8. INFORMATION AND EDUCATION STRATEGY

This Information and Education (I/E) Strategy has been developed in cooperation with several partner groups, individuals and organizations. The purpose of the I/E Strategy is to document a clear set of goals, objectives and action items that will inform and educate the public about things they can do to help restore the designated uses in the watershed. The I/E Strategy sets a clear path for responsible partners, stakeholder groups and others to follow, and builds upon existing partnerships, programs and activities. This will lead to new opportunities and activities, and ultimately measurable improvements in awareness of water quality issues, with the goal of affecting positive behavioral changes in the watershed.

8.1 Survey Data

An abundance of data that describe the water quality-related knowledge and behavior of existing residents in both the urban and rural areas of the watershed are available. Both the Middle Grand River Watershed Planning project (MGRWP) and the Greater Lansing Regional Committee for Stormwater Management (GLRC) have conducted surveys of residents in the region. Several areas in the Red Cedar River Watershed (RCRW) overlap with those of the MGRWP and the GLRC geographical boundaries; since the population demographics in the RCRW are similar to that of the surveyed populations, it is assumed that both the MGRWP and the GLRC data reflect the public's opinions and beliefs of residents in the RCRW. The analysis of the data and subsequent I/E planning activities related to it have been a collaborative effort among these watershed efforts.

Identifying Target Audiences

Based on the survey data and discussions with various partner organizations within the RCRW, target audiences were identified for the I/E activities. The audiences include three categories: urban, rural residential and agricultural. The MGRWP survey data were collected for each of these audiences, while the GLRC survey focused on urban and rural residential audiences.

Urban Audience

The urban audience includes residents within any village or city limits and the urbanized area in the Lansing vicinity as defined by the US Census Bureau.

Rural Residential Audience

The rural residential audience includes individuals who may have a small amount of property without livestock or farms, or who may live in a subdivision or just outside of one.

Agricultural Audience

The agricultural audience includes those who live outside of the urban area and have livestock or farmland. This includes large producers and those operating smaller animal farms, including individuals who may have only a small number of farm animals.

Middle Grand River Watershed Planning Project Survey Data

In the fall of 2011, the Eaton Conservation District (ECD) conducted a residential survey as part of their MGRWP (ECD, 2012). Some of the key findings are summarized here. Three different surveys were sent to three separate audiences: urban, rural residential and agricultural. Each surveyed group agreed that it is their personal responsibility to help protect water quality. The surveyed groups also agreed that using recommended farm best management practices (BMPs) and yard and lawn care can influence water quality in local rivers and lakes. While the audience is aware of the problem and understands the need for BMPs, less than half of respondents (15% agriculture, 35% rural residential and 45% urban) agreed that they would be willing to pay more to improve water quality.

Michigan State University Extension (MSU-E) was identified as the most trusted resource for all three audiences. Conservation districts, county health departments, and the Michigan Department of Natural Resources were the second most trusted resources from agricultural,

rural residential and urban residents, respectively. The survey results indicate that effort is needed to educate stakeholders about the types of water pollution and the specific sources of pollutants. Since there is a high level of agreement about personal responsibility for water resources, behavioral change is more likely to be realized if the importance of specific BMPs is clearly explained to each target audience.

Greater Lansing Regional Committee for Stormwater Management Survey Data

The GLRC completed a statistically valid public education survey in 2006 to develop a baseline representation of knowledge and behavior related to water quality protection and pollution prevention in the urbanized area of the Grand, Red Cedar and Looking Glass River Watersheds (ETC Institute, 2006). Based on these results and the federal stormwater permit requirements, with very limited funding, the GLRC developed a public education campaign. The effectiveness of the campaign was measured with a follow up survey in 2012. The 2012 follow up survey used the same survey instrument and methodology as the 2006 effort, and the data were tabulated across the watersheds to assess changes in knowledge, willingness to change and behavior patterns of citizens in different portions of the watersheds.

GLRC survey results indicate that more than one-third (38% or about 130,000) of area residents had taken some type of action to protect water resources in the past five years and 11% indicated that they "didn't know" if their household had done anything that would have helped protect water resources. The percentage of residents who indicated their household had taken some type of action to protect water resources increased by 11% from 2006 to 2012, which equates to an increase in the number of people taking action by approximately 38,000 residents.

The survey asked how willing residents are to take certain actions to reduce water pollution. Residents were most willing to dispose of hazardous waste at a community collection day (92%), sweep excess fertilizer/grass clippings into their lawn (90%), change their car washing practices (86%), and use low phosphorus or slow release fertilizer (85%). Residents were least willing to have their soil tested (50%).

The survey also queried residents about their knowledge concerning the connection of stormwater runoff and water resources. Forty-nine percent (approximately 168,000 residents) thought stormwater went directly to lakes/streams without treatment; 17% thought it went to a treatment plant, 12% thought it went to lakes/streams with treatment and 22% indicated that they "did not know." The percentage of residents who thought that stormwater went to lakes/streams without treatment decreased 7% from 56% in 2006 to 49% in 2012. The GLRC notes that the survey results indicate more public education about stormwater runoff and its impacts on local rivers and lakes is needed.

8.2 Goals and Objectives of I/E Strategy

Goals and objectives are described here are on an overarching level and are directly correlated from the survey data described above. The actions identified in Table 8.1 are specific to each target audience.

General Goals:

- Increase awareness of impairments, caused by pollutants, including *E. coli*, sediment, nutrients and dissolved oxygen levels
- Encourage implementation of BMPs
- Work collaboratively with other watershed groups, agencies and organizations on I/E efforts

General Objectives:

- Use survey results to guide and adapt strategy
- Through stakeholder involvement, establish a point of contact/organizational structure for implementation activities

- Increase availability of information about BMPs and other implementation-related activities

8.3 Developing Messages

The I/E Strategy builds upon existing messages that are currently in place as part of regional educational efforts. Example messages include education pertaining to the following topics:

- Manure storage and application
- Wetland restoration
- Soil conservation methods
- On-site septic system maintenance
- Proper soil management
- Native plantings
- Fertilizer use and application
- Pet waste reduction
- Low impact development techniques
- Rain barrel use and downspout disconnection

8.4 Selecting Delivery Mechanisms and Activities

Delivery mechanisms are a crucial component of the I/E Strategy. Getting the public engaged is a critical first step in changing knowledge and behavior in order to protect and improve water quality. There are several water quality-related education efforts underway in the watershed and surrounding areas. In addition, the survey data identify agencies and partners that have established credibility as a trusted source to local residents. The I/E Strategy aims to use the existing educational efforts and partnerships with trusted sources to create an effective and efficient approach to outreach and education. Delivery mechanisms include:

- Demonstration projects
- Workshops with trusted sources
- Exhibit/display materials
- Print materials (brochures, posters)
- Promotional items
- Social media announcements
- Public access television
- Local radio
- Billboards
- Incentive programs (septic system cleaning coupons)
- Giveaways
- Direct mail
- Community newspapers
- Multi-media
- Special events
- Presentations

8.5 Regional Collaboration and Partnerships

Regional partnerships are a critical component of the I/E Strategy. The watershed management plan (WMP) and implementation of the plan should enhance and strengthen these existing efforts through increased partnerships, funding and evaluation of outreach activities. Geographic areas and municipal boundaries overlap among and between the Middle Grand River Organization of Watersheds (MGROW), the MGRWP and the Red Cedar River WMP boundaries. In recent years, information, education and outreach efforts have been coordinated to increase effectiveness. This cooperative approach will continue in order to strengthen the existing partnerships, with an emphasis on restoring designated uses.

Middle Grand River Organization of Watersheds

There are a number of watershed-based initiatives underway in the larger Middle Grand River Watershed, to which the Red Cedar River is a tributary. These include the MGRWP, GLRC, Friends of the Looking Glass, Friends of the Maple River and the Maple River Implementation Project. Since all of these efforts have similar I/E components, including audiences, pollutants, messages, calls to action, events, clean ups, etc., the Tri-County Regional Planning Commission (TCRPC) has facilitated a regional approach to I/E with the help of the MGROW. MGROW is an umbrella organization that is striving to service the region's watershed groups (listed above) and bring collaborative solutions to the various efforts. MGROW also works to improve recreational opportunities and improve the public perception of our local water resources.

The TCRPC Mid-Michigan Program for Greater Sustainability has offered its support to the work of MGROW, believing that a regional, collaborative approach to I/E is more cost effective and efficient, and will ultimately help to sustain water resources education over the long term. The MGROW educational campaign currently underway seeks to relay to the public that while they might not live directly on the river, what they do affects water quality. Very simple action-oriented language is used to encourage behavior change.

The campaign is titled *Pollution Isn't Pretty*. The website associated with the campaign (pollutionisntpretty.org) is a gateway page linking to all local watershed initiatives including the RCRW Planning project. Since the launch of the campaign in December 2013, several local radio stations and public access television stations have covered its release. This provides regional coverage and helps spread the messages of the campaign and partnerships. Billboards purchased by the GLRC and the ECD have brought awareness to the campaign. These groups continue to promote the campaign through social media, print materials and educational displays. This is a valuable, efficient and effective collaborative project that is included as a foundation of this I/E Strategy.

<u>Middle Grand River Watershed Planning Project I/E Strategy</u>
The MGRWP, the adjacent watershed's nonpoint source planning effort, has also developed an I/E Strategy. The TCRPC has provided input to both the MGRWP and RCRW I/E Committees, as well as coordinated the Regional Education Campaign on MGROW's behalf. This is important as TCRPC can serve as the liaison for these groups with similar demographics, adjoining watershed boundaries, and water quality impairments.

<u>Greater Lansing Regional Committee for Stormwater Management Public Education Plan (PEP)</u>
The GLRC is a guiding body comprised of participating Municipal Separate Storm Sewer System (MS4) communities within the Greater Lansing Region. The committee has been established to guide the implementation of the entire MS4 Stormwater Program for the communities within three identified watersheds: the Grand, Red Cedar and Looking Glass River. The GLRC focuses on the following components of I/E:

- Promote public responsibility and stewardship in the applicant's watershed(s).
- Inform and educate the public about the connection of the MS4 to area waterbodies and the potential impacts discharges could have on surface waters of the state.
- Educate the public on illicit discharges and promote public reporting of illicit discharges and improper disposal of materials into the MS4.
- Promote preferred cleaning materials and procedures for car, pavement, and power washing.
- Inform and educate the public on proper application and disposal of pesticides, herbicides, and fertilizers.
- Promote proper disposal practices for grass clippings, leaf litter, and animal wastes that may enter into the MS4.
- Identify and promote the availability, location, and requirements of facilities for collection or disposal of household hazardous waste, travel trailer sanitary wastes, chemicals, yard wastes, and motor vehicle fluids.

- Inform and educate the public on proper septic system care and maintenance, and how to recognize system failure.
- Educate the public on, and promote the benefits of, green infrastructure and low impact development.
- Promote methods for managing riparian lands to protect water quality.
- Identify and educate commercial, industrial, and institutional entities likely to contribute pollutants to stormwater runoff.

GLRC Members include those municipalities in the urbanized area. Those communities are currently implementing the GLRC PEP. This I/E Strategy for the RCRW includes the activities being conducted by the GLRC PEP and expands them to other geographical areas of the watershed, throughout Ingham and Livingston Counties.

The Grand Learning Network

The Grand Learning Network is a program facilitated by Michigan State University (MSU) to bring place-based education to local school districts through hands-on activities related to water quality and watershed management. The program provides in-depth professional development opportunities to elementary school teachers, who then implement activities in the classroom. Examples of projects include: salmon in the classroom (raising salmon over the school year and releasing them to area waterways), building rain gardens, planting natural prairie lands (from seed the students raised), providing habitat areas at a restored wetland, etc.

Social Media

Both MGROW and the GLRC have been using social media such as Facebook and Twitter to reach local residents. Social media is also a useful way to connect with partners, sharing each other's events, activities and ideas. The team will look to these organizations to share events and information through existing social media channels as the WMP is implemented.

Local Events

There are several recurring, local events that focus on responsible watershed management. This I/E strategy recognizes the importance of these events and will seek to encourage the continuation of them. Some of these local events are included below.

River clean ups provide a unique opportunity to interact with the public. The MSU Fisheries and Wildlife Club conducts annual fall and spring clean ups on the Red Cedar River through campus. The Ingham Conservation District (ICD) conducts an annual clean up on the Sycamore River near Mason. The Lansing Board of Water & Light, in partnership with the Impression 5 Science Museum, conducts an Adopt A River event on the Grand River in downtown Lansing, not far from the Red Cedar confluence.

Each spring the TCRPC Groundwater Management Board's Annual Children's Water Festival is held on the MSU Campus. Over the past 17 years, the festival has had great success with more than 34,000 students (fourth, fifth and sixth graders) from area schools attending. The festival provides a field trip for students, where they learn about the importance of water resources and their role in protecting and conserving it. The students participate in three 25-minute hands-on activities that relate to water resources. They also get to experience Billy B, the "natural science song and dance man" who provides an interactive musical performance based on water stewardship.

The Mid-Michigan Environmental Action Council (Mid-MEAC) Volunteer Stream Monitoring program monitors the macroinvertebrate communities in the Red Cedar River. They conduct a volunteer training day, and spring and fall collection days. A local entomologist and aquatic biologist assist with macroinvertebrate identification. This is a hands-on activity for volunteers and an opportunity to educate them about indicators of water quality.

Other Potential Partners

There are several other programs, organizations and agencies that will be important partners in the implementation of the I/E Strategy. These include, but are not limited to, Trout Unlimited, Project Fish, Salmon in the Classroom, Conservation Districts, and other local, state and federal agencies.

8.6 Implementation of I/E Strategy

The I/E Strategy action items are categorized by short term (1-3 years) and long term (4-7 years) efforts. Implementation of each action will occur according to the time listed in Table 8.1. While the actions listed are specific to I/E, other educational opportunities may arise through other partnerships described in Chapter Nine. Implementation actions are always evolving as new opportunities arise.

For the I/E Strategy, enhancing the *Pollution Isn't Pretty* campaign is an important next step. The existing campaign can be utilized but developing additional materials that address BMPs for rural residential and agricultural audiences is necessary. This will be coordinated with other watershed groups that utilize the campaign.

Table 8.1 I/E Implementation

	Action	Priority (High, Med, Low)	Topics/Pollutant, Source, Cause Link	Delivery Method	Existing Programs	Lead Agency	Other Responsible Partners*	Timeline ST (1-3 yrs)/ LT (4-10 yrs)	Estimated Cost	Evaluation
URBAN	Use social media to expand audience discussion and sharing of information related to water quality.	High	***E. coli*:** pet waste; **Sediment:** reducing exposed soil, construction sites; **Nutrients:** fertilizer reduction/management	Twitter, Facebook, Pinterest, Instagram, LinkedIn, etc.	PIP, partner organizations, federal agencies, nonprofits, etc.	MSU, GLRC	All partners with an existing social media/online presence	ST - ongoing	$30,000/year Part time social media/website manager	Likes, followers, shares, discussion/comments, SIDMA** pre/post survey results
	Co-host 1 event with a trusted partner to increase knowledge about nonpoint source pollution.	High	***E. coli*:** pet waste; **Sediment:** reducing exposed soil, construction sites; **Nutrients:** fertilizer reduction/management	Direct contact, trusted partner communication channels, social media	Recycling events, Landscaping for Water Quality and Rain barrel, home energy efficiency workshops	MSU	**DNR, MSUE, USEPA, MDARD, MDEQ,** MEO, Mid-MEAC, GLRC, TCRPC	ST - ongoing	$3,000 for printing, promotional items, etc.	Number of attendees, media coverage of event, assessment of pre/post project, SIDMA pre/post survey results
	Participate in 3 community events per year to promote water quality BMPs for pet waste reduction and fertilizer management.	High	***E. coli*:** pet waste; **Sediment:** reducing exposed soil, construction sites; **Nutrients:** fertilizer reduction/management	Interactive presentation and/or guest speaker, material disbursement , promotional items	Children's Water Festival, Arbor Day, Earth Day MDEQ, Quietwater Symposium, community art/music events and initiatives	MSU	TCRPC, **CD**, MSU, GLRC, **State/Federal gov**, nonprofits, **higher education institutions**	ST - ongoing	$3,000/event	Number of attendees/participants, media coverage of event, assessment of pre/post project, SIDMA pre/post survey results
	Increase willingness to change the way an individual cares for their lawn/yard to improve water quality.	High	***E. coli*:** pet waste; **Sediment:** reducing exposed soil, construction sites; **Nutrients:** fertilizer reduction/management	Social media, newsletters, public presentations, billboard campaign, trusted partner communication channels, promotional items and materials	MI Turfgrass Environmental Stewardship Program, MI Water Stewardship website, PIP, MSUE	MSU	TCRPC, **CD**, GLRC, **State/Federal gov**, nonprofits, **higher education institutions**	ST - ongoing	$40,000 to develop and enhance existing campaign and materials	Increased willingness from GLRC survey results, SIDMA pre/post survey results
	Increase awareness that pet waste, residential stormwater runoff, roof runoff, stream bank erosion and street erosion are sources of pollution.	High	***E.coli*:** pet waste; **Sediment:** reducing exposed soil, construction sites; **Nutrients:** fertilizer reduction/management	Social media, newsletters, public presentations, billboard campaign, trusted partner communication channels, promotional items and materials	PIP	MSU	TCRPC, MSU, **CD**, GLRC, **State/Federal gov**, nonprofits, **higher education institutions**	ST - ongoing	$40,000 to develop and enhance existing campaign and materials	Increased knowledge from GLRC survey results, SIDMA pre/post survey results
	Identify 3 neighborhood associations (group of the associations) willing to participate in a demonstration project.	Medium	Stormwater management, low impact development techniques	Direct contact, association newsletters/communications, demonstration project itself	Lansing area - Allen, Old Town, South Lansing, Baily, Westside NW	MSU	Municipalities, GLRC, **CD,** Mid-MEAC, human service nonprofits (faith community), Friends/watershed nonprofits	ST	Minimum $5,000/project	Demo project built, number of people reached, assessment of pre/post project, future practice installation
	Increase awareness of low cost options (i.e. native plants, rain gardens, rain barrels, pervious pavers, downspout disconnect, turf management BMPs, pet waste management), to achieve water quality.	Medium	Stormwater management, low impact development techniques	Social media, newsletters, public presentations, billboard campaign, trusted partner communication channels, promotional items and materials	CD, MSUE programs	MSU	TCRPC, **CD**, MSU, GLRC, **State/Federal gov**, nonprofits, **higher education institutions**	ST - ongoing	$40,000 to develop and enhance existing campaign and materials	Increased awareness from GLRC survey results, SIDMA pre/post survey results
	Increase willingness to pay more to improve water quality by educating about low cost options.	Medium	***E. coli*:** pet waste; **Sediment:** reducing exposed soil, construction sites; **Nutrients:** fertilizer reduction/management	Social media, newsletters, public presentations, billboard campaign, trusted partner communication channels, promotional items and materials, demonstration projects, interactive presentations, community events	CD, MEO, MSUE, MI Water Stewardship website, GLRC	MSU	TCRPC, MSU, **CD**, GLRC, **State/Federal gov**, nonprofits, **higher education institutions**	LT	$40,000 to develop and enhance existing campaign and materials	Increased willingness from GLRC survey results, SIDMA pre/post survey results
	Use 3 images and/or messages related to scenic beauty and people enjoying water resources when engaging audience. Utilize issues related to public health.	Low	Overall environmental stewardship, connecting people to land and water.	Social media, newsletters, public presentations, billboard campaign, trusted partner communication channels, promotional items and materials	Pure Michigan, MGROW	MSU	TCRPC, MSU, **CD**, GLRC, **State/Federal gov**, nonprofits, **higher education institutions**	ST - ongoing	$1,000 - use existing messages and images	Estimated number of people reached

	Action	Priority (High, Med, Low)	Topics/Pollutant, Source, Cause Link	Delivery Method	Existing Programs	Lead Agency	Other Responsible Partners	Timeline ST (1-3 yrs)/ LT (4-10 yrs)	Estimated Cost	Evaluation
RURAL RESIDENTIAL	Increase willingness to adopt BMPs targeting pollutants.	High	***E. coli*:** pet waste, manure management and storage, septic maintenance; **Sediment:** reducing exposed soil, **Nutrients:** fertilizer reduction/management, stormwater management, low impact development techniques, overall stewardship	Social media, newsletters, public presentations, billboard campaign, trusted partner communication channels, promotional items and materials	NRCS - CD programs	MSU	TCRPC, **CD**, GLRC, **State/Federal gov**, nonprofits, **higher education institutions**	LT	$40,000 to develop and enhance existing campaign and materials	Number of BMPs adopted, SIDMA pre/post survey results
	Increase opinion that farm field soil erosion, stream bank soil erosion, improperly maintained septic systems, manure from farm animals, pet waste and residential stormwater runoff are sources of water quality pollution.	High	***E. coli*:** pet waste, manure management and storage, septic maintenance; **Sediment:** reducing exposed soil, **Nutrients:** fertilizer reduction/management, stormwater management, low impact development techniques, overall stewardship	Social media, newsletters, public presentations, billboard campaign, trusted partner communication channels, promotional items and materials	PIP, GLRC, CD, NRCS, MDARD, MSUE programs	MSU	TCRPC, MSU, **CD, GLRC, State/Federal gov, nonprofits,** higher education institutions	LT	$40,000 to develop and enhance existing campaign and materials	Increased knowledge from pre/post surveys, social media and website statistics, SIDMA pre/post survey results
	Identify 3 local governments willing to participate in a demonstration project.	Medium	Stormwater management, low impact development techniques	Direct contact, municipal/community newsletters/communications, demonstration project itself	N/A	TCRPC	Local governments, TCRPC, **CD**, nonprofits	LT	Minimum $5,000/project	Demo project built, number of people reached, assessment of pre/post project, future practice installation, SIDMA pre/post survey results
	Hold 3 workshops per year at a conveniently located community facility such as a library, school, township hall, etc. to educate on nonpoint source pollution	Medium	***E.coli*:** pet waste, manure management and storage, septic maintenance; **Sediment:** reducing exposed soil, **Nutrients:** fertilizer reduction/management, stormwater management, low impact development techniques, overall stewardship	Interactive presentation and/or guest speaker, material disbursement, promotional items	CD, MSUE programs	MSU	TCRPC, **CD**, GLRC, **State/Federal gov,** nonprofits, **higher education institutions**	ST	$3,000 for printing, promotional items, etc.	Number of attendees, assessment of pre/post workshop, SIDMA pre/post survey results
	Use 3 images and/or messages related to picnicking and family activities when engaging audience in information and education strategies. This could include: family playing near a stream, children and water, safe food as it relates to water quality and *E.coli*, etc.	Medium	Overall environmental stewardship, connecting people to land and water.	Social media, newsletters, public presentations, billboard campaign, trusted partner communication channels, promotional items and materials	PIP, partner organizations, federal agencies, nonprofits, etc.	MSU	TCRPC, **CD**, GLRC, **State/Federal gov,** nonprofits, **higher education institutions**	ST	$1,000 - use existing messages and images	Estimated number of people reached, social media and website statistics, SIDMA pre/post survey results
	Conduct direct mailings focusing on non-point source pollution.	Low	***E.coli*:** pet waste, manure management and storage, septic maintenance; **Sediment:** reducing exposed soil; **Nutrients:** fertilizer reduction/management, stormwater management, low impact development techniques, overall stewardship	Direct mail	Community news, utilize tax mailings, postcard	TCRPC	Local governments, TCRPC, nonprofits, **MSUE**	LT	$10,000	Number of residents mailed, website traffic, SIDMA pre/post survey results
	Install 100 educational signs at locations across the watershed.	Low	***E. coli*:** pet waste, manure management and storage, septic maintenance; **Sediment:** reducing exposed soil; **Nutrients:** fertilizer reduction/management, stormwater management, low impact development techniques, overall stewardship	Strategic sign placement	GLRC watershed signs	GLRC	GLRC, road commissions	LT	$8,000/100 signs	Number of signs installed, traffic counts

	Action	Priority (High, Med, Low)	Topics/Pollutant, Source, Cause Link	Delivery Method	Existing Programs	Lead Agency	Other Responsible Partners	Timeline ST (1-3 yrs)/ LT (4-10 yrs)	Estimated Cost	Evaluation
AGRICULTURAL	Increase willingness to adopt Best Management Practices.	High	***E. coli*:** manure management, storage and application; **Sediment:** reducing exposed soil; **Nutrients:** fertilizer reduction/management, stormwater management, green infrastructure techniques, overall stewardship	Social media, newsletters, public presentations, billboard campaign, trusted partner communication channels, promotional items and materials	PIP, CD, NRCS, MDARD, MSUE programs	MSU	TCRPC, MSU, **CD, State/Federal gov,** nonprofits, higher **education institutions**	LT	$40,000 to develop and enhance existing campaign and materials	Number of BMPs installed, SIDMA pre/post survey, SIDMA pre/post survey results
	Increase awareness about BMP maintenance programs and technical assistance available.	High	***E. coli*:** manure management, storage and application; **Sediment:** reducing exposed soil; **Nutrients:** fertilizer reduction/management, stormwater management, green infrastructure techniques, overall stewardship	Direct contact, partner communications	CD, NRSC, MDARD, MSUE projects	MSU, CD	TCRPC, MSU, **CD, State/Federal gov,** nonprofits, higher **education institutions**	LT	$3,000 for printing, promotional items, etc.	Number of people reached, long term assessment of project, future practice installation
	Increase awareness that farm field soil erosion, stream bank soil erosion, improperly maintained septic systems, manure from farm animals, pet waste and residential stormwater runoff are sources of water quality pollution.	High	***E. coli*:** manure management, storage and application; **Sediment:** reducing exposed soil; **Nutrients:** fertilizer reduction/management, stormwater management, green infrastructure techniques, overall stewardship	Social media, newsletters, public presentations, billboard campaign, trusted partner communication channels, promotional items and materials	CD, NRCS, MDARD, MSUE programs	MSU, CD	TCRPC, MSU, **CD, State/Federal gov,** nonprofits, **higher education institutions**	LT	$40,000 to develop and enhance existing campaign and materials	Increased knowledge from pre/post surveys, social media and website statistics, SIDMA pre/post survey results
	Identify 3 trusted sources willing to participate in a demonstration project.	Medium	***E. coli*:** manure management, storage and application; **Sediment:** reducing exposed soil; **Nutrients:** fertilizer reduction/management, stormwater management, green infrastructure techniques, overall stewardship	Direct contact, partner communications, demo project itself	CD, NRSC, MDARD, MSUE projects	MSU, CD	TCRPC, MSU, **CD, State/Federal gov,** nonprofits, higher **education institutions**	LT	Minimum $20,000/project	Demo project built, number of people reached, assessment of pre/post project, future practice installation
	Hold 3 educational events per year in partnership with a trusted source. For example a farm safety day, cover crop workshop.	Medium	***E. coli*:** manure management, storage and application**; Sediment:** reducing exposed soil; **Nutrients:** fertilizer reduction/management, stormwater management, green infrastructure techniques, overall stewardship	Direct contact, partner communications, workshop itself	CD, NRCS, MDARD, MSUE programs	MSU	**DNR, MSUE, USEPA, MDARD, MDEQ,** Mid-MEAC, TCRPC, CD	ST	$3,000 for printing, promotional items, etc.	Number of attendees, pre/post survey, SIDMA pre/post survey results
	Hold 3 peer-peer educational events per year.	Medium	***E. coli*:** manure management, storage and application; **Sediment:** reducing exposed soil; **Nutrients:** fertilizer reduction/management, stormwater management, green infrastructure techniques, overall stewardship	Direct contact, social media, newsletters		MSU, CD	TCRPC, MSU, **CD, State/Federal gov,** nonprofits, **higher education institutions**	LT	$3,000/event	Number of attendee, pre-post survey, SIDMA pre/post survey results
	Use 3 images and/or messages related to scenic beauty when engaging audience in information and education strategies. This could include: images of a farm, streams, ditches with native grasses and wildflowers, etc.	Low	Overall environmental stewardship, connecting people to land and water.	Social media, newsletters, public presentations, billboard campaign, trusted partner communication channels, promotional items and materials	Pure Michigan, MGROW	MSU	TCRPC, **CD, State/Federal gov,** nonprofits, **higher education institutions**	ST - ongoing	$1,000 - use existing messages and images	Estimated number of people reached, social media and website statistics

*Bolded partners were identified by the GLRC survey
** Social Indicators Data Management and Analysis System

8.7 MDEQ Funding Acknowledgement

Materials created with MDEQ nonpoint source implementation funding will be labeled as such using the appropriate MDEQ logo.

8.8 Evaluation Measures

Evaluation of the I/E Strategy will help those implementing it to apply adaptive management techniques where needed. To determine progress towards goals of the I/E Strategy, both formative and summative evaluation techniques will be used.

After several components of the I/E strategy have been implemented, a follow-up survey of watershed residents will be considered to assess additional changes in knowledge and behavior. The GLRC surveys and overall evaluation methodology may be used for the larger audience base as described in the evaluation section of the I/E Strategy table. The survey results can then be used to modify the outreach activities as needed. While several surveys have been completed in the region, the entire RCRW lacks a comprehensive survey. Utilizing the Social Indicators Data Management and Analysis Tool (SIDMA) developed specifically for social indicators related to nonpoint source management efforts, additional information for the entire watershed can be achieved. This survey would target the three audiences: urban, rural residential and agriculture.

Additionally, pre- and post- surveys and/or tests will be used as part of workshops and/or hands-on events in order to assess knowledge gain, level of understanding and interest among participants pertaining to different topics. These evaluation techniques allow the project team to assess the effectiveness of outreach programs and change them as needed to more adequately address topics of concern. Conversations and/or focus group discussions with outreach partners will also be used to assess the effectiveness of programs and identify gaps in programming across the watershed. In summary, formative and summative evaluation methods will be used to help provide an understanding of the successes and challenges of the I/E activities, and allow for adaptations as needed.

9. SUSTAINABILITY

Sustainability of the watershed management plan (WMP) and ongoing assessment of structural and managerial best management practices (BMPs) will help to ensure that water quality improvements are realized over the long term. This chapter will address the organizations, partnerships, and jurisdictional programs that exist within the watershed in order to ensure sustainable water resources management into the future. Plans for water quality monitoring activities and opportunities for long-term programmatic changes are also addressed.

9.1 Existing Structure

Management Team

The Red Cedar River Watershed (RCRW) management team consists of the Michigan State University (MSU) Institute of Water Research (IWR); Streamside Ecological Services, Inc.; and the Tri-County Regional Planning Commission (TCPRC). Representatives from these organizations are the authors of this plan, with input from a number of local partners. They have coordinated and guided all efforts related to the planning process and overall WMP development, including stakeholder engagement.

Stakeholders

Stakeholders are a critical component of the watershed management planning process. Stakeholders who participate in the planning process are much more likely to take action and implement projects to improve water quality than those who do not participate. Stakeholders who were contacted as part of this planning process include local industry, local government staff members, elected officials and commissions, civic groups, adjacent watershed groups, conservation districts, county health departments and others. For a complete list of stakeholders see Appendix A.

The management team conducted stakeholder meetings to share information about the planning process and engage participants in the process. The team provided updates on current progress related to data gathering, impairment status, and field investigations. Stakeholders were engaged in the watershed inventory process, sharing their knowledge about areas of the watershed that are potentially contributing to the impairments. This information was then used during field investigations to verify potential critical areas. Stakeholder knowledge of the existing land uses and landowner practices proved valuable as the team reviewed areas to gather additional data and identified critical areas. Stakeholders also identified other partners who would be interested in assisting with planning, and potentially implementing watershed protection projects.

Email updates were provided to stakeholders throughout the watershed planning process related to specific topics of interest and volunteer opportunities. These opportunities included monitoring, field work and educational efforts. The team followed up with several stakeholders, meeting on an individual basis to discuss their role and potential implementation activities listed in the WMP.

Agricultural Committee

The team met with a number of agricultural stakeholders in a two-part process. The first meeting consisted of agricultural service providers including representatives from the following agencies: Eaton Conservation District (ECD), Ingham Conservation District (ICD), Open Space and Farmland Preservation Board, Shiawassee Conservation District (SCD), and the Ingham County Drain Commissioners' office. The purpose of the first meeting was to gather important information about how to connect with land owners, specifically those in the agricultural community. Several avenues and strategies for connecting with the agricultural community were identified. The group also discussed existing programs for improving water quality, reducing nonpoint source pollution and strategies for promoting BMPs.

The second meeting was with agricultural producers in the watershed. This meeting focused on identifying barriers that hinder the use of BMPs to improve water quality. The committee also discussed strategies to overcome these barriers. The producers that participated were candid and provided valuable information that will be used in the implementation strategy to continue to promote and educate landowners about available programs and BMPs to improve and protect water quality. Both meetings had similar recommendations:

- Provide educational materials to landowners via technicians engaged in existing programs. For example, inspectors from drain commissioner offices and the Michigan Agriculture Environmental Assurance Program (MAEAP) technicians; any resource professional that is out in the field already or has established relationships with local landowners.
- Partner with trusted sources at existing events. Utilizing events that landowners and farmers are already attending is an opportunity to reach the target audience in a place they feel comfortable. Examples would be MSU Extension (MSU-E), drain commissioners and conservation districts, conservation non-profits like Ducks Unlimited and businesses such as Greenstone.

In summary, input from the agricultural meetings held suggested that the highest priority way to reduce agricultural pollutant contributions was to provide improved technical resources about conservation practices and programs to the agriculture community. The groups were reluctant to share a most effective and favorite BMP citing that each agricultural facility had different preferences and successes. The stakeholders did give recommendations on improving technical resource education. More specifically, they suggested to:

- Work with high-visible farmers on conservation practices who share knowledge with other farmers.
- Educate the agricultural community about Natural Resources Conservation Service (NRCS) and conservation district programs.
- For local service providers; turnaround time for responding to communication with farmers should be reduced.
- Communication with farmers should be timed to better coordinate with their seasonal workloads.
- Relationships should be rebuilt at the ICD to mend past problems.
- Utilize different modes of communication, but make sure messages provided are clear and concise.
- The appropriate message should be provided to each different agricultural audience (e.g. large commercial farms, hobby farms, horse farms).
- Manure management education is needed for the horse community.
- Messages conveyed should be personal and not formulaic.
- Information provided should be consistent across organizations.
- Create a document that explains all of the agricultural resources in the area.
- Host informational meetings at different venues, such as grain elevators
- Ensure BMPs have maintenance programs and resources to modify them when they are not working properly.
- Encourage resource and knowledge sharing between agricultural stakeholders themselves.

Information and Education (I/E) Committee

The I/E Strategy and associated chapter describes the collaborative outreach efforts that will continue into the future. The team will continue to collaborate with the Middle Grand River Organization of Watersheds (MGROW) to establish longevity of the I/E efforts. By working with adjacent watershed groups and with MGROW as the overarching organization, resources can be disseminated in an efficient and cost-effective manner. Working together to share the pollution prevention message, encouraging residents to value area water resources and helping residents of the region understand that they all play a role in improving and protecting water resources will be beneficial for the RCRW and adjacent watersheds.

Existing Watershed Organizations and Activities (for sustainability)

The IWR at MSU provides timely information for addressing contemporary land and water resource issues through coordinated multidisciplinary efforts. The IWR endeavors to strengthen MSU's efforts in nontraditional education, outreach, and interdisciplinary studies utilizing available advanced technology, and partnerships with local, state, regional, and federal organizations and individuals. Activities include coordinating education and training programs on surface and groundwater protection, land use and watershed management, among others. Since the Red Cedar River Watershed is also home to Michigan State University, the river has been the test subject of many MSU faculty members, students and staff members.

In addition to the research efforts on campus and throughout the watershed, there are other groups working to protect and enhance the river. These include Friends of the Red Cedar (FORC), MGROW, ICD, Livingston Conservation District (LCD), and the Greater Lansing Regional Committee for Stormwater Management (GLRC). Many of these groups and their activities and efforts are described in more detail in Chapter Eight.

MGROW is an outgrowth of Grand River Expedition 2010, and strives to bring together local communities, sub-watershed groups and other stakeholders in the Middle Grand River towards a greater understanding of and stewardship for the river. Geographically, the MGROW project area includes the Maple, Looking Glass, Red Cedar and Middle Grand River Watersheds.

The GLRC, managed by the TCRPC, is a guiding body comprised of communities with municipal separate storm sewer systems (MS4) within the Greater Lansing region. The GLRC guides the implementation of the permitted stormwater program as mandated by the state and federal governments. The GLRC works to meet specific permit requirements within the urbanized area to reduce polluted runoff from reaching the Grand, Red Cedar, and Looking Glass Rivers. Several activities of the GLRC overlap with general watershed management planning activities.

The Middle Grand River Watershed Planning project is managed by the ECD and geographically covers the area on the main channel of the Grand River from Eaton Rapids to the Sunfield area. This adjacent watershed group is developing a WMP based on the same TMDL reports used to drive the efforts of this plan. In addition, GLRC members, MGROW members, and several local units of governments are geographically in both the Red Cedar and Middle Grand River watersheds.

9.2 Local Partners

In addition to the watershed groups listed above, there are several other partners that are important to the implementation of this WMP. These are summarized below.

Tri-County Regional Planning Commission

The TCRPC manages the Mid-Michigan Program for Greater Sustainability (MMPGS). This EPA/HUD funded program is implementing sustainable practices in local communities and working to improve the quality of life in the region which supports economic development and sound environmental practices, creating a walkable, bikeable and overall attractive sustainable region. The sustainability work under this funding includes water resources management through the funding of some MGROW activities. This effort also engages low income, marginalized populations and works to involve them in local land use planning processes. This helps the watershed management planning project reach additional stakeholders, engage civic groups and in general provides a pathway for implementing different land use planning techniques and opportunities with more educated stakeholders. The TCRPC MMPGS also serves MGROW by supporting their regional education campaign described in detail in Chapter Eight. In summary, collaboration with these efforts only enhances the willingness for land use changes to be more related to water resources protection and pollution prevention.

Also managed by the TCRPC, Green Mid-Michigan (GMM); Regional Green Infrastructure Vision is a green infrastructure policy/poster plan that was developed and adopted by the TCRPC and its partners in 2010. After a multi-year planning process GMM provides a benchmark and a vision for the communities in Clinton, Eaton and Ingham Counties when it comes to protecting potential conservation areas, connecting parks and trails across jurisdictional boundaries and for promoting sustainable land use policy. GMM gives communities a snapshot of where future conservation activities should occur, where low impact development would have the largest impact, and where communities can best link their recreation facilities together.

With regard to watershed planning, GMM offers a data set of potential conservation areas (PCAs). PCAs are areas on the landscape that provide critical ecological services, such as maintaining water quality and quantity soil development and stabilization, pollination of crop land, wildlife travel corridors, stopover sites for migratory birds, sources of genetic diversity and floodwater retention. PCAs are an invaluable tool for watershed planning, allowing agencies and governments to understand where the highest quality PCAs

are located in our region, so that watershed protection strategies can be applied in the most efficient manner possible.

Of the nine largest PCA hubs in the tri-county region, all but two are affiliated with riparian areas and those remaining two areas are located within the drainage systems of the main watershed in the region. The promotion of low impact development strategies in and around these hubs is critical for watershed protection. The largest PCA hubs are also surrounded by rural land uses and natural areas which face issues such as fragmentation for land development and crop land, and agricultural /livestock impacts.

One of the main ways that the region is implementing the GMM vision is through formal adoption of the poster plan by local jurisdictions. Once GMM is adopted by a community, they can amend their Master Plan to include GMM language and data sets and they can amend zoning codes to more fully support the recommendations of GMM. Over 20 local jurisdictions have adopted the plan.

U.S. Department of Agriculture - Natural Resources Conservation Service
The local NRCS office covers both Ingham and Livingston Counties. The 2014 Farm Bill will streamline key conservation programs over a five year period. The purpose of the conservation programs is to protect and enhance soil health, farmland, water quality and local wildlife habitat.

Key program changes include:

- **Financial assistance programs:** The Environmental Quality Incentives Program (EQIP) will absorb the Wildlife Habitat Incentive Program. The Conservation Stewardship Program and Agricultural Management Assistance will continue.
- **Easement programs:** The existing easement programs will be merged into a new program called the Agricultural Conservation Easement Program, or ACEP. ACEP includes the former Wetlands Reserve Program, Grasslands Reserve Program and Farm and Ranchlands Protection Program.
- **Partnership programs:** Regional conservation efforts will be part of a new program – the Regional Conservation Partnership Program, (RCPP). Critical conservation areas for this new program will be designated by the Agriculture Secretary and the NRCS will select project areas at the state and national level.

(NRCS website http://www.nrcs.usda.gov/wps/portal/nrcs/main/mi/programs/farmbill/)

The programs offered by NRCS are an important resource that can be shared with agricultural producers and landowners to provide cost-share for natural resources protection, including water quality.

Farm Service Agency
The Farm Service Agency (FSA) administers farm commodity, credit, crop insurance, environmental, conservation, and emergency assistance programs for local farmers and ranchers. Since local farmers comprise the committee that oversees FSA work, this provides potential connection to several farmers in the watershed. WMP implementation will include working with FSA in the future to help farmers understand the economic benefits of watershed planning and implementation efforts.

United States Geological Survey (USGS)
The USGS is a bureau of the Department of the Interior, provides reliable scientific information to describe and understand the Earth; minimize loss of life and property from natural disasters; manage water, biological, energy, and mineral resources; and enhance and protect our quality of life. The USGS supports studies on local water quality issues with its National Cooperative Water Program funding that allows a funding match for projects.

Other Federal and State Agencies
There are several other federal and state agencies that are potential partners for the WMP. These include but are not limited to: U.S. Army Corps of Engineers, U.S. EPA, U.S. Fisheries and Wildlife, Michigan Department of Agricultural and Rural Development.

Farm Bureau

The Michigan Farm Bureau represents the agricultural community through several different political and planning efforts. The insurance company represents farmers in the political arena, protecting agriculture to enhance their economic situation.

Conservation Districts

The ICD is the primary conservation district in the watershed. The ICD Executive Director is working diligently to grow the district to a capacity level that could be successful in implementing BMPs in the watershed. Typical programs that the ICD promotes are MAEAP and various NRCS programs. The ICD also works closely with the Upper Grand River Watershed Alliance, which is currently implementing the Upper Grand River WMP. The LCD currently has two part-time technicians; they educate local residents about BMPs and conduct an annual tree sale.

County Health Departments

The Ingham County Health Department (ICHD) Bureau of Environmental Health is an active participant in watershed planning activities. As described in previous chapters, ICHD collects water quality data and contributes to the overall protection and enhancement of the river through clean ups and household hazardous waste collections. They have a Community Surface Water Sampling program that has been in place since 2004. This dataset is provides a historical perspective on levels of *E. coli* in the watershed. ICHD also has a Point of Sale ordinance in place. The ordinance requires that when a home is sold, a well and septic inspection by a certified operator is required. If the well or on-site septic system is not up to public health code (failing), then money must be placed in escrow for repair or replacement before the sale of the property can be finalized. This ensures that failing on-site septic systems will be identified and repaired or replaced, reducing the pollution impact to the local water resources. It is important to remember that this is only for homes that are being sold; failing systems that are not part of a sale can continue to contribute pollution for a significant amount of time.

The Livingston County Department of Public Health Environmental Health Division serves as the local permitting agency for onsite sewage treatment systems. The Livingston County Department of Public Works/Solid Waste department conducts household hazardous waste collections (including electronics), and sells rain barrels and compost bins.

County Drain Commissioners

The role of a county drain commissioner is to manage the county storm drain systems. Both Ingham County and Livingston County Drain Commissioners have participated in the development of the WMP. They are crucial to implementation of the plan and can assist with education of the urban, rural residential and agricultural community. The Ingham County Drain Commissioner has completed successful low impact development projects in the watershed. These include the Tollgate Wetlands (wetland reconstruction with treatment) and Towar Rain Gardens (significant reduction in flooding). These stormwater management projects illustrate the innovation that can happen in the watershed.

Local Units of Government

The local units of government in the RCRW include the following Counties, Cities, Charter and General Law Townships, and Villages:

Counties: Clinton, Eaton, Ingham, Livingston and Shiawassee

Cities: East Lansing, Lansing, Mason and Williamston

Charter Townships: Bath, Delhi, Lansing and Meridian

General Law Township: Antrim, Alaiedon, Aurelius, Bunker Hill, Conway, Cohoctah, Handy, Howell, Ingham, Iosco, Leroy, Leslie, Locke, Marion, Perry, Stockbridge, Unadilla, Vevay, Wheatfield, White Oak and Williamstown

Villages: Dansville, Fowlerville and Webberville

9.3 Local Policy Review of Codes and Ordinances

The team has reviewed all local governments' master planning documents. While most have a natural resource goal listed, several are lacking additional information. Local governments closer to the urban area have more environmentally protective ordinances and land use policies such as wetlands ordinances, overlay districts, etc., while others do not. Ingham County is unique in the fact that there is no county planning and zoning; rather, it is done on a Township level, even if the local unit is a general law township. A detailed spreadsheet listing information related to several different land use planning documents within the local jurisdictions is included as Appendix F.

Local Policy and Regulation Recommendations

Local units of government in the watershed have the opportunity to control land use, essentially prohibiting nonpoint source pollution through implementing BMPs for land use management.

It is important that those having land use authority include language for the protection of natural resources. An overarching statement in the Land Use Master Plan and/or Comprehensive Plan sets the stage for the unit of government to implement specific strategies to do just that, protect natural resources. For the purposes of this plan, the focus is specifically on water quality protection. There are several different avenues that local governments can explore in order to implement and achieve that goal. Depending on the characteristics of the jurisdiction, some strategies are more appropriate than others. The team has reviewed the level of regulatory authority currently in place to protect natural resources within the watershed.

General recommendations for ordinances and/or regulations are listed here and in greater detail in the spreadsheet located in Appendix F. Types of ordinances or regulatory mechanisms that are beneficial to reduce nonpoint source pollution include but are not limited to:

- Pet Waste
- Illicit Discharges
- Greenways/greenbelts
- Woodland Preservation
- Farmland and Open Space/Natural Area Preservation
- Wetland Preservation/Restoration
- Invasive Species Management
- On-Site Septic System Inspections
- Lake Management
- LID/Stormwater Management
- Riparian Setbacks
- Overlay Districts

Through the implementation of the WMP, each local unit government will have the opportunity to make improvements to their local codes and ordinances for natural resource and water quality protection and improvement. Draft ordinances and code language will be shared and discussed in detail with each board and/or commission to offer very specific recommendations that can complement other implementation efforts in the watershed. The TCRPC will lead this effort, working closely with the local conservation districts and MSU.

9.4 Measuring Progress and Monitoring Water Quality

Evaluation Framework

The progress made in achieving the objectives and goals of this plan must be measured. Ultimately, this watershed planning project seeks to realize reductions in bacterial loading throughout the watershed. In addition to chemical, physical and biological monitoring, interim indicators of success can also be used to help assess progress towards meeting watershed goals. These may include programmatic assessments and various social indicators. A formative approach to evaluation should be emphasized, in order to allow for adaptive management as the plan is implemented.

Progress in implementing this WMP can be tracked by monitoring:

- Programmatic assessments
- Social indicators
- BMP tracking
- Water quality monitoring

Programmatic Assessments and Social Indicators
Through the use of participant evaluations at educational events, focus groups and interviews, program assessments can be conducted on an ongoing basis. Likewise, surveys of citizens and stakeholders in the watershed can be used to assess knowledge, opinions and behaviors. Tracking of the implementation of the I/E plan will be measured based on the I/E Strategy (Table 8.1).

BMP Tracking and Interim Measureable Milestones
BMPs selected in this plan to address the watershed impairments and threats are practices known to help improve water quality at the source of the pollutant. Measuring these installed BMPs provides support that measures are being taken to reduce pollutant loading from various causes. Measurable interim milestones are outlined for the implementation of BMPs in Table 6.2. The priority parameters to measure include *E. coli*, dissolved oxygen (DO) and sediment, and nutrients.

Water Quality Monitoring
Direct surface water measurements of *E. coli*, nutrients, and DO/sediment can be used to determine if the watershed is meeting the goals and objectives of this WMP. Because of the existing *E. coli* TMDL and the need to meet the partial and full body contact designated uses in the watershed, *E. coli* will be the highest priority parameter to be measured. DO, nutrients, habitat and macroinvertebrate assemblage will also be sampled in some subwatersheds.

Tracking water quality improvements due to the implementation of BMPs will be the top monitoring priority. Maintaining the water quality where designated uses are currently being met and assessing subwatersheds where the conditions are unknown is a secondary monitoring priority. Due to the limited scale of this watershed inventory and planning project, additional monitoring is recommended to better understand the extent and sources of the pollution in the watershed.

It is proposed that a committee be formed to guide the monitoring effort in the watershed. This working committee should be responsible for coordinating the monitoring activities among multiple organizations. The committee should determine sampling frequencies and parameters to be measured in priority subwatersheds, develop long-term plans to measure BMP effectiveness, and ensure that Quality Assurance Program Plans (QAPPs) are developed and followed for all monitoring efforts.

The proposed water quality monitoring activities are described below and in Table 9.1:

1. Conduct ongoing *E. coli* sampling in partnership with the Ingham County Community Surface Water Sampling Program. The program is a consortium of local units of government and state agencies with an interest in surface water quality and its stewardship. The ICHD Bureau of Environmental Health is currently the administrative agency for the group. Future monitoring may include shifting sampling locations from historic sites to better characterize bacterial inputs from priority tributaries. In addition, wet weather sampling events will be considered for addition to the existing weekly sampling protocol in some subwatershed locations.

2. Further identify human influences through canine source tracking in the eight subwatersheds that were flagged as having known or suspected human sources of bacteria inputs. Activities that will be considered include river corridor investigations featuring canine scent tracking and mapping of septic systems in priority subwatersheds.

3. In partnership with MSU faculty members from the Department of Civil and Environmental Engineering and Biosystems Engineering and the USGS, quantify the relative contributions of

human and animal sources to the total microbial pollution load that is discharged in the highest priority subwatersheds, beginning with the Tier I subwatersheds. Multiple quantitative qPCR *bacteroides* tests will be performed and the ratios indicating relative contribution of pollutant sources will be determined. Determination of these ratios, together with geographic information system (GIS) data, will help to better inform land use decision making in those subwatersheds.

4. Work with jurisdictions within the urbanized area of the watershed to link *E. coli* sampling and microbial source tracking efforts with stormwater permit monitoring requirements. Jurisdictions will be required to monitor for bacteria inputs as part of the *E. coli* TMDL beginning with the 2018 permit issuance. DO sampling may also be required for some jurisdictions.

5. Work with various organizations and the MiCorps program to continue macroinvertebrate assessments across the watershed. Macroinvertebrates have long been used as indicators of water quality and long term assessments can show water quality changes over time.

6. Conduct stream habitat assessments in high priority subwatersheds.

Table 9.1 Proposed Water Quality Monitoring Activities

Subwatersheds	Type of Analysis	Timeline/Frequency	Estimated Cost	Responsible Party
Establish monitoring working committee	N/A	Quarterly Meetings		MSU, USGS, ICHD, MDEQ
Tier I and Tier II subwatersheds	*E. coli* Monitoring	Weekly + wet weather sampling	$75/sampling location	ICHD, MSU, USGS, MDEQ
Sloan, Wolf, Headwaters Sycamore Creek, Mud, Red Cedar, Middle Branch, Coon, Handy Howell	Canine Scent Tracking	Once per tributary or as determined by Monitoring Committee	$6,000	MSU, ICD
Tier I Subwatersheds	Microbial Source Tracking	TBD	$15,000/year	MSU, USGS, ICHD, MDEQ
TBD (to fill data gaps)	Benthic Macroinvertebrates	2x/year	$6,000/year	Mid-MEAC, ICD
TBD (to fill data gaps)	Stream Habitat Assessment	3 year interval	$12,000	Streamside Ecological Services
Mud Creek	Dissolved Oxygen	Weekly	$2,000	MSU, ICD, USGS, MDEQ
TBD	Nutrients	TBD	TBD	MSU

9.5 WMP Implementation Plan and Updates

The planning team is currently made up of individuals from MSU-IWR, TCRPC and Streamside Ecological Services, with input from a number of local partner organizations and agencies. It is anticipated that this team will be responsible for periodic plan updates, although the WMP is written so that anyone within the watershed can actively participate in the implementation of the plan. It is recommended that the WMP be updated every five years to highlight completed, successful implementation projects, and re-assess the condition of the watershed. Updates will include a summary of water quality improvments related to implemented BMPs, changes to TMDL status, and increased responsibility of existing and newly identified project partners. Additional pollutants identified will be addressed.

Criteria Requiring Watershed Management Plan Revision

As BMPs are implemented, water quality sampling results will be assessed in the corresponding subwatersheds to determine whether the practices are resulting in the desired water quality pollutant load reductions. Land use changes will also be tracked as part of this effort. If pollutant load reductions are realized, it can be assumed that the BMPs are effectively achieving the goals of the watershed management plan and TMDLs.

If however, water quality does not improve despite the implementation of the BMPs, additional investigation should be done to determine if new sources and causes are present in the watershed, or if additional BMPs are necessary. The ultimate desired outcome is to meet the goals and objectives of this watershed management plan, by achieving water quality that meets the water quality standards in order to support the designated and desired uses.

REFERENCES

Barry-Eaton District Health Department. (2007). Regulations governing on-site sewage and on-site water supply system evaluation and maintenance in Barry and Eaton County, Michigan. Retrieved from http://www.barryeatonhealth.org/LinkClick.aspx?fileticket=9A24LcI98eQ%3d&tabid=610

Barry-Eaton District Health Department. (2011). *Time of Sale or Transfer Program, the first three years: November 1, 2007 through October 31, 2010*. Retrieved from http://www.barryeatonhealth.org/LinkClick.aspx?fileticket=jqspmiveOnY%3d&tabid=610

Center for Watershed Protection. (2005). *Urban subwatershed restoration manual no. 11, Unified subwatershed and site reconnaissance: A User's manual version 2.0.* Ellicott City, MD: Author. Retrieved from http://www.cwp.org/online-watershed-library/doc_download/65-urban-subwatershed-restoration-manual-series-manual-11-unified-subwatershed-and-site-reconnaissance-a-user-s-manual

Cwikiel, W. (2003). *Michigan wetlands – Yours to protect: A Citizen's guide to wetland protection* (3rd ed.). Petoskey, MI: Tip of the Mitt Watershed Council. Retrieved from http://www.watershedcouncil.org/water%20resources/wetlands/wetland-resources/files/document%201%20citizens%20guide%20to%20wetland%20protection.pdf

Delhi Charter Township. (2012). Historic *E. coli* surface water sampling data, 2009-2012 [Data file]. Available from Delhi Charter Township.

Fishbeck, Thompson, Carr, and Huber Inc. (2010). *Upper Maple River watershed management plan* (MDNRE #2007-0118). Retrieved from http://www.michigan.gov/documents/deq/wrd-nps-upper-maple-wmp_370632_7.pdf

Eaton Conservation District. (2012). *Eaton County natural resource assessment*. Retrieved from http://www.eatoncd.org/uploads/1/6/4/4/16449128/2011resource_assessment_with_appendices.pdf

ETC Institute. (2006). *Greater Lansing regional water quality survey findings report.* Lansing, MI: Greater Lansing Regional Committee. Retrieved from http://www.mywatersheds.org/publications/Other%20PEP_Habitat/Lansing%20Water%20Qual%20Survey%20Final%20Report_Nov%2021.pdf

Higman, P.J. & S. Campbell. (2009). *Meeting the Challenge of Invasive Plants: A Framework for Action*. Retrieved from http://mnfi.anr.msu.edu/reports/2009-11%20Invasives_strategy_final.pdf

Hamilton Anderson Associates, Inc. (HAA) (2007). *Natural areas – 2006 River bank stabilization study* (CP05562/REC ID 58580).

Hyde, D.A., Enander, H.D., Slaughter, B.S., Monfils, M.J., Penskar, M.R., Badra, P.J., & Paskus J.J. (2009). *Significant natural features in the Tri-County Region (Clinton, Eaton and Ingham Counties): Providing ecological information for a green infrastructure plan (Phase 2)* (Report No. 2009-07). Lansing, Michigan: Michigan Natural Features Inventory, Michigan State University Board of Trustees.

Horizon Environmental Corporation (2010). *Tyler Creek Golf Course Weather & Surface Water Monitoring Study Report.*

Ingham Conservation District. (2013). *E. coli* surface water sampling data, collected in 2013 [Data file].

Ingham County Health Department. (2012). Historic *E. coli* surface water sampling data, collected between 2009-2012 [Data file]. Available from Ingham County Health Department.

Ingham County Health Department. (2013). *E. coli* surface water sampling data, collected in 2013 [Data file].

Latimore, J. (2005). *Habitat selection and resilience of stream fishes in the Red Cedar River Watershed, Michigan* (Doctoral dissertation). Michigan State University, Department of Fisheries and Wildlife, East Lansing, MI. Retrieved from http://ezproxy.msu.edu.proxy2.cl.msu.edu/login?url=http://search.proquest.com.proxy2.cl.msu.edu/docview/305469919?accountid=12598

Latimore, J. (2006). *MiCorps volunteer stream monitoring procedures.* Michigan Clean Water Corps. Retrieved from http://www.micorps.net/streamresources.html

Livingston County Health Department, Livingston County Drain Commission, & Ingham County Drain Commission. (2001). Historic *E. coli* surface water sampling data, collected between 2000 – 2001 [Data file].

Luukkonen, C.L. (2009). *Model refinement and simulation of groundwater flow in Clinton, Eaton, and Ingham Counties, Michigan* (U.S. Geological Survey Scientific Investigations Report 2009–5244). Reston, VA: U.S. Geological Survey. Retrieved from http://pubs.usgs.gov/sir/2009/5244/pdf/sir2009-5244.pdf

Michigan Department of Agriculture and Rural Development. (2014). Generally accepted agricultural and management practices for manure management and utilization. Lansing, MI: Author. Retrieved from http://www.michigan.gov/documents/mdard/2014_MANURE_MANAGEMENT_AND_UTILIZATION_GAAMPs_452812_7.pdf

Michigan Department of Environmental Quality. (1999a). *Biological surveys of Sycamore Creek and select tributaries, Ingham County, Michigan, September 22, 1995; August 22, 1996; and September 13, 1996* (MI/DEQ/SWQ-99/148). Lansing, MI: Author.

Michigan Department of Environmental Quality. (1999b revision). *Pollutants Controlled Calculation and Documentation for Section 319 Watershed Training Manual*. Retrived from http://www.michigan.gov/documents/deq/deq-wb-nps-POLCNTRL_250921_7.pdf

Michigan Department of Environmental Quality. (2003). *A biological survey of the Red Cedar River and selected tributaries, Livingston and Ingham Counties, Michigan. August and September 2001* (Staff Report MI/DEQ/WD-03/025). Lansing, MI: Author.

Michigan Department of Environmental Quality. (2008 revision). Policy and procedures: qualitative biological and habitat survey protocols for wadeable streams and rivers (WB-SWAS-051). http://www.michigan.gov/documents/deq/wb-swas-procedure51_280711_7.pdf

Michigan Department of Environmental Quality. (2009 revision.). *A biological survey of the Red Cedar Watershed and selected tributaries located in Ingham and Livingston County, Michigan, June-August 2008* (Staff Report MI/DEQ/WB-08/088). Lansing, MI: Author.

Michigan Department of Environmental Quality. (2012a). *Application of the Richards-Baker Flashiness Index to gaged Michigan rivers and streams* (MI/DEQ/WRD-12/028). Retrieved from: http://www.michigan.gov/nps

Michigan Department of Environmental Quality. (2012b). Red Cedar River Watershed: Landscape level wetland functional assessment (enhanced NWI).

Michigan Department of Environmental Quality. (2012c). *Total maximum daily load for E. coli in portions of the Red Cedar River and Grand River Watersheds; including Sycamore, Sullivan, Squaw, and Doan Creeks. Ingham, Eaton, Clinton, Jackson, and Livingston Counties.* Retrieved from http://www.michigan.gov/documents/deq/wrd-swas-tmdl-draft-redcedar-grand_391057_7.pdf

Michigan Department of Environmental Quality. (2012d). *Water quality and pollution control in Michigan 2012 Sections 303(d), 305(b), and 314 Integrated Report* (MI/DEQ/WRD-12/001). Lansing, MI: Author.

Michigan Department of Environmental Quality. (2013a). *A biological survey of the Red Cedar Watershed and selected tributaries: Ingham and Livingston Counties, Michigan July and August 2011* (Staff Report MI/DEQ/WRD/-13/009). Lansing, MI: Author.

Michigan Department of Environmental Quality. (2013b). *Draft total maximum daily load for dissolved oxygen in the Grand River, Red Cedar River, and tributaries: Ingham, Eaton, and Clinton Counties.* Retrieved from http://www.michigan.gov/documents/deq/wrd-swas-tmdl-draft-grandredcedar_424646_7.pdf

Michigan Department of Environmental Quality. (2013c). Groundwater statisitics. Retrieved from http://www.michigan.gov/documents/deq/deq-wd-gws-wcu-groundwaterstatistics_270606_7.pdf

Michigan Department of Environmental Quality. (2013d). Historic *E. coli* sample results from Burchfield Park, Hawk Island County Park, Lake Lansing Park South, and Valhalla Park, BeachGuard database [Data files]. Retrieved on December 18, 2013, from http://www.deq.state.mi.us/beach/SearchResults.aspx?instatepark=False&beachtype=Public&countyId=33

Michigan Department of Environmental Quality. (2014). Floodplains. Retrieved January 2014 from http://www.michigan.gov/deq/0,4561,7-135-3313_3684_3725-11255--,00.html

Michigan Department of Natural Resources. (1974). *A biological and sediment chemistry survey of Sycamore, Willow, and Mud Creeks, and Vevay Drain from Mason to Lansing, Ingham County, Michigan, July 2 to November 8, 1973* (Report No. 2290). Lansing, MI: Author.

Michigan Department of Natural Resources. (1992). *A biological survey of the Red Cedar River, Livingston and Ingham Counties, Michigan, June 24-28, 1991* (MI/DNR/SWQ-92-201). Lansing, MI: Author.

Michigan Department of Natural Resources. (2011). *Draft Grand River assessment*. Ann Arbor, MI: MDNR Fisheries Division. Retrieved from http://grandrapidswhitewater.org/documents/

Michigan Department of Technology, Management and Budget, Center for Shared Solutions and Technology Partnerships. (2012). Michigan Geographic Framework v13a, census, groundwater, hydrography and topography data [Data files]. Retrieved June 2013 from http://www.mcgi.state.mi.us/mgdl/

Michigan State University. (2014). Enviro-weather database, MSUHort station 2012-2013 [Data file]. Retrieved on February 19, 2014, from http://enviroweather.msu.edu/

Michigan State University, Institute of Water Research. (2009). High Impact Targeting (HIT) model results for Red Cedar River Watershed [Data file]. Retrieved on October 11, 2013, from www.iwr.msu.edu/hit2

Mid-Michigan Environmental Action Council. (2012). Stream monitoring report: On Mid-MEAC's volunteer stream monitoring program and the status of the Red Cedar Watershed. Retrieved from: http://www.midmeac.org/LinkClick.aspx?fileticket=V0RCZbbfsR4%3d&tabid=1393

National Oceanic and Atmospheric Administration. (2008). NOAA Coastal Change Analysis Program (C-CAP) zone 51 (lower) 2006-era regional land cover data [Data file]. Charleston, SC: NOAA Office for Coastal Management. Retrieved from www.coast.noaa.gov/digitalcoast/data/ccapregional.

Paskus, J. & Endander, H. (2008). Clinton, Eaton, and Ingham Counties potential conservation areas assessment (MFNI 2008-11). Lansing, Michigan: Michigan Natural Features Inventory, Michigan State University Board of Trustees.

O'Neil, G. (2010). Impact Targeting: applying conservation tools to the worst areas for maximum sediment/nutrient reductions. USDA-NRCS Conservation Innovation Grant final report.

Ouyang, D., Bartholic, J., & Selegean, J. (2005). Assessing sediment loading from agricultural croplands in the Great Lakes basin. *Journal of American Science, 1*(2), 14-21.

Southeast Michigan Council of Governments. (2012). SEMCOG 2040 Forecast Database for Livingston County [online spreadsheets]. Retrieved on December 4, 2012 from: http://www.semcog.org/Data/Apps/regional.forecast.cfm

Spicer Group, Inc. & Wetland and Coastal Resources (2009, revision) Cook and Thorburn Drain Watershed Management Plan.

Tetra Tech. (2006). Red Cedar River watershed management plan. Lansing, MI: Greater Lansing Regional Committee on Phase II Nonpoint Source Pollution. Retrieved from http://www.lansingmi.gov/watershed_management_plan

Tri-County Regional Planning Commission. (2012). Tri-County Region Interim Population Projections [pdf]. Retrieved from http://www.tri-co.org/gis.htm

U.S. Department of Agriculture Natural Resources Conservation Service. (2007). Part 630 Hydrology National Engineering Handbook: Chapter 7 Hydrologic Soil Groups (210-VI-NEH) [pdf]. Retrieved from http://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=22526.wba

U.S. Department of Agriculture Natural Resources Conservation Service. (2010). Conservation Choices: Your guide to 30 Conservation and Environmental Farming Practices. Lansing, MI: Michigan NRCS.

U.S. Department of Agriculture Natural Resources Conservation Service. (2013). Web Soil Survey Database (SSURGO 2.2). Retrieved on June 28, 2013, from http://datagateway.nrcs.usda.gov/

U.S. Environmental Protection Agency. (2000). Ambient Water Quality Criteria Recommendations: Information Supporting the Development of State and Tribal Nutrient Criteria: Rivers and Streams in Nutrient Ecoregion VII (EPA 822-B-00-018). Washington, DC: Author. Retrieved from http://water.epa.gov/scitech/swguidance/standards/criteria/nutrients/upload/2007_09_27_criteria_nutrient_ecoregions_rivers_rivers_7.pdf

U.S. Environmental Protection Agency. (2008a). Handbook for developing watershed plans to restore and protect our waters (EPA 841-B-08-002). Washington, DC: Author. Retrieved from http://water.epa.gov/polwaste/nps/upload/2008_04_18_NPS_watershed_handbook_handbook-2.pdf

U.S. Environmental Protection Agency. (2008b). Fecal coliform and *E. coli*. Retrieved from: http://www.epa.gov/katrina/fecal.html

U.S. Environmental Protection Agency (2013a). STEPL and Region 5 Model. Retrieved on March 20, 2015, from http://it.tetratech-ffx.com/steplweb/

U.S. Environmental Protection Agency. (2013b). Wetland Definitions. Retrieved on February 5, 2013 from http://water.epa.gov/lawsregs/guidance/wetlands/definitions.cfm