan

1. Obtain easements or purchase lands for those areas identified as critical
2. Township and county governments adopting ordinances to protect natural resources.
3. Educate the public on the resource values of Kearsley Creek.

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