

KNOWLEDGE MANAGEMENT, FLOODING, THE WATERSHED APPROACH AND THE CITY OF WATERLOO, ONTARIO, CANADA

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Abstract

We apply a knowledge management perspective to explore how concern over flooding was folded into a holistic watershed approach in the City of Waterloo, Ontario, Canada. The framing of the Laurel Creek Watershed Study in the early 1990s is pivotal in defining flood mitigation as one of a suite of environmental concerns most effectively addressed by a comprehensive approach to watershed planning and management. Amending the City of Waterloo's Official Plan to incorporate recommendations from the Laurel Creek Watershed Study constitutes a milestone in using watershed planning to underpin municipal land use planning.

The significance of this research to the natural hazards community is twofold. First, it is novel in applying a knowledge management perspective to a natural hazards issue. Second, it explores how and why concern about a natural hazard, in this case flooding, becomes a non-stand alone issue in local agenda setting.

Introduction

In Canada, provincial statutes principally determine the responsibilities of local municipalities for water and related land management. Municipalities typically locate, store and distribute water for municipal use and maintain water distribution systems (Conservation Ontario 2001). In Ontario, municipalities through the Planning Act are responsible for local land use planning. Municipalities must be responsive to the element in the Act's Provincial Policy Statement requiring that:

The quality and quantity of ground water and surface water and the function of sensitive ground water recharge/discharge areas, aquifers and headwaters will be protected or enhanced (Ontario 1997 9).

Long before the Provincial Policy Statement came into force, municipalities were sensitive to water concerns in their communities. Indeed, a number of communities in Ontario came into being as a direct result of the economic opportunities presented by exploiting local waters. For example, 110 kilometers southwest of Toronto, in 1808 Albert Erb built a dam for a sawmill on Laurel Creek that created Silver Lake. This was the beginning of UpTown Waterloo. With the creation of Waterloo

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Park, the area became a focus of community life, leading to the fairly rapid development and urbanization of the eastern half of the Laurel Creek watershed (Thomas 1992).

In this brief paper, we apply a knowledge management perspective to explore how concern over flooding was folded into a holistic watershed approach in the City of Waterloo, Ontario, Canada. We begin by discussing information and knowledge to highlight Innes' (1998) idea of employing information as a lens for viewing policy issues. Highly selected, episodes in the history of the City of Waterloo are presented as a background to the Laurel Creek Watershed Study. This study has proved pivotal in defining flood mitigation as one of a suite of environmental concerns most effectively addressed by a comprehensive approach to watershed planning and management. A decade later, the City is still guided in its planning and management by the recommendations from the study. In concluding, questions are raised from a knowledge management perspective about the implications of a holistic watershed approach for flood mitigation.

Information, knowledge decision making and influence

Information according to Peter Drucker (1989 209) "is data endowed with relevance and purpose." Albert Simard (2000) defines knowledge as new understanding derived from synthesizing information from multiple sources. In a decision making context, knowledge comes from putting information into productive use, from making information actionable.

Bukowitz and Williams (1999) interpret knowledge management to be a means to help people share what they already know they know and about helping people share and articulate what they know but don't realize they know it. The lack of awareness of this knowledge by those who have it occurs because this knowledge is embedded in how they work and so has become routine and can be done without thinking about it. Innes (1998) argues that embedded information, information that is invisibly part of the assumptions and definitions of those who hold it, is the most influential form of information. Information then is a lens rather than what is viewed and formally evaluated. To become influential in policy, information must reflect socially constructed, shared understanding created by the actors in a policy community. The process of creating such understanding, in turn, can shape how people understand an issue and what they do about it (Innes 1998).

The City of Waterloo, flooding and the Laurel Creek Watershed Study

The Waterloo area in which Albert Erb settled in the early 1800s prospered. By 1848 there were nine operating grist mills and by the 1880s the number of operating mills in the area peaked at 48. By 1910 80% of the forest cover in the Laurel Creek Watershed was cleared to make way for agriculture. By 1946 increasing urbanization resulted in more problems with erosion and flooding (Trushinski 1992).

In the 1960s the primary interest of the City of Waterloo in Laurel Creek Watershed was flood control. As a result, in 1966 Laurel Creek Reservoir was built to provide flood water storage. At the same time, the harmful effect of pollution on all the areas through which water flowed was recognized (Bailey 1966).

In 1989 the City of Waterloo adopted an "Environment First" approach promoted by then Mayor Turnbull. The underlying philosophy of the approach was to consider potential environmental impacts before making recommendations and decisions. One outcome was to develop strategies that the City could employ, in areas where it had a fair amount of legal control, to enhance, protect and manage the natural environment (Trushinski 1991). The City went on to pursue its "Environment First" approach beyond what it could do on its own.

To develop a comprehensive watershed plan for Laurel Creek and its four tributaries; Monastery, Beaver, Clair, Cedar and Forwell Creeks, in 1991, the City of Waterloo joined in a roundtable partnership involving formal representation from the Grand River Conservation Authority, the Province of Ontario, Waterloo Region, the City of Kitchener, the Townships of Wilmot and Wellesley, Laurel Creek Citizen's Committee, the University of Waterloo, Trout Unlimited and the development industry (Thomas 1992). The overall purpose of the Laurel Creek Watershed Study was to comprehensively assess the natural resource features of the 74 km² watershed and the ecosystem functions they perform. The study was intended to guide local and regional authorities in planning land use development and in protecting, enhancing and rehabilitating the natural environment (Trushinski 1992).

The Laurel Creek Watershed Study was undertaken because of three concerns. One concern was that the negative impacts of past and current urban and rural land use development were adversely affecting the overall health of the watershed. The second concern was the potential for increased levels of flooding in the City of Waterloo, including UpTown, from new development upstream, such as on the City's west side. The third concern was the need for better understanding of the ecological connectivity and functioning of natural environments and land use so as to "avoid" negative impacts from further development (Trushinski 1992). In this paper, it is the second concern that will be highlighted.

The first of the watershed study's five goals was "To minimize the threat to life and the destruction of property and natural resources from flooding, and preserve or reestablish natural floodplain hydrologic functions" (Thomas 1992 6, 11). The roundtable identified several areas where storm events could lead to risk to life and property damage. This situation arose from building in the floodplain and flow surges caused by development lacking stormwater management. Ten flood damage areas were identified in the watershed; the most significant in terms of buildings exposed to flood risk was UpTown Waterloo. The roundtable recognized that existing reservoirs feature in controlling flood risk, that natural storage areas in the upper watershed helped to reduce downstream flooding and that the natural floodplain contributed to controlling flood flows. Runoff from existing urban areas was identified as a major cause of flooding in UpTown Waterloo. Unless runoff flows, volume and timing were controlled effectively, the roundtable thought new development on Waterloo's west side or in the neighboring Townships would increase flooding (Thomas 1992).

The roundtable made a series of recommendations to address flooding (Thomas 1992);

- 1) To reduce flood risk at ten flood prone sites using structural or non-structural measures, including stream rehabilitation and restoration, roadway culvert replacement, storage, flood proofing and land use policies,
- 2) Not to permit new development that would be subject to flood damage except as laid out in the Special Policy Area policies,
- 3) To carry out subwatershed studies and stormwater management plans as part of development plans. These studies should demonstrate
 - a) that as specified in the Laurel Creek Watershed Study, stormwater management for the proposed development meet watershed flow targets, such as peak, volume and timing, and
 - b) that an increase in flooding in any of the flood prone areas, including UpTown Waterloo will not be caused by flows from the development,
- 4) Incorporate infiltration practices into stormwater management plans for new development and retrofit in existing development. Emphasize source controls,
- 5) Design stormwater management plans in new urban development areas to maintain existing flow characteristics and to emphasize at source controls and infiltration,
- 6) Undertake sub-watershed studies as communities are planned, and
- 7) To not build on the floodplain when undertaking new development.

Recommendations from the Laurel Creek Watershed Study were incorporated into the official plan for the City of Waterloo via an official plan amendment completed in 1994. As a result, City of Waterloo land-use and planning decisions are integrated with watershed management because all new district plans, new draft plans to subdivisions, the zoning bylaws, and site plan approval guidelines must correspond to the approved watershed policies (Joliat 1999 16-17).

The Laurel Creek Watershed Study, the watershed approach, flooding and knowledge

The year and a half long Laurel Creek Watershed Study was a landmark knowledge management exercise. The Study has enduring implications for how the City of Waterloo approaches watershed management and the ecological functioning of natural environments throughout the City. A decade after the study's release, the City continues to be guided by its insights. By following through on the study's recommendations, new development has not necessarily increased the risk of flooding.

The Laurel Creek Watershed Study highlights how for a public issue, knowledge is a precondition for intervention (Handmer 1999). The study was a means to synthesize existing understanding by having people draw on their own individual and organizational knowledge as well as tapping into the understanding of other individuals and their organizations. People were able to share what they knew they knew and have others draw out knowledge that they may not have articulated previously in as receptive a forum as the roundtable. The study was also an opportunity to generate new knowledge about the functioning of the Laurel Creek Watershed.

The City of Waterloo, in adopting a watershed approach, as advocated in the Laurel Creek Watershed Study, has bundled its flooding concern with other water resources and land use management issues. One consequence has been the move away from tactics that narrowly "solve" one natural resource related concern in the City of Waterloo to strategies that address the multi faceted elements of ecological functioning. This is exemplified in the shift from channelizing streams as a means to reduce flooding to a multi-objective program of stream rehabilitation (McGoldrick 2002 personal communication). A more bounded example is retrofitting stormwater ponds initially designed to control water quantity to also control water quality. The flood element of a watershed approach may not be as easily distinguished as an identifiable agenda item as was flooding when there was less of an integrated approach to addressing water related concerns. It is unclear whether or not flooding information is successfully embedded in watershed policy. By successfully embedded we mean that it is influential because it has become part of the assumptions and definitions of those who hold that information (Innes 1998). Does the shared understanding of the watershed approach in the City of Waterloo, seamlessly and invisibly include flood awareness? Does it mean that individuals will have a higher tolerance for non-life threatening, economically insignificant flood events because of their awareness of the ecologically beneficial dimensions of disturbance?

Conclusion

Amending the City of Waterloo's Official Plan to incorporate recommendations from the Laurel Creek Watershed Study is a milestone in using watershed planning to underpin municipal land use planning (Trushinski 1993). It is a commitment by the City of Waterloo to recognize ecological reality and its implications in local government decision making. At the same time, employing a comprehensive approach to considering water resources has ramifications for the treatment of constituent concerns, such as flooding. For example, flood mitigation is treated as one of a number of environment related issues. "Solutions" to flooding are at best meant to enhance other watershed features, such as aquatic life, and at least not produce serious adverse consequences for other elements of ecological functioning. Watershed knowledge then becomes a synthesis of

information drawn from different dimensions of watershed management. Ideally, the result of applying such knowledge is a synergistic approach to watershed management.

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