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COMMUNITY INPUT TO THE WATERSHED MANAGEMENT PROCESS: DETERMINING THE PERCEIVED STATE OF CAYUGA CREEK, NIAGARA COUNTY, NY

Kelly M. Frothingham
Geography and Planning Department
Buffalo State College
1300 Elmwood Avenue
Buffalo, NY 14222

ABSTRACT: *Many problems with streams and rivers in the United States have been identified, including poor water quality, in-stream and riparian habitat degradation, streambank erosion, and flooding. The number of stream restoration projects that have been implemented to address these problems has increased in recent years, as has the cost per year of restoration. The watershed management process increasingly involves multidisciplinary teams of local community members, public interest groups, government officials, and researchers working together in order to solve complex environmental problems. In particular, local community member input to the process is important to effective stream restoration. The overall goal of this study was to provide an opportunity for local community members to contribute to the watershed management process for Cayuga Creek, Niagara County, NY. Thus, the specific objective was to develop and administer a questionnaire to watershed residents to assess their opinions and perceptions of environmental problems in the watershed. A twenty-one-question questionnaire was administered to 338 residents that live adjacent to the creek. Fifty-three questionnaires were returned, resulting in a 16 % return rate. The majority of respondents felt that the overall quality of Cayuga Creek was fair or poor. The top five major concerns in the creek were as follows: trash in the creek, fallen trees, water quality, hazardous waste, and streambank erosion. Respondents were also asked specifically about streambank erosion, riparian habitat, and flooding. These questionnaire results will inform on-going watershed management in the Cayuga Creek watershed.*

Keywords*: Watershed management, Stream restoration, Community participation, Cayuga Creek*

INTRODUCTION

Many problems with streams and rivers in the United States have been identified, including poor water quality, in-stream and riparian habitat degradation, streambank erosion, and flooding (Bernhardt et al., 2005; Environmental Protection Agency [EPA], 2009). An increasing number of stream restoration projects have been implemented to address these problems and the amount of money spent on projects has risen over time to approximately $1 billion per year to restore streams and rivers in the United States (Bernhardt et al., 2005). In order to effectively manage these problems and determine the most appropriate stream restoration projects to be completed, a watershed management plan can be completed. The watershed management process typically involves the following phases: 1) getting organized, 2) problem and opportunity identification, 3) developing a restoration plan, and 4) implementing the restoration plan (Federal Interagency Stream Restoration Working Group [FISRWG], 1998; Shields et al., 2003; EPA, 2008). Although a watershed management plan is not necessary to complete an individual stream restoration project, a survey of restoration project managers indicated that a watershed management plan can inform specific project design and implementation (Bernhardt et al., 2007; Hassett et al, 2007).

Watershed management increasingly involves multidisciplinary teams of local community members, public interest groups, government officials, and researchers working together to solve complex environmental problems (National Research Council [NRC], 1999; Born and Sonzogni, 1995; FISRWG, 1998; Rhoads et al., 1999; Bernhardt et al., 2007; Palmer et al., 2007). In particular, local community member input to a watershed management plan is an essential element of effective stream restoration (NRC, 1999; Leach et al., 2002; Bernhardt et al., 2007; Palmer et al., 2007). Bernhardt et al. (2007) found that community involvement is much higher in all stages of the watershed management process in the most effective restoration projects and Palmer et al. (2007, p. 478) argued that "Citizens can and do have an incredibly important role to play in river restoration." Moreover, public participation has been shown to be most useful in the early planning stages of watershed management (Duram and Brown, 1998). In cases where communities are addressing nonpoint source pollution as part of their watershed

management plan, public input, participation, and education is required under Phase II of the US Clean Water Act (EPA, 1999).

The overall goal of this study was to provide an opportunity for local community members to contribute to on-going watershed management in Cayuga Creek, Niagara County, NY. Thus, the specific objective was to develop and administer a questionnaire to watershed residents living adjacent to Cayuga Creek to assess their opinions and perceptions of environmental problems in the watershed. While there were numerous ways to engage the community in the watershed management process (e.g., public meetings, focus groups, interviews, workshops), questionnaires/surveys have been used successfully to solicit input from community members about watershed conditions (Leach et al., 2002; Lomnicky, Barber, and Bryce, 2002; Kaplowitz and Witter, 2008). It was expected that these questionnaire results will increase community members' input to the watershed management process and influence the types of restoration projects that will be implemented in the watershed.

STUDY AREA

Cayuga Creek is tributary to the Niagara River, which has been designated by the International Joint Commission (IJC) as one of forty-three Areas of Concern (AOC) in the Great Lakes Basin. AOC designations result when one or more Beneficial Use Impairments (BUI) (e.g., degradation of fish and wildlife populations, loss of fish and wildlife habitat) are impaired. Cayuga Creek, and its main tributary, Bergholtz Creek, are also listed on the New York State 303(d) List of Priority Waterbodies for organics, toxicity, nutrients and pathogens (New York State Department of Environmental Conservation [NYSDEC], 2010).

Cayuga Creek is 16 km long and has a drainage basin area of 91 km^2 (Figure 1). The headwaters of the creek originate in Lewiston, NY and the creek flows southwest through the Tuscarora Indian Reservation and into the Town of Wheatfield. The creek then flows south through the Tuscarora Indian Reservation and the Niagara Falls International Airport-Air Force Base complex, into the Town of Niagara, and into the City of Niagara Falls to its confluence with the Little Niagara River (Figure 1). Land use in the watershed is mixed, with the predominant land use being agriculture (approximately 40%) (Gould et al., 2009). The majority of agricultural land use is in the upper portion of the watershed, while the middle and lower portions of the watershed are characterized as residential and commercial, with increasing urbanization in the City of Niagara Falls (Gould et al., 2009).

Figure 1. Map of the Cayuga Creek watershed, including towns in Niagara County, NY.

The Stream Visual Assessment Protocol (SVAP) (Natural Resource Conservation Service [NRCS], 1998) was used in 2004 and 2008 (Frothingham et al., 2005 and 2009) to qualitatively assess stream elements such as riparian zone, bank stability, water appearance, and nutrient enrichment. Results from the stream corridor assessments indicated that the overall quality of the creek was fair in 2004 and poor in 2008 and impairments included bank instability, lack of a natural riparian corridor, and poor water quality (Frothingham et al., 2005 and 2009). There is also a history of flooding in the Cayuga Creek watershed (U.S. Army Corps of Engineers [USACE], 2002), especially in the Town of Niagara. The creek was channelized through a land parcel in the Town of Niagara in 1968 and a berm was built on the east side of the stream (USACE, 2002). The stream was channelized to facilitate water conveyance to reduce flooding, but the channelization project has been attributed higher peak discharges (USACE, 2002).

There has been an active watershed management group, the Cayuga Creek Steering Committee, working in the Cayuga Creek watershed since 2003. During that time, the Buffalo Niagara Riverkeeper, a non-profit public interest group, has been acting coordinator of the Steering Committee. Other members of the Steering Committee include representatives from the U.S. Fish and Wildlife Service, USACE, NYSDEC, Niagara County Soil and Water Conservation District, Niagara County Center for Economic Development, the City of Niagara Falls, Tuscarora Nation, New York Power Authority, Ecology and Environment, Inc., academics, and members of a local citizens group. To date, the Steering Committee has focused its efforts on the first two phases of the watershed management process: 1) getting organized by building an advisory group and establishing technical teams; and 2) data collection and analysis focused on problem and opportunity identification and establishing the baseline condition of the creek. The most recent activity of the Steering Committee was the development of the Cayuga Creek Watershed Restoration Road Map (CCWRRM), which identifies problems and opportunities for stream restoration within the watershed (Ecology and Environment, Inc., 2009).

METHODOLOGY

A twenty-one-question questionnaire was developed to assess Cayuga Creek watershed landowners' opinions and perceptions of environmental problems in the watershed. All twenty-one questions were closed-ended; however, respondents were given the chance to elaborate on their multiple choice answers in some instances. The first part of the questionnaire was designed to gauge respondents' opinions and perceptions of the overall conditions of Cayuga Creek. Respondents were asked to choose how they use the creek (e.g., fishing, swimming, waste disposal, other), whether of not they were concerned about specific issue in the creek (e.g., streambank erosion, flooding, trash in the creek), and they were asked their opinion on the overall condition of the creek (e.g., excellent, good, fair, poor). The second part of the questionnaire asked specifically about respondents' opinions and perceptions of streambank erosion, riparian buffers, flooding, and aquatic habitat because previous studies indicated that these are problems in the watershed (Frothingham et al., 2005 and 2009; USACE, 2002). Streambank erosion questions in this section addressed the extent of streambank erosion on each respondent's property, whether or not the respondent thought erosion was increasing over the last few years, and, if so, why streambank erosion had increased. Respondents were also asked if they would prefer using rocks and concrete, trees and plantings, or a combination of methods to stabilize eroding streambanks. The questions pertaining to flooding addressed whether or not each respondent experienced flooding on their property, if they thought flooding had increased in the past few years, and, if so, why flooding had increased. Respondents were also asked if a buffer of natural vegetation, like trees and brush, but not mowed grass, was present on their property and, if so, they were asked to estimate the width of the buffer. If a respondent answered "No" to the buffer question, they were asked if they would consider letting a natural vegetation buffer grow rather than mowing their lawn next to the creek's edge. Respondents were also asked about maintaining and enhancing aquatic habitat. The third and final portion of the questionnaire asked about the respondents' gender, age, household income, and if they would be likely to get involved in planning and restoration activities in Cayuga Creek. That information was collected to provide a general characterization of the respondents.

A total of 338 questionnaires were distributed to residents in the watershed that have land adjacent to the creek. Addresses within 46 meters (150 feet) of the creek were extracted from land parcel data using ArcGIS (Figure 1). This analysis yielded 239 addresses and questionnaires were mailed to those addresses; one was returned to sender as a result of mailing and/or address error. An additional 100 questionnaires were hand-delivered to residents living in the Cayuga Village Trailer Park; questionnaires were hand-delivered because the parcel data only listed one address for the office of the trailer park.

Figure 2. Map of the 46 m (150 ft) buffer and resultant parcels (outlined in red) in a representative section of Cayuga Creek.

RESULTS

Fifty-three questionnaires were returned, resulting in a 16 % return rate. That return rate is typical of a mail survey (Patten, 2001), although lower than other watershed survey studies have reported (e.g., Kaplowitz and Witter, 2008).

Seventy-seven percent of the questionnaire respondents were landowners. Of the remaining respondents (23%), most (75%) listed their relationship to the landowner as renter; two people listed family relationships (e.g., daughter, husband) and one respondent left the question blank. Of the respondents who indicated their gender (fifty-one), most were male (61%) and 39% were female. Fifty-two respondents answered the questions asking them their age; most (86 percent) were forty-six years old or older. Forty-six respondents answered the question about their household income level; most (72%) were from households making between $20,000 and $100,000 per year, indicating that respondents were typical of this region of Niagara County, which is characterized by middle class households (i.e., household income levels between $25,000 and $100,000 per year [Drum Major Institute for Public Policy, 2010]).

The main use of the respondents' property was predominantly residential (96%) and most (94%) properties were one acre or less. Seventy-four percent of the respondents have lived on their property for ten or more years, thus most respondents were able to provide a long-term perspective of watershed issues.

Respondents were asked if they use Cayuga Creek for a number of different activities (see Table 1). All activities that applied could be checked. Nineteen respondents indicated that they did not use the creek for any activities (Table 1 and Figure 3), but fifteen respondents checked two or more activities. For those using the creek (thirty-four respondents), the top three activities were nature observing, fishing, and canoeing/kayaking (Table 1 and Figure 3). Other uses for the creek included motor boating and feeding the ducks.

Table 1. Cayuga Creek Activities

Activity	Response
Fishing	12
Swimming, wading	0
Hiking, walking	3
Canoeing, kayaking	9
Nature observing	23
Storm drainage	8
Waste disposal	0
None	19
Other	4

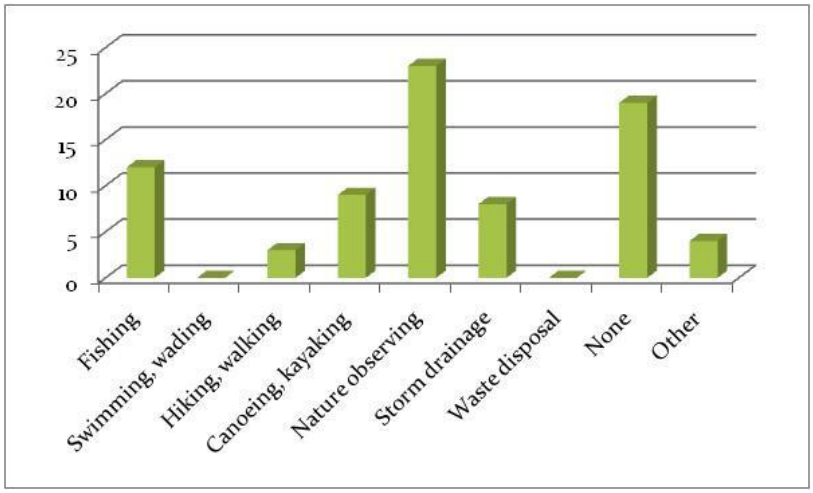

Figure 3. Cayuga Creek activities.

The majority of respondents (96%) felt that the overall quality of Cayuga Creek was fair or poor and of those respondents, more than half (60%) classified the overall condition as poor. The respondents' perception of the overall quality of Cayuga Creek is consistent with results from the stream corridor assessments, which indicated that the overall quality of the creek ranged from fair to poor (Frothingham et al., 2005 and 2009). Respondents were asked to indicate if they were concerned about a variety of issues in Cayuga Creek (see Table 2). The top five major concerns in the creek were as follows: trash in the creek, fallen trees, water quality, hazardous waste, and streambank erosion (Figure 4).

Table 2. Potential Issues of Concern in Cayuga Creek

Potential Issues of Concern	
Streambank erosion	Hazardous waste sites/dumps
Soil erosion from farmland	Pesticides/fertilizers used on farm fields
Water quality	Pesticides/fertilizers used on lawns
Flooding	Trash in the creek and/or on the banks
Household septic systems	Fallen trees/blockages
Sewer lines and their discharge pipes	Spread of non-native, invasive species (Purple Loosestrife, Japanese Knotweed)
Urban runoff from roads and parking lots	Loss of wildlife habitat
Development construction runoff	Other

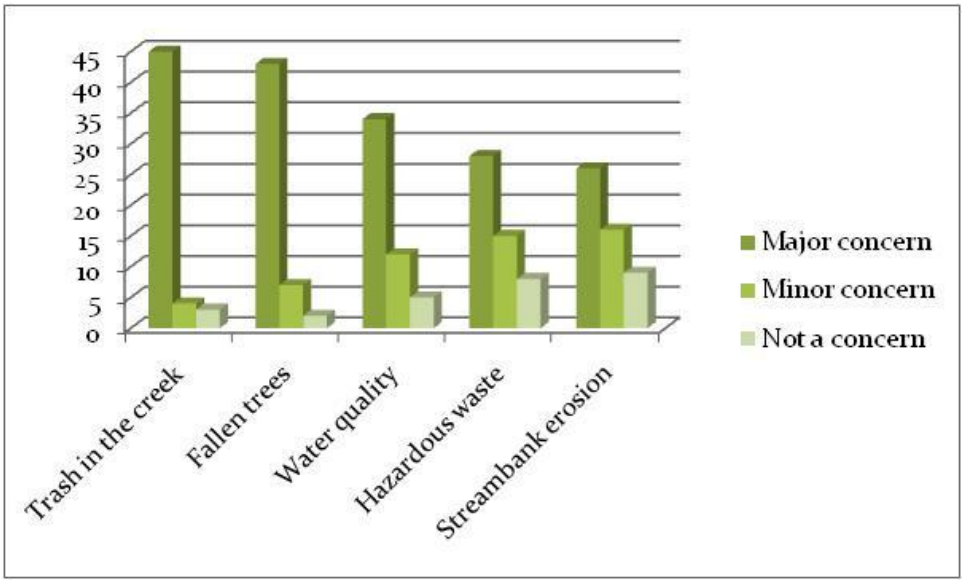

Figure 4. Top five concerns.

When asked specifically about streambank erosion, 38% of respondents indicated that erosion was not a problem on their property; however, another 38% were experiencing moderate or extreme streambank erosion (Figure 5). The majority of respondents (62%) were interested in bank stabilization measures that combine rocks and concrete with trees and other plantings (Figure 6). Of those who did not prefer a combination of both stabilization methods, an equal percentage of respondents (13% each) preferred either rocks and concrete or trees and other plantings (Figure 6). Of the six respondents (11%) that did not have a bank stabilization technique preference, five were not experiencing bank erosion on their property and one indicated that erosion was minor.

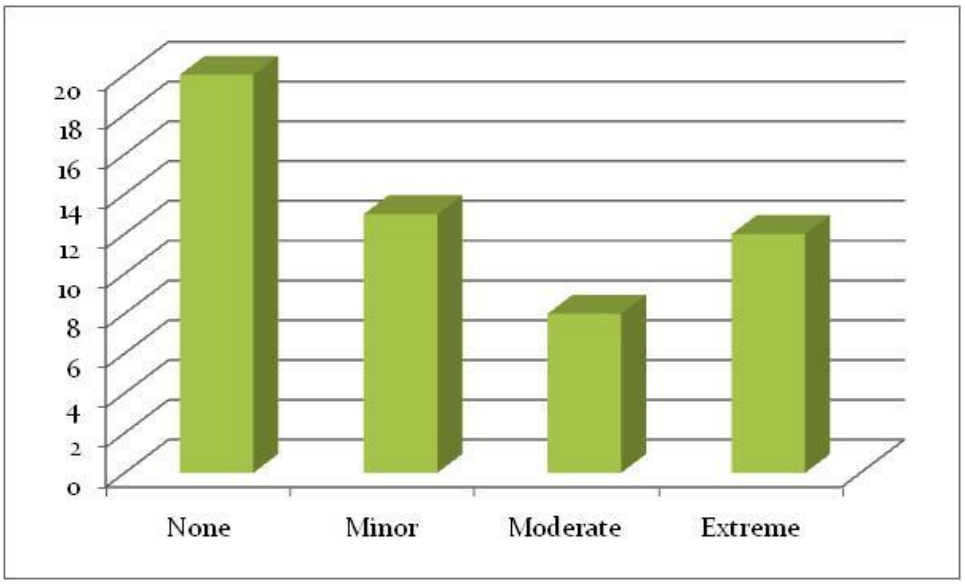

Figure 5. Bank erosion problem perceptions.

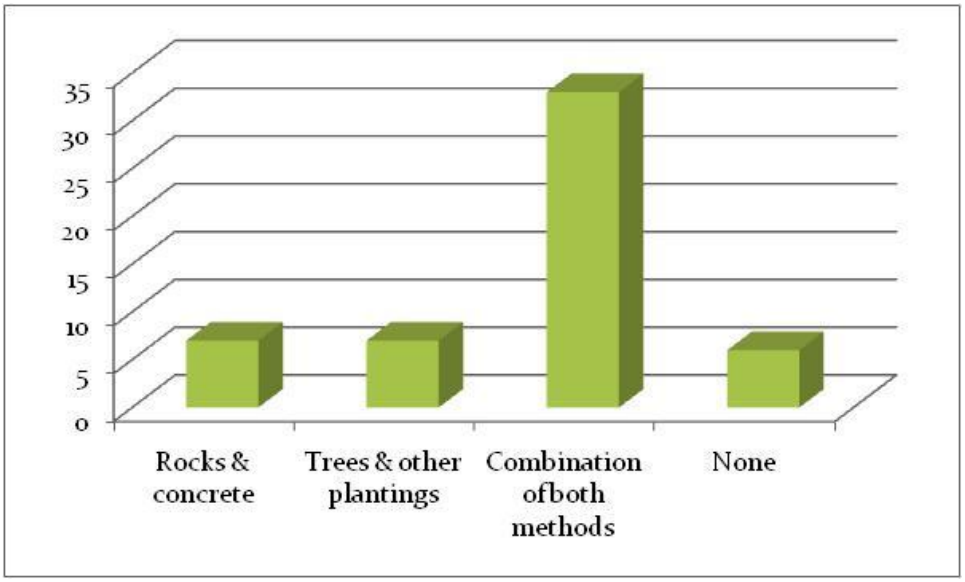

Figure 6. Bank erosion treatments preferences.

Respondents also were asked if they thought streambank erosion had increased in the last few years. Fifty-three percent thought erosion had increased and 47% believed it had not increased. Respondents were asked why they thought streambank erosion increased and twenty respondents provided their opinions. The most common reasons given for an increase in streambank erosion were an increase in water to the creek (e.g., overland flow), daily changes in water levels as a result of NY Power Authority (NYPA) activity, tree and debris blockages, and a lack of vegetation on the streambanks.

Forty-nine people answered the question about having a buffer of natural vegetation along the stream. Over half (61%) of the respondents indicated that they have a buffer, and the width of the buffers on their property ranged from 0.6 to 152 meters, although most (i.e., all but one) were between 0.6 and 61 meters, with an average buffer width of 8 meters. Of those who do not have a buffer along the stream (39%), 63% would consider letting a natural vegetation buffer grow rather than mowing their lawn next to the creek's edge.

Forty-eight people answered the question about whether or not they experience flooding on their property during a typical year. Although flooding has been documented in the watershed (USACE, 2002), most respondents (60%) never experience flooding during a typical year. Moreover, few respondents (37%) believe that flooding has increased in the past few years. However, of those who believe that flooding has increased in the past few years, the most common reasons cited for the increase were fallen trees and debris in the channel, weather conditions (e.g., "rain, lots of snow"), and development, including expansion of the Niagara Falls International Airport.

Finally, fifty-one people answered the question about maintaining and enhancing aquatic habitat within the creek and keeping the creek in its natural state is either extremely important or important to 84% of the questionnaire respondents.

DISCUSSION AND CONCLUSIONS

The Cayuga Creek Steering Committee has been working on watershed management in the Cayuga Creek watershed since 2003, but that process has included limited community member involvement. The objective of this study was to develop and administer a questionnaire to assess community members' opinions and perceptions of environmental problems in the watershed. The overall goal of the questionnaire was to give more community members the opportunity to provide input to the watershed management process. The questionnaire was distributed to community members relatively early in the watershed management process, thus allowing community input to the management plan when it was most effective and valuable (Bernhardt et al., 2007; Duram and Brown, 1998). Results from this study will inform the on-going watershed management process, including which projects outlined in the CCWRRM might be implemented. Specific projects proposed in the CCWRRM are intended to make improvements in the following environmental categories: streambank stabilization and erosion control; habitat

conservation and restoration; storm water management; and contaminant reduction (Ecology and Environment, Inc., 2009).

Residents feel that the overall condition of Cayuga Creek is poor. If residents are using the creek, they are nature observing, fishing, and canoeing/kayaking and they are concerned with fallen trees/debris, water quality, and streambank erosion. The fact that a number of residents (nineteen) are not using the stream at all may be linked to the perceived and actual water quality issues and lack of public access. Previous studies have shown that water quality is, in fact, impaired in Cayuga Creek (Frothingham et al., 2005 and 2009; NYSDEC, 2010). CCWRRM projects that address water quality problems through contaminant reduction and storm water management include, for example, sewer cleaning, root treatment, wetland restoration, and debris removal (Ecology and Environment, Inc., 2009). In addition, a project area within the CCWRRM addresses public access and recreation and suggests that a water or canoe trail be constructed (Ecology and Environment, Inc., 2009). Specific elements of a trail could include a canoe launch, tree removal, and signage and the CCWRRM states that a canoe trail "…will encourage recreational use of the creek while providing opportunities for environmental education." (Ecology and Environment, Inc., 2009: 24).

Specific questions address bank instability, lack of a natural riparian corridor, and flooding because previous studies indicate that these are problems in the watershed (Frothingham et al., 2005 and 2009; USACE, 2002). Questionnaire results show that bank erosion is a problem in targeted areas and the majority of respondents are interested in innovative bank stabilization techniques that combine rocks and concrete with trees and other plantings. These results could inform specific restoration project development (e.g., use of biotechnical bank stabilization versus hard engineering techniques) within the streambank stabilization and erosion control environmental category of the CCWRRM (Ecology and Environment, Inc., 2009). While some residents have natural riparian buffers, riparian restoration that includes an increase (number and width) in buffers would also stabilize streambanks, improve water quality, and increase habitat. This would in turn improve all the environmental categories outlined in the CCWRRM (Ecology and Environment, Inc., 2009). Flooding has been documented in the watershed in the Town of Niagara (USACE, 2002); however, most questionnaire respondents do not indicate that flooding is a problem on their property, which suggests that the spatial scale of flooding may be limited. This finding indicates that a CCWRRM project, such as channel realignment and/or floodplain reconnection (Ecology and Environment, Inc., 2009) on the land parcel in the Town of Niagara might be an effective restoration approach to alleviate the flooding that has occurred. Finally, residents are concerned about maintaining and enhancing aquatic habitat within the creek and keeping the creek in its natural state. Habitat conservation and restoration is an important environmental category in the CCWRRM and specific projects include restoring in-channel habitat, fish passage, riparian habitat, and wetlands and fishery enhancement (Ecology and Environment, Inc., 2009).

The questionnaire has provided insight into what community members think about environmental problems in the Cayuga Creek watershed, as well as what they are using the creek for and what they value most about the creek. An increased understanding of these issues has provided the opportunity to inform on-going watershed management planning in the Cayuga Creek watershed by linking community members' concerns with the CCWRRM to identify restoration projects that can be implemented.

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REFERENCES

Berhardt, E. S.; Palmer, M. A.; Allan, J. D.; Alexander, G.; Barnas, K.; Brooks, S.; Carr, J.; Clayton, S.; Dahm, C.; Follstad-Shah, J.; Galat, D.; Gloss, S.; Goodwin, P.; Hart, D.; Hassett, B.; Jenkinson, R.; Katz, S.; Kondolf, G. M.; Lake, P. S.; Lave, R.; Meyer, J. L.; O'Donnell, T. K.; Pagano, L.; and Sudduth, E. 2005. Synthesizing U.S. river restoration efforts. *Science* 308: 636-637.

Berhardt, E. S.; Sudduth, E.; Palmer, M. A.; Allan, J. D.; Meyer, J. L.; Alexander, G.; Follastad-Shah, J.; Hassett, B.; Jenkins, R.; Lave, R.; Rumps, J.; and Pagano, L. 2007. Restoring rivers one reach at a time: Results from a survey of U.S. river restoration practitioners. *Restoration Ecology* 15 (3): 482-493.

Born, S. M. and Sonzogni, W. C. 1995. Integrated environmental management: Strengthening the conceptualization. *Environmental Management* 19 (2): 167-181.

Duram, L. A. and Brown, K. G. 1999. Assessing public participation in U.S. watershed planning initiatives. *Society and Natural Resources* 12: 455-467.

Drum Major Institute for Public Policy. 2010 Middle class according to The Drum Major Institute for public policy. http://drummajorinstitute.org/ (last accessed 15 January 2010).

Ecology and Environment, Inc. 2009. Cayuga Creek Watershed Restoration Road Map, 38 pp.

Environmental Protection Agency (EPA). 2009. National Water Quality Inventory: Report to Congress 2004 Reporting Cycle. Office of Water, EPA 841-R-08-001, 37 pp.

———. 2008. Handbook for Developing Watershed Plans to Restore and Protect Our Waters. Office of Water, Nonpoint Source Control Branch, EPA 841-B-08-002. http://water.epa.gov/polwaste/nps/handbook_index.cfm (last accessed 10 November 2010).

———. 1999. NPDES regulations for revisions of the water pollution control program addressing storm water discharges; Final rule. 40 C.F.R. 9, 122, 123, and 124. *Federal Register* 64 (235): 68722-68854.

Federal Interagency Stream Restoration Working Group (FISRWG). 1998. Stream Corridor Restoration: Principles, Processes, and Practices. By the Federal Interagency Stream Restoration Working Group 15 Federal agencies of the U.S. gov't. GPO Item No. 0120-A; SuDocs No. A 57.6/2:EN 3/PT.653. ISBN-0-934213-59-3.

Frothingham, K.M.; Draganac, M.; Sowyrda, A.; Bakert, J.; Carroll, A.; Conwall, N.; Laspada, B.; Pantano, J.; Pollard, V.; Skowronski, J. 2009. Cayuga Creek Watershed Stream Visual Assessment Protocol. Technical report prepared for the Buffalo Niagara Riverkeeper, 51 pp.

Frothingham, K.M. and Brown, N. 2005. Cayuga Creek Watershed Stream Assessment. Technical report prepared for the Friends of the Buffalo Niagara Rivers, 47 pp.

Gould, J.; Reth, K.; Irvine, K.N.; and Perrelli, M. 2009. Cayuga Creek, Niagara County, N.Y. 516(e) Sediment Transport/Delivery Model. Technical report prepared for U.S. Army Corp of Engineers, Buffalo District.

Hassett, B.A.; Palmer, M.A.; and Bernhardt, E.S. 2007. Evaluating stream restoration in the Chesapeake Bay watershed through practitioner interviews. *Restoration Ecology* 15 (3): 563-572.

Kaplowitz, M.D. and Witter, S.G. 2008. Agricultural and residential stakeholder input for watershed management in a mid-Michigan watershed. *Landscape and Urban Planning* 84: 20-27.

Leach, W. D.; Pelkey, N. W.; and Sabatier, P. A. 2002. Stakeholder partnerships as collaborative policymaking: Evaluation criteria applied to watershed management in California and Washington. *Journal of Policy Analysis and Management* 21 (4): 645-670.

Lomnicky, G. A.; Barker, J. R.; and Bryce, S. A. 2002. A mail survey approach to watershed condition assessment. *Journal of Soil and Water Conservation* 57 (1): 1+. *Academic OneFile*. Web. 19 October 2010. Document URL http://find.galegroup.com/gtx/infomark.do?&contentSet=IAC-Documents&type=retrieve&tabID=T002&prodId=AONE&docId=A84805983&source=gale&srcprod=AONE&userGroupName=buffalostate&version=1.0.

National Research Council (NRC). 1999. *New strategies for America's watersheds*. Washington, DC: National Academy Press.

Natural Resource Conservation Service (NRCS). 1998. *Stream visual assessment protocol*. Technical Note 99-1, 42 pp.

New York State Department of Environmental Conservation (NYSDEC). 2010. The Niagara River/Lake Erie Basin Waterbody Inventory and Priority Waterbodies List. http://www.dec.ny.gov/docs/water_pdf/pwlniag10.pdf (last accessed 10 November 2010).

Palmer, M. A.; Allan, J. D.; Meyer, J.; and Bernhardt, E. S. 2007. River restoration in the twenty-first century: Data and experiential knowledge to inform future efforts. *Restoration Ecology* 15 (3): 472-481.

Rhoads, B. L.; Wilson, D.; Urban, M.; and Herricks, E. E. 1999. Interaction between scientists and nonscientists in community-based watershed management: Emergence of the concept of stream naturalization. *Environmental Management* 24(3): 297-308.

Shields, F. D.; Copeland, R. R.; Klingeman, P. C.; Doyle, M. W.; and Simon, A. 2003. Design for stream restoration. *Journal of Hydraulic Engineering* 129 (8): 575-584.

Patten, M. L. 2001. *Questionnaire research: A practical guide*, 2nd ed. Los Angeles, CA: Pyrczak Publishing. 146 pp.

U.S. Army Corps of Engineers (USACE). 2002. Cayuga Watershed Management Feasibility Study Project. Section 905(b) (WRDA 86) Analysis Reconnaissance Report, 58 pp.