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Jillan Scahill Farrell

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OUTREACH AND CITIZEN ENGAGEMENT IN THE
WINNICUT RIVER WATERSHED: A PARTICIPATORY ACTION STUDY

BY

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Bachelor of Arts, Loyola University New Orleans, 2003

THESIS

Submitted to the University of New Hampshire

In Partial Fulfillment of

the Requirements for the Degree of

Master of Science

in

Natural Resources

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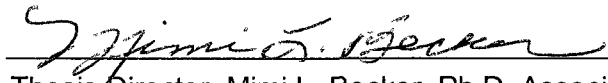
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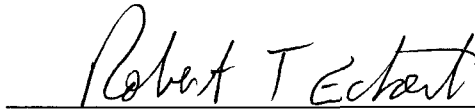


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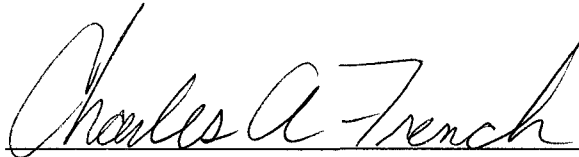
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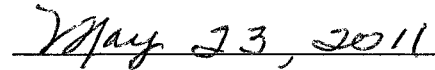
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“To laugh often and much; To win the respect of intelligent people and the affection of children; To earn the appreciation of honest critics and endure the betrayal of false friends; To appreciate beauty, to find the best in others; To leave the world a bit better, whether by a healthy child, a garden patch, or a redeemed social condition; To know even one life has breathed easier because you have lived. This is to have succeeded”

-Ralph Waldo Emerson

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ABSTRACT

OUTREACH AND CITIZEN ENGAGEMENT IN THE WINNICUT RIVER WATERSHED: A PARTICIPATORY ACTION STUDY

By

Jillan Scahill Farrell

University of New Hampshire, September 2011

Recently, citizen initiated watershed management has seen a rise in popularity. Citizen watershed groups have been created across the country especially in New England. These groups advocate for protections and responsible watershed-wide management. Each watershed contains a certain set of unique ecological, social, regulatory and problem situations and therefore each watershed organization requires a full mapping process of the policy and social process as well as the ecological and problem situation before engaging the citizens. This research explores the Winnicut River watershed in southeastern New Hampshire. Covering three communities and representing a subwatershed of the Great Bay coastal watershed this watershed has important social and ecological importance but up until this study initiated had little or no citizen action.

This is a study in participatory action in citizen engaged watershed management and it uses a policy sciences approach to examine current social processes, problem orientation and regulatory framework. Employing a collaborative learning approach the study applies appropriate and relevant citizen outreach and engagement tools to establish the Winnicut River Watershed Coalition. The knowledge and experience gained from the examination and application of methods was used to evaluate and develop future recommendations for the Winnicut River Watershed Coalition.

CHAPTER 1

OVERVIEW, PROBLEM STATEMENT AND LITERATURE REVIEW

Overview

In recent times, the increase in community-based watershed management groups has been tremendous. From watershed associations to citizen action groups to local advisory committees, the initiation of citizens in the management of their waters and watersheds is on the rise. The realization that degradation to surface waters is a combined effect of land use change and human alteration of the landscape has led to an increased necessity for engagement and collaboration of the stakeholders and resource users in order to better identify the sources of the problem and to help to develop amenable solutions. The primary objective of this participatory action study was to identify and assess the social and ecological landscape of the Winnicut River Watershed of New Hampshire, to develop and employ appropriate methods of citizen engagement and outreach to the setting and to evaluate the process. The methodology of participatory action research was employed because the aim was to pursue action and research outcomes at the same time

Problem Statement

At the end of 2008, the Winnicut River was declared impaired by New Hampshire Department of Environmental Services (NHDES) and the US Environmental Protection Agency (USEPA) in relation to the following parameters: E. coli, Dissolved Oxygen, Polychlorinated biphenyls, Dioxin, pH, Benthic-Macro invertebrate Bioassessments, and Estuarine Bioassessments for the following designated uses: aquatic life, fish

consumption, primary contact recreation, secondary contact recreation and shellfishing (EPA 2008). The 9.1-mile long river winds through a landscape that contains a variety of land uses that have been determined to cause risks to water bodies. These include buffer free riparian areas such as lawns and patios, high nutrient sources such as golf courses, increased stormwater runoff areas such as roads and parking lots and there are many eroded or completely collapsed culverts along the river's path (Konisky, 2009). This historic and culturally important river also serves as one of the five primary tributaries to Great Bay. As of July 2009, Great Bay was also declared impaired. The 2009 State of the Estuaries Report noted that 65% of the nitrogen loads impairing Great Bay estuary were coming from the tributaries and runoff (Piscataqua Region Estuaries Partnership [PREP] 2009: 13). By July 2009, the impairments and ecological degradation of Great Bay prompted the New Hampshire state legislature to create a legislative order that established the Southeast Watershed Alliance to guide collaborative management of the estuary at the municipal level (Kanner 2009; RSA 485-E). The history of misguided decisions in land use planning along the Winnicut River coupled with the large increases in non-point source pollution and uncontrolled residential development in the three communities has led to degradation of water quality in the river. A lack of public awareness, education and/or concern for the Winnicut River and its water quality, its link to drinking water quality, its connection to fisheries and overall ecological health of the watershed has fostered a general disregard for the river from a regulatory and social perspective. It is the behaviors of the collective communities that largely contribute to the pollution problems in the river and Great Bay. Without widespread citizen education and awareness about the River and Bay's health and the causes of the pollution no progress in reversing the degradation will be possible.

Literature Review

The approach to the literature review for this study was multi fold due to the complex and unique nature of this participatory action research. Literature based on traditional watershed management gave an opportunity to understand the complications inherent in trying to govern and regulate a watershed based on political boundaries that may involve multiple jurisdictions. The professional literature that focused on the collaborative approach and social learning processes was used to identify the engagement tactics and strategic planning initiatives that were employed in this study. One of the key characteristics in participatory action research approach is collaboration which enables results based on mutual understanding and consensus-based democratic decision making and collective action (Oja & Smulyan, 1989:12), all goals that were identified for the Winnicut River Watershed Coalition effort. Research that addressed questions of collaboration, co-learning and co-management were explored to better understand the complexities and tools for successful collaboration. The direct applied citizen outreach that was employed in this study reflected the literature focused on public participation and public engagement. Harold Laswell's seminal research work of the 1950's that focused upon the policy sciences analytic framework and the political and social interplay of public participation was explored to add depth to the time scale. Due to the nature of problems being faced in the Winnicut River Watershed dealing with water quality and land use, literature was about both the science of water quality and the effects of land uses on natural resources, especially water quality was reviewed. Since the problems with the Winnicut's water quality are largely caused by human impact the science of water quality was explored to understand the implications of human activities that cause non-point source pollution and to assess the cause and effect relationships for the system as a whole.

Watershed Management

In recent times municipal land use planning has increased to address water quality challenges and identify potential palatable outcomes (Wondolleck & Yaffee 2000). The citizens of municipalities are far more varied in their values, expectations, cognizance and levels of concern given the complexity of current issues and the quantity and varied quality of information accessible via the Internet (Brunner 2002; Wondolleck & Yaffee 2000; Rubin 1997). The problems facing us are complex and constantly changing and the discourse surrounding fiscal, governmental and cultural values is increasing and becoming widely divergent. Citizens are able to access far more information and opinions on every cultural or social debate via the internet than they were able to ten or twenty years ago. There has been a marked increase in incongruent groups with diverse and sometimes opposing views such as those who support residential and commercial development for economic benefit and those who support increasing open space and conservation land for environmental benefit (Wondolleck & Yaffee 2000). This debate and societal conflict of values is particularly true in the case of southeastern New Hampshire, which has seen a large rise in population and a huge shift in demographics over the last 25-30 years (SPNHF 2005). In the case of the three watershed communities of the Winnicut the growth rates have been substantial. From 1990-2000 there was 28.25% growth rate for Stratham; 17.10% growth rate for North Hampton and a 15.9% growth rate for Greenland (NH Office of Energy and Planning 2000). A 2005 study conducted by the Society for the Protection of New Hampshire's Forests shows a large increase in immigration from adjacent states, particularly Massachusetts as the main factor to the growth (SPNHF 2005). This kind of immigration causes a shift in demographics and societal values. New Hampshire and Massachusetts differ in their approach to taxes, government's role, ideas towards regulation and natural resource protection. The increase in population has brought the need for responsible land use planning to the forefront as the need for housing and services is

in direct competition with the need for protection of land and natural resources such as water quality.

In addition, local government officials who are charged with the land use decision making for their municipality are barraged with information, data and suggested courses of action all of which can appear to be lacking continuity, consistency or synthesis of message. The boards are visited by numerous and varied organizations and representatives on a weekly basis presenting different suggested paths of action (Town of Greenland 2009, Town of Stratham 2009, Town of North Hampton 2009). The officials are asked to keep taxes low by residents, save open space by conservationists, build commercially by developers, plan for growth by planners, protect wetlands by scientists; this occurs week to week, meeting by meeting (Greenland, North Hampton, Stratham Meeting Minutes, 2009-2010). The messages are diverse and can appear to be mutually exclusive of another. Additionally, municipal officials are volunteers with limited time for decision-making, information gathering, review, implementation or oversight. The municipal officials are charged with not only the daily running of a town, but are also expected to possess an understanding of complex scientific concepts and be able to weigh numerous suggestions for action to take to address water quality issues. The science and technology regarding water quality, though prolific, often times can lack accessibility and clarity for use by these decision makers (Feurt 2006).

Watershed-wide management that addresses the degradation of water quality necessitates crossing political boundaries and thus may be inconsistent with any one town's Master Plan or regulatory documents. Municipal leaders, due to the perceived limitations of political boundaries and municipal jurisdictions, do not easily understand or consider the cumulative effects of local development on the watershed outside their town's boundaries. Effective watershed management requires a working knowledge and adaptive approach to hydrology, ecology and basic chemistry of their surface and groundwater resources that goes

beyond political boundaries. Also local knowledge of land uses, landowners and direct relationships with places and water resources is crucial (Sowers 2010). Municipal officials may be more inclined to participate in such management practices if they have substantive knowledge about the issues and possess or have access to the skills and resources to effectively and confidently make management decisions (Webler, et. al. 2003).

Actions taken to protect water quality and engage in watershed management through land use management occur in a complex social setting that involves governance, business, regulations at local, state and federal levels as well as accountability to diverse constituencies (Feurt 2006). Municipal resources, both financially and socially, are usually limited. This reality can add another level of complexity to finding appropriate actions to address challenges of water quality protection. In the recent national economic downturn, 2008-2010, communities' budgets were cut further due to decreased tax revenue and suffering dividends. Thus many actions that required any capital spending were delayed or voted down at 2010 Town Meeting (Town Meeting Vote, Greenland, Stratham, North Hampton 2010). A more clear, collaborated, holistic approach to watershed management that not only rests on the energies and skills of the municipal officials but brings new, diverse resources, energy and people together to include all of the watershed will be the most effective means to effectual watershed-wide management.

Public Engagement, Social Learning and Social Process

It can be useful to distinguish, somewhat artificially, between active stakeholders associated with a particular issue and concerned publics. Stakeholders may include industrialists, investors in the stock market, food retailers, doctors, government ministries, farmers, lawyers, learned societies, publishers, the media, anti-biotech and green lobbyists, and disease sufferers' organizations. Publics have no immediate stake in the issue, but know that it will have an impact on the society in which they live and would willingly grasp an opportunity to have a voice (Nature 2000; 405: 259).

As of the 2008 census the population total for the three watershed communities of the Winnicut River: North Hampton, Stratham and Greenland was 15,220 (ELMIBa, b, c 2009).

Not all citizens live in the 17.5 square miles of drainage for the Winnicut River Watershed but with its 7 perennial tributaries: Barton Brook, Norton Brook, Marsh Brook, Winniconic Brook, Thompson Brook, Haines Brook, Packer Brook and numerous small first order streams there are a total of 46.5 stream miles in the watershed, most of which contain residential development on their banks (NH Rivers Council 2009). The citizens, who live along the streams within the drainage basin of the watershed, are the primary targets for engagement in the collaborative approach to natural resource and watershed management that is the focus of this project.

Collaborative approaches to public participation in natural resource management have been of great interest in recent years (Wondolleck and Yaffee 2000). This is due to the fact that collaborative management efforts are not purely interest-driven but rather they take a holistic approach and focus on grounding the decision-making in sound science while also reflecting the non-technical aspects of a resource such as economic, cultural and societal values and goals (Wondolleck and Yaffee 2000). The communities in the Winnicut River watershed display great variety in their demographics and thus will undoubtedly show significant and varied interests and values in regards to natural resources and management strategies. Therefore it is appropriate to initiate a collaborative citizen engagement mechanism in this watershed - all interests and values should be heard. The rise in the establishment of watershed groups across the country and in the Southeastern New Hampshire region in recent years shows that effective models for citizen collaboration and natural resource co-management are feasible.

The concept of ***social learning*** has also emerged as a benefit to collaborative natural resource endeavors. It has been defined as: “enhancing common knowledge, awareness and skills by thinking, discussing and acting together” (Borrini-Feyerabend 2000:132). The benefits of awareness raising and social learning are multifold and extend far beyond the initial single river or watershed where the efforts began. These types of initiatives foster a cognizance of the cause and effect complex system that is watershed ecology and help to create an informed and educated citizenry which has proven to be the largest contributor to social change (Wondolleck

and Yaffee 2000). Social learning or collaborative learning is a vital tool to harness when addressing natural resource issues as the issues are fraught with complexity and inherent uncertainty and values conflicts (Schusler, et. al. 2003).

An understanding of the concept of social process also needs to be addressed when looking at complex social-ecological systems such as watersheds. Tim Clark and Andrew Willard define “social process” as the interaction of people as they influence the actions, plans, or policies of other people, even if they are unaware of one another. Social process is the process wherein people create and sustain the human community and the environment that makes it possible” (Clark, et.al. 2000: 12). Identifying the stakeholders, their perspectives, their values, their situations and strategies and then identifying their interactions is what is known as *mapping* the social process. This enables someone to be able to identify the unique social context in which all natural resource problems are embedded (Lasswell 1971; Lasswell and McDougal 1992; Clark, et.al. 2000). The main thrust of the definition of the social process centers upon the interplay of human values, in that people’s values underlie their perspective and frame or view of the world (Clark, et.al. 2000). Researchers can identify these values as well; Lasswell (1957) divides them into eight categories, and sets to mapping the natural resource problem and initiating the policy decision process (Lasswell and Kaplan 1950; Lasswell and McDougal 1992; Clark, et.al. 2000).

Co-management and Collaborative Approach

According to Richard Margerum (2008) the best, most effective way to address collective pollution sources is through collaboration and participatory action. Since the pollution is non-point source it is by definition complex so the methods to addressing that pollution must be multifarious and inclusive. The top-down prescriptive approach will not effectively address the diverse social, ecological, political and economic contexts, rather a bottom-up, grassroots approach is far more appropriate and can lead to a more successful outcome (Margerum 2008). Participatory Action Research (PAR) rests upon the idea that local knowledge and social capital

are integral resources to employ when addressing management of natural resources. PAR studies such as this one aim to contribute to the practical improvement of problem situations as well as expand public knowledge (Allen, 2001). There are four basic themes of a PAR study according to Allen (2001): i) Collaboration through participation; ii) acquisition of knowledge; iii) social change; iv) empowerment of participants. Zuber-Skerritt's (1992) definition of PAR encapsulates the unique and effective nature of the research in order to address complex, social problems: "Critical collaborative enquiry by reflective practitioners, who are accountable in making the results of their enquiry public, self-evaluative of their practice, and engaged in participative problem solving and continuing professional development" (p.15).

Berkes described the concept of co-management as being "the sharing of power and responsibility between the government and local resource users" (Berkes 2009). There needs to be co-management of resources for successful solutions to complex natural resource problems. According to Wondolleck and Yaffee (2002) for the highest success of ecosystem management there must be three communities involved – communities of place, communities of identity and communities of interest. This concept of co-management has also increased in popularity as the complexities and extensive use and overuse of resources expands. Co-management and governance go hand-in-hand. Governance as opposed to government means that one should look beyond government alone and view more public-private-civil society partnerships as a way to address the inherent limitations of a single managing agency (Berkes, 2009). Adaptive management is inherent in co-management because it is the most fundamental component to achieve success when working within and among partnerships of many varied stakeholders and with dynamic, shifting ecological systems. The management mechanism must remain adaptable and malleable in order to respond to feedback and adjust accordingly. Adaptive management, otherwise thought of as learning-by-doing, was originally discussed by C.S. Holling's book Adaptive Environmental Assessment and Management (Holling 1978) and from there has expanded into a breadth of contemporary research, discussion and practice. The challenge of

remaining adaptable is quite apparent when looking at the federal and state agencies charged with protecting and managing natural resources. Due to the increasing amount of special interest groups and lobbyists especially at the federal level all issues of national and worldwide importance are becoming more and more polarized. The trend towards fence sitting legislators and vague legislative language in laws and rules coupled with the increase in communication methods and technologies has resulted in many regulatory agencies becoming vastly narrow and rigid in their focus and oversight not allowing for adaptation (Brunner et. al. 2002). These agencies are not able to reflect the changing nature of society or the complex and dynamic nature of ecological systems and therefore the need for civic engagement and resource user participation in the management process is essential.

A shift to a more *decentralized* authority and responsibility is best in this new information age and changing management conditions (Wondolleck & Yaffee 2002: 17). Collaborative learning is an interdisciplinary approach that allows for community based ecosystem management (Feurt, 2009). Steven Daniels and Gregg Walker (2001) defined collaborative learning as “an expert practice for designing, implementing and evaluating the dialogues that support ecosystem management”. The process consists of techniques designed to facilitate shared understanding of complex environmental issues. Christine Feurt’s work in 2009 took Daniels’ and Walker’s research, combined them with her own expertise in ethnographic methodologies and cultural model theory and developed a systems approach to breaking down barriers to science translation (Feurt 2009). Her work focused on collaboration among those people who were charged with managing and regulating water. The practice uses facilitated collaboration amongst a diverse cross section of expertise and knowledge to build a dialogue and develop a shared vision among the resource managers that then guides the resource management. The approach involves scientists, municipal planners, regulators at all levels, policy makers and managers creating what Feurt calls the “kaleidoscope of expertise.” It is this diverse knowledge base that allows for an increased social infrastructure to facilitate the co-

creation of knowledge and diffusion of information among the new social network (Feurt 2009). A key component to the collaborative learning approach rests in its adaptability and flexibility to encompass varying ideas, emerging knowledge and changing technologies. By building the knowledge network the approach allows for newest technologies to be shared amongst the collaborators while also keeping the interdisciplinary approach to accommodate the varying knowledge capacities (Feurt 2009). Feurt's work focused on resource managers and regulators and did not extend out to resource users, the citizens. Her model is interesting to consider as it shows the great value in social infrastructure development and social learning processes. However, any holistic collaborative approach to natural resource management, such as that undertaken in this study, must engage the resource users and include the local knowledge and values of the citizens in the "kaleidoscope of expertise" (Feurt 2009). The most effective engagement strategy in collaboration is to connect the local community to its most understood or recognized resource and create trust based on the mutuality of that shared resource as it engages stakeholders in addressing problems or achieving goals.

Public Participation

Public participation has many iterations of meaning and can be implemented across a spectrum of engagement from one-time public input hearings to citizen science¹ studies and data co-creation. Creighton describes it as: "the process by which public concerns, needs and values are incorporated into governmental and corporate decision making" (2005: 7). Webler and Tuler describe it as: "a variety of procedures for enabling diverse members of the public to be active participants in deliberations about preferred policy options, and in some cases decision-making" (2001: 29). In this study the concept of public participation refers to the active involvement of the citizens in the three watershed towns. Active, two-way engagement that goes beyond simple participation is of paramount

¹ *Citizen Science* Citizen science enlists the public in collecting large quantities of data across an array of habitats and locations over long spans of time. Citizen science projects have been remarkably successful in advancing scientific knowledge, and contributions from citizen scientists now provide a vast quantity of data about species occurrence, trends and water quality around the world (Bonney et. al. 2009).

importance in this study. The emergence of increased public participation in science and environmental issues occurred in conjunction with the public's rising mistrust in governments will and/or ability to address complex environmental problems. The public also began to mistrust the idea that science serves the public good this largely stemmed from technology "run amok" (e.g. the experiments with biotechnology and research using animal-human hybrid embryos in Britain as well as the increase in genetically modified foods and difficulties with communicating science to achieve heightened awareness of global climate change) (Backstrand 2003). Additionally, the rise in "corporate science" or the blurring of lines between funding and results led to more skepticism of science amongst the public. People started to pay attention to science and the policy decisions arising from that science and started to feel as though they were not involved enough in decisions that were clearly affecting all of humanity, as suggested by Backstrand, 2003. The existence of citizen advisory boards, civic environmental groups and community watch groups has grown tremendously since the 1970's (Wondolleck and Yaffee 2000). Communities are demanding more oversight of and communication with their leaders when it comes to decisions and actions related to environmental issues that affect them. The popularity of the internet has also armed citizens with more resources and information with which to question their leaders but the superfluity of information at their fingertips can also lead to a sense of paralysis due to the feeling of being overwhelmed with causes to support and actions to take (Wondolleck and Yaffee 2000). This is why active two-way public engagement, co-learning and collaboration are key to helping citizens decode the myths and gain clarity to their concerns.

Land Use and Water Quality

The Center for Watershed Protection in Maryland has performed and published extensive research on experimental work as well as literature reviews on the effects and relationships of urbanization and watershed health. It has listed impervious land cover as being one of the most detrimental effects of urbanization to an area's watershed health (CWP 2003). This has been widely researched to show that as a watershed basin increases impervious land cover to 10% the stream

water quality begins to degrade (Klein, 1979; Booth and Reinelt, 1993; Schueler, 1994; Booth and Jackson 1997). Specific conductance, turbidity, nitrite plus nitrate yields and selected macro invertebrate community data were also found to be significantly correlated with most measures of urbanization including impervious cover, radial buffers, stream buffers and habitat condition from a 2003 United States Geological Survey study conducted in the Seacoast region (Deacon, J.R., et.al. 2005). As an area becomes developed the impervious surfaces (i.e. roadways, driveways, rooftops, parking lots) covering the land become increased. This can lead to a decrease in water quality since the wetlands, forested lands and other lands of open space that normally aids in absorbing and cleaning stormwater naturally become less and less intact (Klein 1979). In addition to losing open ground for infiltration the ecosystem also loses habitat for wildlife.

The effects of urbanization and land use cause headwater and stream quality to decline leading to further degradation downstream. Local land use practices and development decisions contribute to water resource degradation through increased non-point source pollution caused by erosion of sediments, nutrients, toxins and microbial contaminants (Feurt 2006). Not only do the impervious surfaces not allow infiltration but they aid in escalating the amount and speed of the water running off the land increasing the velocity at which pollutants, sediments and nutrients arrive in the water bodies (Im, et. al. 2003). Large wetland systems, such as the Line Swamp that makes up the Winnicut River's headwaters, are particularly susceptible to degraded water and sediment quality due to adjacent land use (Houlahan and Findlay 2004). Houlahan and Findlay, also found that for wetland waters nitrogen and phosphorous levels were negatively correlated with forest cover at 2250 meters from the wetland edge, while sediment phosphorous levels were negatively correlated with wetland size and forest cover at 4000 meters and positively correlated with the proportion of land within 4000 meters that is itself wetland (Houlahan and Findlay 2004). They suggest one must look at the larger spatial scale of a watershed and understand that a narrow buffer surrounding individual small wetland systems is not enough to protect the overall water quality but rather a buffer of up to 4000 meters from the wetland edge would have the best effect on maintaining water quality (Houlahan and Findlay, 2004: 687). The

Center for Watershed Protection and the Connecticut River Joint Commission have suggested a variability of buffer size depending upon its purpose (Figure 1-1) (CRJC 2000) (CWP 2000).

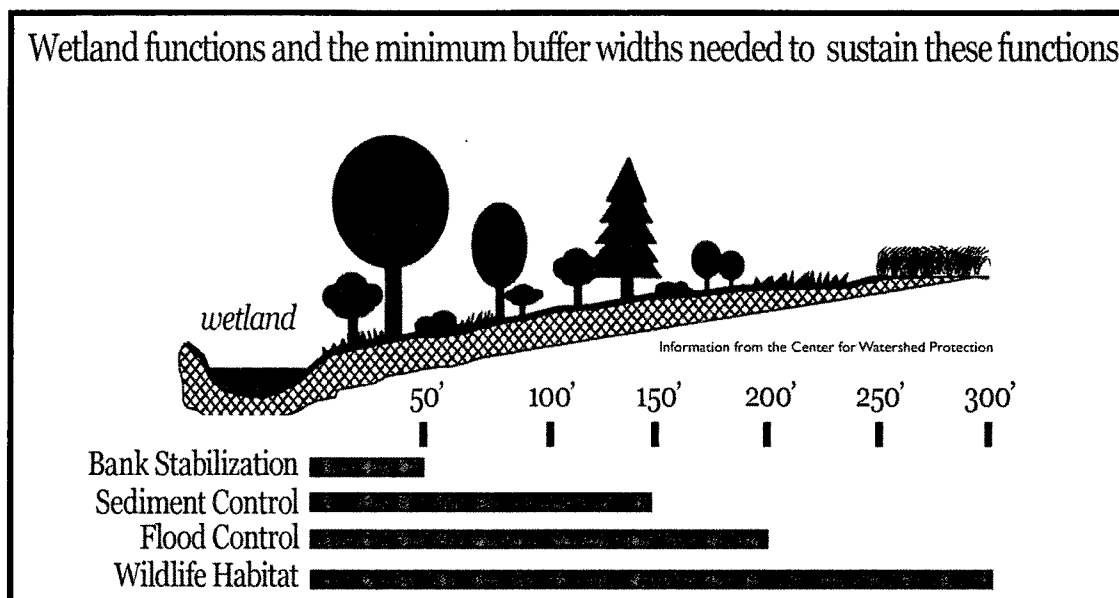


Figure 1-1. Wetland functions and the minimum buffer widths needed to sustain those functions.

Source: (Graphic amended from CWP 2000)

CHAPTER 2

INTRODUCTION TO THE WINNICUT RIVER WATERSHED

General Watershed Characteristics

The Winnicut River is a 9.1 mile long 3rd order stream that rises at the northern outlet of Line Swamp in the southwest corner of North Hampton, New Hampshire flows north through Stratham, New Hampshire with its outlet at the Great Bay estuary in Greenland, New Hampshire (Lord and Arcieri 2008: 4) ([Figure 2-1](#)).

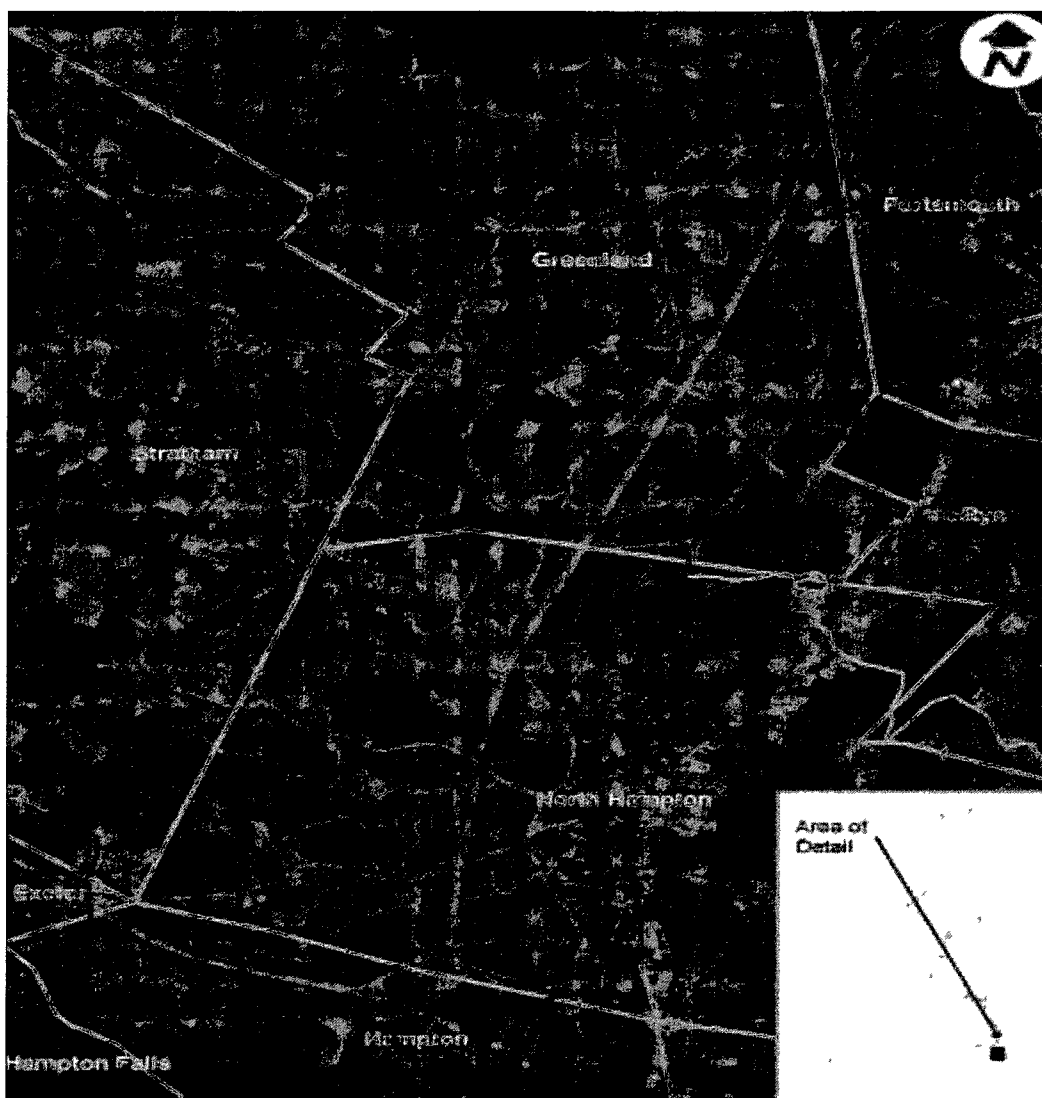


Figure 2-1. GIS map with the Winnicut River Watershed outlined in Red.
Source: (Streamscape Environmental 2009)

The Winnicut River is one of five primary tributaries to Great Bay (the other four are: Oyster River, Lamprey River, Bellamy River and the Squamscott/Exeter River). The Great Bay covers over 6,000 acres, not including its tidal river tributaries. At its outlet at Hilton Point in Dover, New Hampshire, waters from the Bay flow into the Piscataqua River then meet the Salmon Falls River and then proceed southeast to the Atlantic Ocean with its mouth at Portsmouth and New Castle, New Hampshire and Kittery Point, Maine (Great Bay Stewards 2010) ([Figure 2-2](#)).

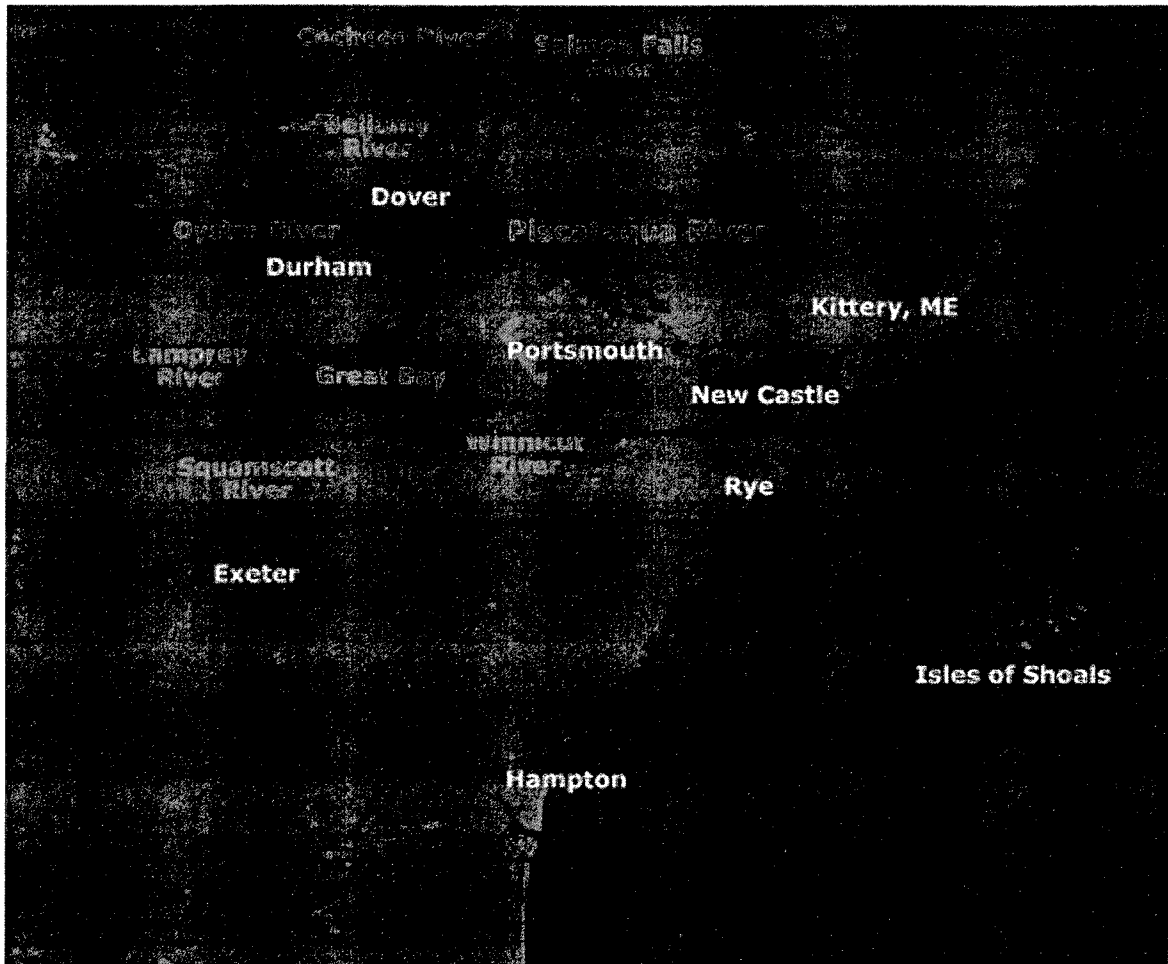


Figure 2-2. Satellite imagery of the Great Bay estuary drainage.

Source: (USGS 2009)

The Winnicut River watershed has a drainage basin of approximately 17.5 square miles. The Winnicut River, its perennial tributaries (including Barton Brook, Norton Brook, Marsh Brook, Winniconic Brook, Thompson Brook, Haines Brook, and Packer Brook), and numerous small first order streams account for a total of 46.5 stream miles in the watershed (NH Rivers Council 2009). The Winnicut River is the only tributary river to Great Bay estuary that does not contain an extant, head-of-tide dam along its entire reach. The river's only dam was removed by the New Hampshire Coastal Program with funding from National Oceanic and Atmospheric Administration in October 2009 reconnecting 39 miles of spawning and rearing habitat for migratory fish including river herring, smelt and American eel (NHFG 2009). In addition the project's scope hopes to

recover a portion of the 5,500 feet of riverine habitat that was lost through the creation of the impoundment and restore 21,000 square feet of intertidal habitat (Woodlot 2007: 12) (NHFG 2009).

The runoff water entering the watershed comes primarily from three communities: North Hampton, Stratham and Greenland with 27% of Greenland's 10.7 sq. mi. of land area emptying into the Winnicut River, (ELMIBa 2009). The headwaters of the river lie in the large wetland system at the southwest corner of North Hampton called Line Swamp. Most of the land in North Hampton west of interstate I-95 is wetlands that make up the Line Swamp system (Lord and Arcieri 2008). The watershed's 17.5 square mile drainage basin includes three 18-hole golf courses. The watershed has exhibited high attenuation rates for flood waters due mostly to its intact riparian buffers along a majority of its reaches, its relatively flat topography and its large wetlands systems (Konisky 2008, Lord and Arcieri 2008). In addition, the watershed includes the drinking water aquifer areas for the town of North Hampton's water supply accessed through wells off of Winnicut Road in North Hampton (Lord and Arcieri 2008), as well as one of the aquifers that provides drinking water for the City of Portsmouth system which is underlying Breakfast Hill Road, Post Road and Portsmouth Avenue in Greenland.

Demographics and Growth in the Winnicut River Watershed

In 2009, the combined populations of the three towns that at least partially lie in the watershed totals 15,220 (North Hampton = 4511; Stratham = 7287; Greenland = 3422) (ELMIBI a, b, c 2009). The entire state of New Hampshire had been experiencing unprecedented population growth from approximately 1950-2005 until the recent economic downturn put a major stall in building permit applications and new development in the Winnicut River watershed area. In the town of Greenland in 2000 26 new building permits were granted. In 2009 16 were approved. Stratham approved 65

building permits in 1999 but only 8 in 2009. North Hampton granted 59 new building permits in 2000 and only 12 in 2009 (US Census Bureau 2010). Stratham ranked the highest percent in population growth from 1990-2000 among the three towns seeing a 28.25% growth rate increase and ranking 28th in the state for percent change in growth rate. North Hampton ranked 83rd in the state with a 17.10% growth rate from 1990 to 2000 and Greenland ranked 94th overall in the state showing a 15.9% growth rate in final decade of the 1990's (NH Office of Energy and Planning 2000). When the 2010 census data is tabulated it is expected that New Hampshire will see additional population growth throughout its municipalities. In a 2009 report, The United States Department of Agriculture Forest Service ranked the Piscataqua-Salmon Falls watershed, of which the Winnicut is a part, as being the number one watershed projected to experience the most change in water quality from 2000-2030 in water quality as a result of increases in housing density on private forest lands (Stein, et. al. 2009). Researchers project that 63% of the private forest in the watershed will experience increased housing density (Stein, et. al. 2009) which will affect water quality as forests provide a natural filter for all water in the hydrologic system. Additionally, the Contoocook and Merrimack watersheds, both in Southern New Hampshire, were ranked 2 and 4 respectively out of the top 15 (Stein, et. al. 2009).

The 2008 Winnicut Dam Removal Feasibility Study states that the Winnicut River watershed is the “most pristine of the tributary rivers to the Great Bay estuary” due to a lack of permitted point-source pollution and limited development adjacent to the river (Woodlot Alternatives, Inc. 2007). However, the Winnicut River watershed is currently not supporting a number of designated uses for New Hampshire surface waters, most likely due to the expansion of impervious surfaces from residential development in the watershed over the past 10 to 20 years. Within the small watershed, there are 84 miles of roads, extensive areas of impervious surfaces, and a 450 acre golf course located

along the Winnicut's banks (Justice and Rubin, 2006). In a 2004 report on river monitoring in New Hampshire's coastal watersheds, NHDES explains its decision to add a monitoring location on the Winnicut River stating that, "the relatively rural watershed has experienced recent and continuing development that could impact the quality of the water flowing into Great Bay" (Landry 2004).

Rapid development in the three watershed towns has resulted in a marked increase in impervious surface cover. The Piscataqua Region Estuaries Partnership, (formally the New Hampshire Estuaries Project) has been collecting impervious cover data for its focus area which includes the three Winnicut watershed towns, from 1990 through 2005 with updated data expected in 2011 and the increase in cover in Stratham, Greenland and North Hampton is quite dramatic ([Table 2-1](#)). The watershed has surpassed the 10% impervious cover mark that was laid out by the Center for Watershed Protection, meaning that demonstrated water quality deterioration is occurring (Figure 2-3) (CWP, 2003). A 2005 study in New Hampshire demonstrated that the percentage of urban land use that occurs in stream buffer zones and the percent of impervious surface in a watershed can be used as indicators of stream quality (Deacon et al., 2005).

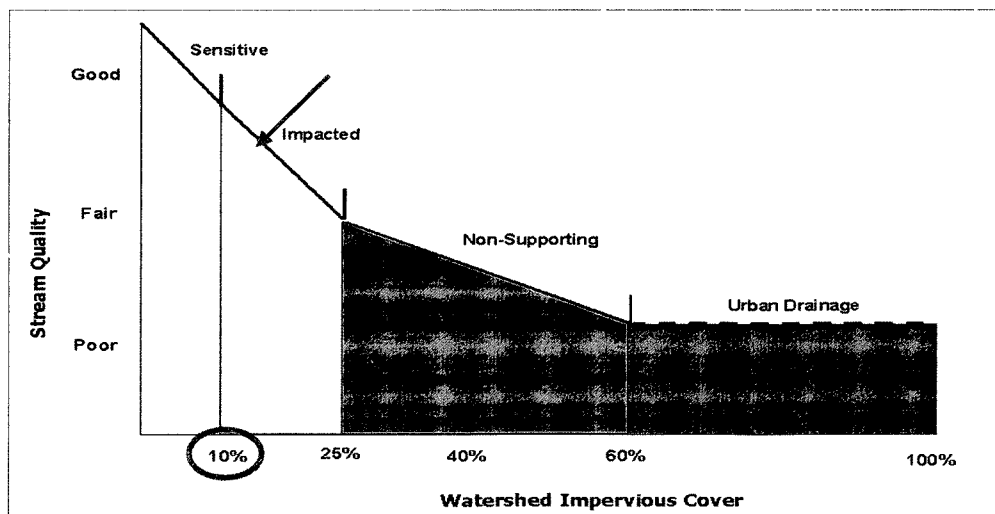


Figure 2-3. Watershed Impervious Cover (%) (x) in relation to Stream Quality(y)
Source: (CWP 2003)

Table 2-1. Increase in impervious surface cover for the three Winnicut River Watershed communities

Town	Land Area (Acres)	% Impervious Cover		
		1990	2000	2005
Greenland	6,780	6 7%	10 5%	12 5%
North Hampton	8,865	7 3%	10 8%	12 4%
Stratham	9,672	6 5%	10 1%	12 9%

(PREP 2009), Data Source (UNH Complex Systems Research Center 2009)

Water Quality and the Winnicut River Watershed

At the end of 2008, the Winnicut River was declared “impaired” by New Hampshire Department of Environmental Services and the US EPA in relation to the following parameters E coli, Dissolved Oxygen, Polychlorinated biphenyls, Dioxin, pH, Benthic-Macro invertebrate Bioassessments, and Estuarine Bioassessments for the following designated uses aquatic life, fish consumption, primary contact recreation, secondary contact recreation and shellfishing (USEPA 2011) Waters rated as “impaired” by the states cannot support one or more of their designated uses which then triggers the regulatory measure of a Total Maximum Daily Load allocation (TMDL) A Total Maximum Daily Load, or TMDL, is a calculation of the maximum amount of a pollutant that can be present in a segment and still allow attainment of water quality standards, and an allocation of that amount to the pollutant’s sources The TMDL calculation is $TMDL = WLA + LA + MOS$, where, *WLA* is the sum of wasteload allocations (point sources), *LA* is the sum of load allocations (nonpoint sources and background), and *MOS* is the margin of safety (USEPA 2010)

The water quality assessment for the 303(d) list¹ is based on five types of testing

¹ Section 305(b) of the Clean Water Act requires submittal of a report (commonly called the “305(b) Report”), that describes the quality of its surface waters and an analysis of the extent to which all

Table 2-2 lays out the criteria used for determining whether or not “impairment” for designated uses is occurring in a water body.

Table 2-2. The five types of criteria used by NHDES and the EPA to determine impairment status of a water body.

Biological integrity data are objective measurements of aquatic biological communities (usually aquatic insects, fish, or algae) used to evaluate the condition of an aquatic ecosystem. Biological data are best used when deciding whether waters support aquatic life uses.
Chemical data include measurements of key chemical constituents in water, sediments, and fish tissue. Examples of these measurements include metals, oils, pesticides, and nutrients such as nitrogen and phosphorus. Monitoring for specific chemicals helps states identify the causes for impairment and helps trace the source of the impairment.
Physical data include characteristics of water such as temperature, flow, dissolved oxygen, and pH. Physical attributes are useful screening indicators of potential problems, often because they can have an impact on the effects of chemicals.
Habitat assessments include descriptions of sites and surrounding land uses; condition of streamside vegetation; and measurement of features such as stream width, depth, flow and substrate. They are used to supplement and interpret other kinds of data.
Toxicity testing is used to determine whether an aquatic life use is being attained. Toxicity data are generated by exposing selected organisms such as fathead minnows or daphnia ("water fleas") to known dilutions of water taken from the sampling location. These tests can help determine whether poor water quality results from toxins or degraded habitat

Source (USEPA 2010)

New Hampshire’s water quality standards are composed of three parts: designated uses, water quality criteria, and anti-degradation. Designated uses are the desired uses that surface waters, like the Winnicut River should support such as: swimming (referred to as primary contact recreation) and fishing (referred to as aquatic life). New Hampshire state statute Title L: Water Management and Protection, Chapter 485-A: Water Pollution and Waste Disposal section on Classification of Waters (State of New Hampshire 2011) does not expand in detail the designated uses for New Hampshire surface waters. In the

such waters provide for the protection and propagation of a balanced population of shellfish, fish and wildlife, and allow recreational activities in and on the water. Section 303(d) requires submittal of a list of waters (i.e , the 303(d) List) that are impaired for these purposes (NHDES(c) 2008).

New Hampshire Code of Administrative Rules, Chapter Env-Wq 1700: Surface Water Quality Regulations interprets of RSA 485-A in further detail and stipulates and refines the general uses into seven specific designated uses. The Winnicut River falls into the category that is subject to these seven uses, with its tidal portion being subject to Shellfish consumption. Table 2-3 shows the designated use, the DES definition of that use and which surface waters are applicable to that use (NHDES 2010).

Table 2-3. Designated Uses for New Hampshire Surface Waters.

Designated Use	DES Definition	Applicable Surface Waters
Aquatic Life	Waters that provide suitable chemical and physical conditions for supporting a balanced, integrated and adaptive community of aquatic organisms.	All surface waters
Fish Consumption	Waters that support fish free from contamination at levels that pose a human health risk to consumers.	All surface waters
Shellfish Consumption	Waters that support a population of shellfish free from toxicants and pathogens that could pose a human health risk to consumers.	All tidal surface waters
Drinking water supply after adequate treatment	Waters with adequate treatment will be suitable for human intake and meet state/federal drinking water regulations.	All surface waters
Primary Contact Recreation (i.e. swimming)	Waters suitable for recreational uses that require or are likely to result in full body contact and/or incidental ingestion of water.	All surface waters
Secondary Contact Recreation (e.g. Kayaking)	Waters that support recreational uses that involve minor contact with the water.	All surface waters
Wildlife	Waters that provide suitable physical and chemical conditions in the water and the riparian corridor to support wildlife as well as aquatic life.	All surface waters

Source: (NHDES 2010)

The New Hampshire Code of Administrative Rules Chapter Env-Wq 1703: Water Quality Standards lists 32 criteria that establish New Hampshire's water quality standards. These include: combined sewer outflows, bacteria, dissolved oxygen, benthic

deposits, oil and grease, color, turbidity, slicks, odors and surface floating solids, temperature, nutrients (i.e. phosphorus and nitrogen), gross beta radioactivity, strontium-90, radium-226, and pH (NHDES 2008).

Antidegradation is the third component to New Hampshire's water quality standards and refers to provisions designed to preserve and protect the existing beneficial uses and to minimize degradation of the State's surface waters (NHDES 2010).

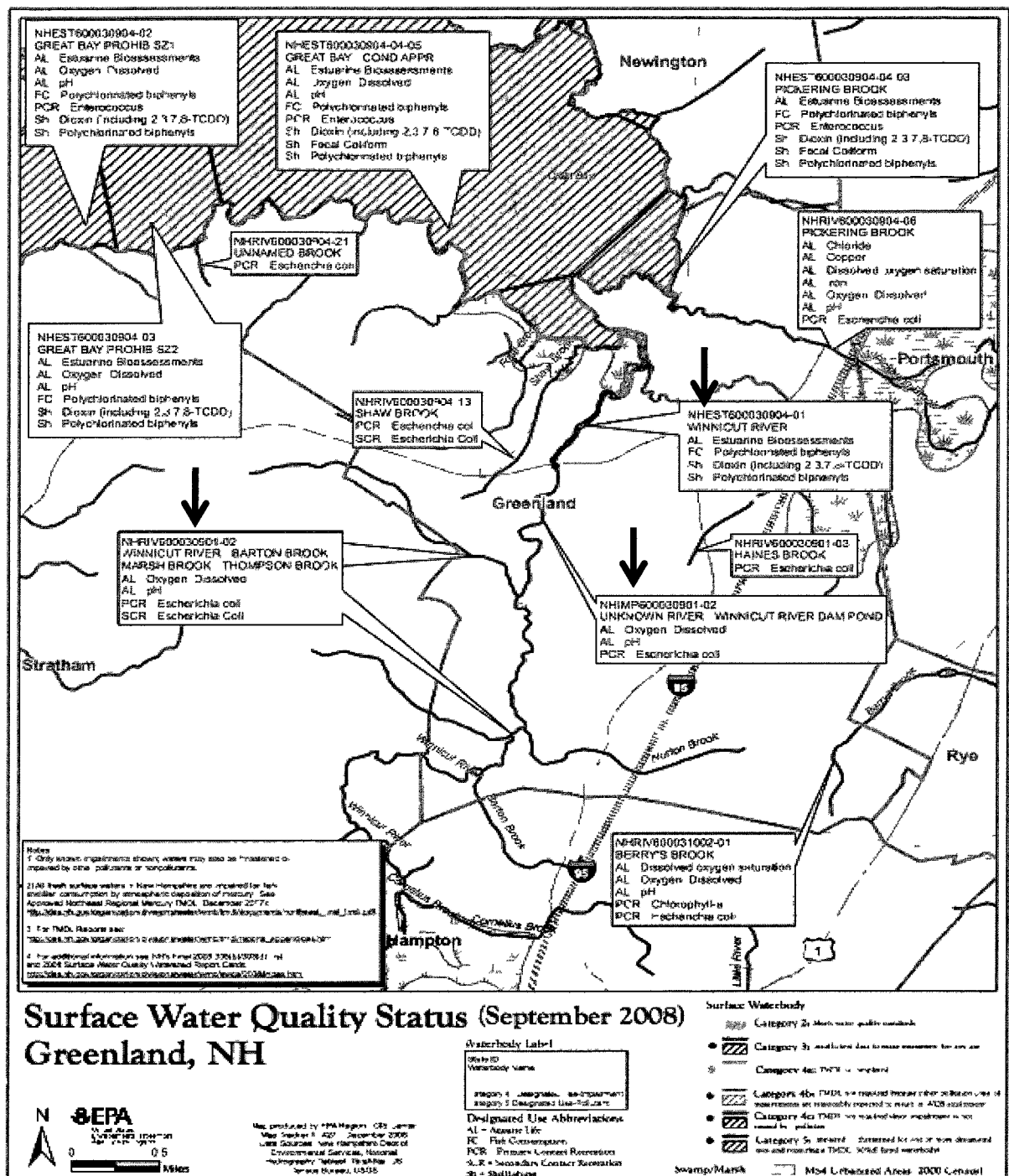


Figure 2-4. Map of the Winnicut River, related tributaries and regional watershed with arrows signifying Category 5 Impaired or threatened for one or more designated uses and requiring a TMDL (303(d) listed waterbody). Three arrows mark the Winnicut River data. Source: (USEPA, Waterbody Report for Winnicut River, 2008)

Table 2-3 shows the Winnicut River's reported designated uses as defined by New Hampshire's Water Quality Standards and the EPA's national uses. Table 2-4 shows the Winnicut River's reported EPA Designated Use Group and its impairment status. Table 2-5 shows New Hampshire's causes of impairments, cause of impairment groups and NH state TMDL development status. Table 2-6 lists all the sources that generate pollution and contribute to impairment in the assessed waters of the waterbody.

Table 2-4. Water Quality Assessment Status for the Winnicut River for Reporting year 2008, the overall status of this waterbody is Impaired.

Designated Use Group	Status
Fish, Shellfish, And Wildlife Protection And Propagation	Impaired
Public Water Supply	Good
Aquatic Life Harvesting	Impaired
Recreation	Impaired
Recreation	Impaired
Fish, Shellfish, And Wildlife Protection And Propagation	Not Assessed

Source: (US EPA, Waterbody Report for Winnicut River, 2008)

Table 2-5. Causes of Impairment of the Winnicut River for Reporting Year 2008.

Cause of Impairment	Cause of Impairment Group	State TMDL Development Status
Dissolved Oxygen	Organic Enrichment/Oxygen Depletion	TMDL needed
Escherichia Coli (E. Coli)	Pathogens	TMDL completed
Mercury	Mercury	TMDL completed
pH	pH/Acidity/Caustic Conditions	TMDL needed

Source: (US EPA, Waterbody Report for Winnicut River, 2008)

Table 2-6. Probable Sources Contributing to Impairment for Reporting Year 2008.

Probable Source	Probable Source Group	Cause(s) of Impairment
Atmospheric Deposition - Toxics	Atmospheric Deposition	Mercury
Source Unknown	Unknown	Dissolved Oxygen; Escherichia Coli (E. Coli); pH

Source: (US EPA, Waterbody Report for Winnicut River, 2008)

CHAPTER 3

RESEARCH APPROACH AND METHODS

Purpose

This is an applied participatory action research project. The primary purpose of the study was to utilize a collaborative learning methodology to identify and assess the social and ecological landscape of the Winnicut River Watershed of New Hampshire and then develop and apply appropriate methods of outreach and citizen engagement to the setting to help to address the decline in water quality in the Winnicut River and to bring about change. Participatory action research rests on four primary themes i) collaboration through participation; ii) acquisition of knowledge; iii) social change; iv) empowerment of participants (Allen 2001). A collaborative learning methodology is an expert practice for designing, implementing and evaluating the dialogues that support ecosystem management (Daniels and Walker 2001). The process consists of five distinct phases (assessment, training, design, implementation/facilitation and evaluation) designed to facilitate shared understanding of complex environmental issues and foster change. This study's methodology was separated into these five phases and goals, objectives, tasks and means were laid out accordingly. Tables 3-1, 3-2, 3-3, 3-4 and 3-5 lay out the five phase structure to this study based upon a collaborative learning approach. Outreach methods refer to the creation of letters, media pieces, articles and fact sheets; one-way communication with the public. Citizen engagement refers to recruitment of interested volunteers, public workshops, community events; two-way communication and action from the citizens.

An integral component involved with the assessment phase of the collaborative learning methodology was the context mapping of the social process and problem situation. Employing a policy sciences framework (Lasswell 1957; Clark et.al. 2000) as well as personal participation in the communities, I was able to assess, identify and organize the varied organizations, stakeholders and participants into social process maps and contexts of the problem situation. The group that formed to build this watershed group spent great effort in discussing and identifying the key stakeholders and organizations that needed to be engaged in this process as well identifying the factors and contexts at play in the watershed that need to be addressed in order to address the complex problem of water quality degradation. The group employed a systems thinking diagramming process to better understand the factors and their interactions that have led to the current socio-ecological problem. The process of social learning and group co-creation was employed in mapping the social process and problem situation in order to better inform the outreach and engagement tactics used. Social learning refers to the enhancement of common knowledge, awareness and skills by thinking, discussing and acting together (Borrini-Feyerabend 2000). In participatory action studies and collaborative learning projects casual, personal conversations, off the record, are permissible and utilized throughout the study to help inform and direct actions. Personal communication with “gatekeepers” in each community allowed for greater access and increased awareness of stakeholders and contexts. These gatekeepers included town administrators, local planning commission circuit riders and active, vocal community members. A great benefit to a participatory action study is the ability to be opportunistic and capitalize upon opportunities to casually converse with community members in town hall settings, community businesses and after board meetings. The collaborative learning methodology rests more upon personal interactions and group collaboration, social thinking and learning than on one-on-one researcher,

subject interviews. Concentrated focus was employed in triangulating the data collected by identifying and surveying all current regulatory documents in the three communities as well as town visions and Master Plans and these insights were incorporated into mapping the problem situation.

In recent months, there has been a marked increase in attention and awareness of the water quality degradation in Great Bay and its subwatersheds. Media attention in 2010 included a 5-part series focused on the threats to Great Bay by New Hampshire Public Radio's Amy Quinton (NHPR 2011) and approximately 9 feature articles and news stories in *The Portsmouth Herald*. This media coverage has fostered an increased dialogue at both the state and federal government levels as well as involvement from the local, national and international conservation non-governmental organizations such as The Nature Conservancy and Coastal Conservation Association. Since the Winnicut River is a tributary to Great Bay, a site designated both as a National Estuarine Research Reserve and a National Estuary Program, there is no denying the high value placed on this estuary. The Winnicut River being one of five tributary rivers to Great Bay has contributed significantly to its water quality decline and can be an important factor in its potential restoration. The Piscataqua Region Estuaries Partnership 2009 State of the Estuaries Report states that 65% of the total nitrogen loads to Great Bay Estuary are coming from tributaries and runoff (PREP 2009: 13). However, restoration and improvement in water quality has not yet been exhibited anywhere in the Great Bay system, which continues to decline. With all the focus being directed at the issue and region, why are there still no marked improvements in Great Bay estuary's water quality? A key reason is that there is a lack of local understanding of the situation, the specific causal factors and contributing sources of the problem or the potential solutions. At the municipal level, until recently, there was a lack of public and local decision maker engagement, or actual solution seeking. The establishment of the Southeast Watershed

Alliance by the New Hampshire legislature at the end of 2009 has given the municipal leaders a table to sit at and a collective voice to speak through. The development and actions of the SWA has been slow and the development of implementable solutions is still a ways off but the knowledge sharing and increased awareness surrounding the issues of water quality has been increasing. New solutions are needed to address the sources of pollution causing Great Bay impairments: non-point source pollution, stormwater pollution, failing septic systems, lack of stream buffer protection, among others. Solutions to addressing these pollution sources rest in coordinated municipal level regulations and ordinances including Master Plan and implementation policies such as those in updated zoning codes. Municipal officials' decisions are the leverage point for reversing the degrading conditions. That is why a local level engagement and organization of citizens at the grassroots level could potentially result in the best tactics for reaching and helping the municipal decision makers, encouraging them to address problems and helping them develop solutions.

Researchers Situation

An important aspect to a participatory action project such as this is to identify the primary researcher's perspective on the situation. Being embedded in the study and collaborating actively with the participants can garner valuable information but the researcher must also disclose the "lens" through which she is viewing the social process and problem situation as that has impacts on the data acquired and the perspective from which it is analyzed due to known and unknown biases. The study and conducting of research must be done in an adaptive way in order to address these biases to get a better, more holistic, objective picture of the situation. I have attempted to identify my biases and then began to address these biases through my methodology and research techniques.

This project is a result of my involvement on numerous levels in the communities and the greater Great Bay region. I believed that my Masters study should be something that was action orientated and applied, rather than purely theoretical. This insistence on the applied led me to become an alternate member of the Town of Greenland's Conservation Commission from September 2009-November 2009 while I was renting a home in the town. Initially I was also active on the Natural Resource Inventory (NRI) subcommittee helping to draft an NRI for the town in early 2009 which led me to becoming more deeply engaged in the commission. I was involved in many meetings, conversations and decisions focused on the natural resources of the town of Greenland and quite often including the Winnicut River and its surrounding lands.

I was a renting resident of the Town of Greenland and therefore did not pay any taxes to the town. I was unmarried and had no children in the Greenland school district. I was working to attain my Masters of Science in Natural Resources and working part-time for the Piscataqua Region Estuaries Partnership (PREP) an EPA funded organization that focuses upon water quality and habitat restoration in 42 towns in New Hampshire and 10 in Maine, including Greenland, Stratham and North Hampton. My bias was predominantly shifted toward natural resource protection and conservation and less on fiscal responsibility and low taxes. My younger age (28-30 during the study) helped perpetuate that shift away from the fiscal factors. Due to my work and involvement with PREP I garner a larger, regional view of the problem of pollution, regulatory missteps and town-level politics and I often struggled with my adherence to keeping the efforts local while allowing regional information to inform and direct the study. I do not have long-time loyalty to the town of Greenland due to my transient nature of being a young tenant and not a resident and was originally born and raised in Massachusetts.

Objectivity is a challenge in a participatory action study so I attempted to triangulate my impressions, data collection and perspectives as much as time and

resources would allow. This triangulation took the form of conversations with multiple parties and consensus building amongst the planning team as well as primary and secondary data mining. Taking my impressions and perspectives and triangulating that with the data on the state of the river and with data mining regulatory decision making through town board meeting minutes I was able to overcome my biases and feel confident my methodology and results were accurate and germane to the situation.

Explicit transparency was of utmost importance to this research project and my methodological approach. The research conducted on the state of the river, the regulatory decision making framework and the context situation helped to widen my perspective of the problem situation and ensured that I kept transparent in what it was I was reading and researching. Conversations and actions amongst the group and with key stakeholders were always initiated by my explaining what it was I had read and why I was undertaking the effort and approach I was taking.

Another method that helped address my lack of local knowledge and history bias was to engage with a long-time, active, vocal resident. This resident served on numerous town boards, has lived in Greenland close to 50 years, owns a large tract of land and currently was serving as both the town Health Officer as well as the chair of the NRI subcommittee. This resident helped to give me the perspective of long-time residents, land owners and the exchange and often times the essential “gossip” and idiosyncrasies amongst the town board members. The age perspective also helped to address my younger age and the biases inherent in that.

Another tool I employed to overcoming my lack of local history and active local involvement was to actively involve Jean Eno. Eno has been a 15-year resident of Greenland, owns a home on a tributary to the Winnicut, serves on the Greenland Conservation Commission and is an energetic and vocal proponent for natural resource protection.

There was an initial bias that centered on Greenland only due to my and Eno's involvement with the Conservation Commission rather than representing the whole watershed including the towns of North Hampton and Stratham. When Colin Lawson became engaged with the project he brought a wider watershed approach due to his Master's degree research that was focused on the culverts and infrastructure of the Winnicut River watershed and he had past experience and personal relationships with the town boards from Stratham and North Hampton and brought those perspectives to the group.

In order to access the "gatekeeper" I became engaged with the Greenland Town Administrator to volunteer assistance in helping draft the Notice of Intent for the EPA's Municipal Separate Storm Sewer Systems (MS4s) permitting process. The administrator was addressing the public education and outreach requirements of the proposed Phase II permit and was seeking input and assistance on how best to use limited town resources in the most efficient ways possible. This experience helped to address my initial lack of awareness and bias surrounding municipal spending, public works challenges and fiscal limitations. Understanding that the town does not have a town public works department but must hire contractors for all of their salting of roads, catch basin maintenance and clean out and landscaping allowed for me to be aware of the potential road blocks to measures that might address the Winnicut River's decreasing water quality. It also reinforced the concept that a regional, group approach to addressing the threats to water quality could help to address the single-town resource limitations.

Overall I used a triangulation approach to bringing the threads of data together. My engagement with watershed residents, my discussions with the planning team, my research into the regulations and water quality impairments coupled with my wider perspective I was gaining at the Piscataqua Region Estuaries Partnership allowed for

me to back cast my timescale, understand the context leading up to the current problem situation and bring that knowledge to the effort that was forming to initiate the grassroots organizing surrounding the Winnicut River Watershed Coalition.

The Collaborative and Adaptive Learning Approach with the Winnicut River

Watershed Coalition:

In order to initiate action in the Winnicut River Watershed and to connect the citizens to their river as well as to their municipal leaders to build capacity for seeking community solutions, education and information sharing must occur. Based off the research conducted both primary and contextually in participatory action it was widely held that the citizens of the three watershed communities are largely uninformed or not aware of the severity regarding the threats to Great Bay and the Winnicut River. The threats regarding the ecosystem and the watershed have been widely researched and reported on in numerous reports (PREP 2009, Trowbridge, P. 2009, Mills, K. 2009, Daley, et.al. 2011) but these reports have not been successfully translated for citizens to identify with or comprehend fully. Therefore this study sought to implement a collaborative learning approach in order to take the science and ecosystem assessments and connect it to the citizens in order to incite action. Using Daniels and Walker's Collaborative Learning Project model, the research approach evaluates what it takes to incite action in a community in regards to natural resource restoration and protection. The study was designed to identify the capacity of the community to change, the types of information and tools the community needs to have in order to act. It assessed what methods were successful at engaging the community and what methods were unsuccessful. Rather than mapping out the science of the problem of pollution, this study seeks to map out the social capacity required to reverse the pollution problem and

to identify how to build the social infrastructure and social capital needed to engage in collaborative solution seeking.

Steven E. Daniels and Gregg B. Walker define a Collaborative Learning Project in five distinct phases: situation assessment, training, design, implementation/facilitation and evaluation. The implementation/facilitation phases define the Collaborative Learning process core (Daniels and Walker, 2001). Assessment is the group process by which the situation is evaluated for its capability for collaboration. Does the community have the interest level, demographics and social structure to willingly collaborate? Training refers to the process for providing encouragement and obtaining the buy-in needed among key stakeholders for collaboration to work. Who are the key stakeholders and opinion leaders? What other groups and people are asking the community for their support and interest? What will it take for the key decision makers and opinion leaders in the community to engage in the efforts required for collaborative learning and problem solving? Design rests upon the development of a contextual, adaptive strategy for involving participants in a significant process of engagement. What will get citizens involved? What do they want to hear, do, see in order to participate? What will keep them engaged? Implementation/facilitation is the active process of meetings, field visits, workshops, forums, etc. which are designed to promote mutual learning, productive, constructive debate and feedback and ultimately action. Evaluation entails data gathering and reflection on the process and outcomes (Daniels and Walker, 2001). The Winnicut River Watershed Coalition engagement and development process was designed according to these five phases Tables 3-1, 3-2, 3-3, 3-4 and 3-5 specify the exact methodology employed in the study.

Table 3-1. Phase 1, Assessment methodology performed in the Participatory Action and Citizen Engagement Study of the Winnicut River Watershed.

PHASE 1: Assessment		
GOAL I: Develop a holistic understanding of the current ecological and physical conditions of the Winnicut River and watershed		
OBJECTIVES	TASKS	MEANS: Literature Review
Research physical setting of the watershed	Specify exact watershed boundary	Use existing GIS mapping and topographic delineation
	Identify headwaters and all tributaries	GIS Mapping, Natural Resource Inventory for Greenland and North Hampton, Local knowledge from Greenland Conservation Commission
	Define physical setting of the 3 watershed towns	GIS Map, NH Office of Energy and Planning land data, US Census Data on population change
	Identify the different types of land uses in the 3 towns, get percentages of each type	GIS maps, US Census Data, NH Office of Energy and Planning Community Profiles, Rockingham Planning Commission Data
Identify the effects of urbanization on water quality to better connect land use patterns to ecological conditions in the river	Identify percentage of impervious cover in each town	PREP impervious surface mapping
	Identify number of residential houses in each town	US Census data regarding Building permits granted in each town, Town Reports, NH Office of Energy and Planning Community Profiles, US Census Building permit data
	Identify any high impact land uses – e.g. Golf Courses, Quarry/Mining operations, large commercial developments	NH DES permitting files, Town planning and Zoning Board of Appeals minutes, NH DES Groundwater withdrawal permits, NH DES sanitation permits
Identify the current biogeochemical characteristics of the river	Identify current levels of dissolved oxygen, nitrogen, turbidity,	NH DES Water Quality Assessment for Winnicut, PREP water quality monitoring reports for Winnicut Station; Great Bay National Estuarine Research Reserve Water Quality Assessment for Winnicut tributary
	Identify geological make up of river and its bed	USGS data, NHGS data, Winnicut Feasibility Report from Dam Removal (Woodlot Alternatives, Inc. 2007)
Identify the full water quality assessment data for the Winnicut River and its	Identify what designated uses the Winnicut is impaired for and what is the cause of the	US EPA 2008 Section 305(b) and 303(d) Surface Water Quality Report.

tributaries to gain full insight on the current sources of pollution and impairment	impairment	
	Identify probable sources for the impairment	US EPA 2008 Section 305(b) and 303(d) Surface Water Quality Report.
	Identify the overall status of the Great Bay in regards to nitrogen loading and its tributaries	2009 State of the Estuaries Report (PREP 2009).
Determine how the current sources of pollution are connected to land uses versus those caused by failure to employ or enforce existing regulations	Identify land uses in regards to water quality impacts	Center for Watershed Protection; PREP reports; Chesapeake Bay Center publications
Goal II: Develop complete contextual understanding of the social landscape and problem situation of the Winnicut River Watershed		
Objectives	Tasks	Means: Context Mapping, Literature Review, Social Learning
Gain insight on growth patterns in relation to land use change over time	Identify demographics and household makeup of the three towns	US Census Data, American Community Survey Data, NH Office of Energy and Planning Community Profiles, Rockingham Planning Commission Data
	Identify population of the three towns from 1990-2009	US Census Data, NH Office of Energy and Planning Community Profiles
	Identify number of new housing units from 1999-2009	US Census Building Permit Data
Understand the governance structures and the decision making framework for the three watershed communities	Obtain data on number of planning board members, select board members and conservation commissions	Town websites
	Obtain data on frequency of meetings for land use boards	Town websites
	Identify the purpose of any ad-hoc committees	Town websites, board meeting minutes
	Obtain each town's Master Plans	Website, visit Town Hall, email to Board Chairs
	Assess Master Plan for mention of natural resources, water quality or Winnicut River	Read document searching for key words, tag section
	Obtain each town's Zoning ordinance, subdivision regulations and site plan review regulations	Town websites, Piscataqua Region Environmental Planning Assessment (Sowers, 2010)
	Assess and compare each town's regulations in regards to: riparian buffers, septic setbacks, wetlands buffers, building setbacks, fertilizer application setbacks	Piscataqua Region Environmental Assessment (Sowers 2010), Read and tag regulatory documents

Identify historical uses of the river	Determine what industry was present at the dam site in Greenland	Research at Weeks Public Library, Hughes Book, Historical photos, Gundalow Company research
Identify current uses of the river	Determine what fish are present in the river	NH Fish and Game Data, Suds 'n Soda Fishing Report, Online Fishing Report, Portsmouth Kayak Adventures trip schedule
Identify potential stakeholders and their diversity of perspectives	Identify all governing jurisdictions in the region	Online congressional district map, EPA Regional Map, NOAA regional map
	Identify all conservation organizations that deal with water quality, fish, waterfowl and riparian species	Mission statement search, NHDES online database of NGO's, embedded research
	Identify active community volunteers in water quality focused organizations	Each organization's website to view board members, presidents and directors
	Identify garden clubs, boy scout troops and historical societies in each of the 3 towns	Online research, interview town administrators
	Identify all partners involved with the dam removal project	NH Fish and Game report
	Identify all shoreline property owners	2008 Tax Assessment for each town overlaid with Google Map to identify roads that are on the shoreline
	Identify all state and local officials	Online NH Congressional database, each town's website
	Connect with the Great Bay National Estuarine Research Reserve Sandy Point Discovery Center	Email and phone call to Steve Miller and Kathy Mills - key informants
	Gain greater overall perspective of key town stakeholders, board member idiosyncrasies, annual schedules for new warrants and regulations and general regulatory layout	Informal personal communications during board meetings and town hall visits
		Email communications amongst board members
		Attend PREP stakeholder meetings surrounding updated Management Plan

This initial phase provided the data to ground the study and undertake the contextual mapping exercise to learn about the social process and the problem situation facing citizens in the Great Bay estuary and Winnicut River Watershed specifically. This provided the baseline from which the group was able to then move towards action implementation. The data gained in phase one was synthesized, triangulated, assessed and incorporated into the wider group's social learning process and collaboration discussions and largely informed the public outreach and engagement tactics employed in the later phases of implementation. The planning team used a consensus method for its decision making in phase two and three. The group of four discussed ideas, previous experiences, impressions and known data and came to a consensus on the direction forward.

Table 3-2. Phase 2, Training methodology performed in the Participatory Action and Citizen Engagement Study of the Winnicut River Watershed.

PHASE 2: Training GOAL: Create interest and heightened awareness in key stakeholders of organizing efforts for the Winnicut River Watershed Coalition (WRWC) and invite support		
OBJECTIVES	TASKS	MEANS
Initiate a community outreach effort to create awareness for the development of a watershed association	Meet and introduce planning committee to 3 town administrators	Emails and phone calls
	Create and mail letter and fact sheet to chair of each town's planning board, conservation commission and select board introducing organizing effort for the WRWC, inviting their support and sharing information	Draft letter, edit collaboratively
		Get addresses from Town websites and mail
	Create and mail a letter to previously identified shoreline property owners	Use three towns' 2008 Tax Assessment to identify names and addresses and then overlay onto Google map to determine the roads that lie along the shore
	Hold a public meeting for three planning board chairs, three town administrators, 3	Collaborate with Theresa Walker from Rockingham Planning Commission and

	conservation commission chairs to update on the dam removal project and introduce the WRWC	Kevin Lucey from NH Coastal Program for presentation materials
	Introduce the planning committee and WRWC to the three towns' conservation commissions and ask for their support	Email chairs to get on agendas at the Commission's September meetings
Secure Funding	New Hampshire Rivers Council to apply for New Hampshire Charitable Foundation Community Impact Grant on behalf of the WRWC grassroots effort	Cline to draft proposal, WRWC team to provide input

Table 3-3. Phase 3, Design methodology performed in the Participatory Action and Citizen Engagement Study of the Winnicut River Watershed.

PHASE 3: Design		
GOAL: Create outreach and education materials for the WRWC organizational effort and lay out calendar for community meetings, Launch celebration and future steps		
OBJECTIVES	TASKS	MEANS
Design professionally and graphically pleasing outreach and educational materials to show the coalition's legitimacy and permanency	Create professional logo and unified look for WRWC materials	Use graphic designer contact for pro bono design work
		Get feedback from planning committee on logo
	Design 1-page fact sheets that lay out the historic and current values of the river, the current threats and how to get involved with the WRWC organization	Synthesize research and data on river into quick, interesting facts
		Use NH Rivers Council's graphic design software and printer to print 150 fact sheets for distribution to town halls, libraries and community bulletin boards
	Draft 1 page letter for shoreline property owners, key stakeholders and municipal officials	Use NH Rivers council Software and printer and mailing capacities
Organize 9 month work plan for launch of the WRWC	Collaboratively determine dates of launch celebration, 3 public meetings, 3 municipal meetings and first volunteer event	Coincide with municipal voting schedule and field research season
Develop volunteer activities that WRWC can organize	Get NH DES's Volunteer River Assessment Program criteria	Contact rivers coordinator at NH DES
	Develop the monitoring plan	Coordinate with NH DES to

	for the Winnicut River	determine what locations are needed to fulfill data gaps
	Secure water quality monitoring equipment	Connect with NH DES VRAP coordinator and enroll Winnicut into the program and establish requirements

Table 3-4. Phase 4, Implementation methodology performed in the Participatory Action and Citizen Engagement Study of the Winnicut River Watershed.

PHASE 4: Implementation		
GOAL: Implement 9-month engagement strategy		
OBJECTIVES	TASKS	MEANS
Plan and organize a community supported 1 day celebration to mark the launch of the WRWC – The Riverwalk and Family Barbeque	Identify who will be on the planning committee for the event	
	Determine budget and fiscal responsibilities for event	Identify how much of the New Hampshire Charitable Foundation grant can be used
	Determine date and location of event	Check all other community events occurring on the same day and weekend
		Ensure on-site parking ease
		Ensure location is within watershed boundaries
		Ensure access to river for the Riverwalk
		Ensure weather at the time of the year is generally acceptable for outdoor activity
	Advertise and publicize event widely	Place ad in local paper – The Wire
		Submit community event listing to all area papers
		Hang flyers in all town halls, libraries, recreation centers and common areas
		Hang flyers on any community/event bulletin board in businesses in the 3 towns
		Post event on 3 town's website
		Send flyer via email to key stakeholders and municipal officials
		Personally invite area teachers
		Create social media pages to publicize event online
		Personally invite town administrators and ask them to promote event to others

	Determine the event will be zero waste to better align to the organization's ideals	Contact Eco-Movement Consulting in Portsmouth
		Make large jugs of iced tea, lemonade and water to eliminate plastic bottles
		Buy compostable cups and plates
		Use planning committee's personal silverware
		Use large bowls for condiments to eliminate single use packets
		Design and hang interpretive signage to clearly mark where to dispose of what and why
	Ensure there is wide community involvement	Ask restaurants and markets in the 3 towns to donate or cost-share food in exchange for sign at the event
		Recruit local boy scout troop for involvement with River Walk guided tour
		Solicit donations from businesses in the 3 towns for 50/50 raffle
		Invite artists from Great Bay estuary (52 town region) to display and sell artwork
		Invite previously identified regional conservation organizations to have an information table at the event
		Invite local Audubon Chapter representative to serve as a guide for the River Walk
	Determine food and refreshments for event	Ask restaurants and markets in the 3 towns to donate or cost-share the hot dogs, burgers, cheese, condiments, buns, salads and sweets
Plan and organize a series of 3 community meetings in each of the 3 towns to follow up on the River Walk	Determine dates	Want to follow on interest arising from River Walk event but summer is very busy – Determine Sept.
	Determine and book locations	Research and contact public meeting spaces in the 3 towns
		Ensure parking ease
		Ensure ample space and seating
		Ensure handicapped accessibility
	Determine time	Must occur outside typical workday – post 5pm
	Advertise and publicize	Place advertisement in local

	meetings in the 3 towns	paper
		Hang flyers in common community locations
		Put notice up on each town's website
		Send letter to key stakeholder mailing list
		Send letter to shoreland property owner list
	Determine agenda	Introduce steps to date for WRWC
		Lay out reasons WRWC is forming – impairments to the river
		Identify how volunteers can get involved with VRAP
		Get contact information for volunteers to stay connected

Table 3-5. Phase 5, Evaluation methodology performed in the Participatory Action and Citizen Engagement Study of the Winnicut River Watershed.

PHASE 5: Evaluation		
GOAL: Assess and evaluate effectiveness of the 4 phases of development and implementation to determine successes, setbacks and lessons learned in order to provide recommendations for future steps and adaptations.		
OBJECTIVES	TASKS	MEANS
Assess effectiveness of key stakeholder engagement	Identify number of key stakeholders who became engaged with the effort	Report on number of stakeholders who were sent a letter that then attended an event or requested further information
Determine what method of advertising worked	Ask everyone in attendance at community meetings how they found out about it	
Identify which sectors of the community were represented and which were not	Create sign in sheets for each event that includes space for organizational affiliation or interest	Use Excel to create sign in sheets, scan and save each sheet following meeting
	Record number of volunteers recruited and from which towns	Use Excel to create a volunteer sign-up sheet
Reflect and report on principal investigator's impressions on successes and failures in the engagement process	Record impressions, thoughts and overall feelings immediately following each outreach and engagement event	Use study notebook to keep all notes together and cohesive
Report on challenges faced	Record all impressions of challenges encountered in the planning and implementation of the study	Use study notebook to record notes and impressions
Supply future plans and a recent update on the WRWC since the study ended	Contact Jean Eno to get update on current efforts, number of active volunteers and future plans for the WRWC	Phone call or email record notes in study notebook.

Supply recommendations and opportunities for the future based off perceived successes and failures of the engagement process reflecting the professional literature and previous case studies	Literature review on citizen based watershed management and case studies	Primary source research
Report on lessons learned in the methods used, specifically PAR and Collaborative Learning		

CHAPTER 4

RESULTS & DISCUSSION

Introduction

The implementation phase of this project was the most time and effort intensive due to endeavors to reach and engage as many citizens as possible across three communities. The methods for implementation were targeted to inform the citizens of the water quality issues in the Winnicut River and invite their participation in the newly forming citizen effort to address those issues. The public's attendance was invited for a large Winnicut River Watershed Coalition kick-off event and then subsequent public meetings. These initiatives occurred between September 2009 and July 2010. The results of specific initiatives are reported upon and discussed in this chapter. The development of a Winnicut River Watershed Coalition (WRWC) was a collaborative effort that combined the diverse skill sets of four primary organizers – the primary investigator, Jill Farrell; Jean Eno, Greenland Conservation Commissioner; Josh Cline, then Director of the New Hampshire Rivers Council; and Colin Lawson, Antioch University Masters student in Environmental Conservation. This collaborative approach allowed for increased access to resources, diverse skill sets and greater accomplishment of tasks because responsibilities were shared. The initial development of the Coalition took a full year from first idea to public meetings and recruitment of volunteers (September, 2009-September 2010).

Background to the formation of the Winnicut River Watershed Coalition:

The concept of forming a Winnicut River Watershed Coalition arose as a result of the Winnicut Dam removal process which was a joint project amongst the New Hampshire Department of Environmental Services, New Hampshire Fish and Game Department, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, USDA Natural Resources Conservation Services, New Hampshire Charitable Foundation, the Coastal Conservation Association, the NH Mooseplate Grant Program and the Town of Greenland. The project also received funding through the American Recovery and Reinvestment Act of 2009. Attention had been piqued in the watershed, especially in the town of Greenland due to the construction taking place under the main highway of Route 33. Residents were logging complaints to the town regarding the loss of the impoundment for fishing and others were asking what exactly was occurring (Anderson, K. 2009) (Town of Greenland, 2009). The process of public meetings and planning that went into the planning phase of the removal project was not widely attended by the community and many citizens were unaware of the project until it was underway.

The Winnicut Dam removal process was initiated in 2002 with the completion of a feasibility study and then went through a series of public meetings, engineering plans and finally de-construction began in spring of 2009. The dam removal was designed to allow for 39 miles of passageway to be reopened for migratory fish, it was hoped it would enable the recovery of 5,500 feet of riverine habitat lost by the dam's impoundment and it would restore 21,000 square feet of intertidal habitat, including 6,500 square feet of salt march wetland (NH Fish and Game, 2009). The dam was fully removed in October 2009 and a ceremony arranged by the New Hampshire Department of Environmental Services was held on October 16, 2009 (Choate, D. 2009). A second phase to the project was the installation of a specially designed fish ladder under the Route 33 bridge

to allow for fish passage upstream. Through the process of the feasibility study and subsequent monitoring prior to and during deconstruction, ecological information regarding the state of the Winnicut River was accumulated by Kevin Lucey and others with the New Hampshire Department of Environmental Services Coastal Program. This information contributed to the declaration of the Winnicut River as being “impaired” by the US EPA on their 2008 305(b)/303(d) list.

According to the 2008 Water Quality Assessment report, the Winnicut River and several of its tributaries are impaired for multiple designated uses, including Aquatic Life, Primary Contact Recreation, and Secondary Contact Recreation. Several assessment units within the Winnicut River watershed are currently not supporting one or several of these uses and are in need of TMDL’s due to the following parameters: Dissolved Oxygen, pH, Escherichia coli, Benthic-Macroinvertebrate Bioassessments, and Estuarine Bioassessments (USEPA 2011). (See *Chapter 2, pp. 2-26 for full water quality discussion*).

Data surrounding fish species, invasive plant presence and buffer infringements were also collected throughout the process of compiling the feasibility study and deconstruction monitoring. It was a result of this new data surrounding the Winnicut that began the collaborative effort to form the Winnicut River Watershed Coalition.

Additionally the interest from the natural resource professionals in the Winnicut was at an all-time high in Summer and Autumn, 2009 due to the dam removal process. The Winnicut Dam removal was the first of its kind in southeastern New Hampshire and the hope for the project’s success in restoring stream miles and estuarine habitat was shared by many conservation professionals. A newly completed culvert assessment study performed by Dr. Ray Konisky at The Nature Conservancy was published in December 2009 (Konisky, 2009). Konisky’s assessment looked at a total of 42 road crossings upstream of the dam in the Winnicut watershed, and classified them as

severe, moderate, minor, or passable for fish passage. One crossing was identified as severe, thirty-five were moderate, six were minor, and no crossings were determined to be fully passable for all fish (Konisky 2009). Colin Lawson conducted a culvert assessment study in the Winnicut watershed in Spring of 2009 that was modeled after the work of Derek Sowers from the Piscataqua Region Estuaries Partnership (PREP) and the EPA's Climate Ready Estuaries Project on the Oyster River, New Hampshire (Stack, L., et. al. 2010). Lawson's study would look at the potential for culverts in the watershed to be undermined by expected higher precipitation events due to climate change. Lawson's study is due to be published in 2011. In addition, Theresa Walker from the Rockingham Planning Commission had secured a grant from the PREP's Community Technical Assistance Provider program. The grant partnered Dave Kellam of PREP's staff with Jean Eno and Jill Scahill Farrell from the Greenland Conservation Commission to produce a newspaper style publication that discussed Greenland's water resources and efforts citizens can take to protect them (TOGCC 2009). The town of Greenland received 2,100 copies of the newspaper and one was mailed to 3,559 households in Greenland on September 30, 2009.



Figure 4-1. Front page, above the fold of the *Citizen's Guide To Protecting Greenland's Water Resources* publication.
Source: (PREP 2009)

Lawson, Eno and Scahill Farrell were all beginning to discuss the need for a citizen engagement process in the Winnicut River watershed to help to implement the necessary restorations that had now been discovered through the recent scientific research projects. The new data that had been acquired surrounding the Winnicut's health as well as the public outreach campaign through the newspaper began to create a groundswell of interest in the river and its watershed in the communities of Stratham, North Hampton and Greenland. The restoration efforts that were slated to occur as a result of the dam removal were something that needed to be promoted and widely distributed. The concept of forming a citizen watershed group became more and more clear. In September 2009 Lawson had arranged a meeting with Josh Cline of the New Hampshire Rivers Council. Cline had expressed interest in the efforts that were beginning in the Winnicut watershed and was interested in providing support to the effort and subsequent organization. Cline and Lawson with input from Eno developed and submitted a grant proposal to the New Hampshire Charitable Foundation's Community Impact Grant Program that rested upon citizen engagement and support for the formation of the Winnicut River Watershed Coalition. The grant proposal was submitted October 1, 2009. A grant was awarded to the New Hampshire Rivers Council in December, 2009 for the amount of \$20,000 to fulfill three main outcomes:

1. Formation of Winnicut Area Watershed Association
2. VRAP volunteers recruited and water quality sampling initiated.
3. Project Website up and running (NHRC, 2009).

Table 4-1. Table of meetings that were part of the WRWC planning process.

PARTICIPANTS	DATE	LOCATION
Colin Lawson, Jill Farrell	9/10/2009	UNH Dairy Bar, Durham, NH
Rick Mauer (Greenland Conservation Chair), Ray Konisky (The Nature Conservancy), Jessica (UNH M.S. Candidate), Colin Lawson, Jean Eno	9/24/2009	The Nature Conservancy Offices, Newmarket, NH
Jean Eno, Jill Farrell, Josh Cline, Colin Lawson	10/16/2010	Winnicut Dam Removal Ceremony, Winnicut Dam site, Greenland, NH
Colin Lawson, Jill Farrell	11/5/2009	Online Webinar RE: ecosystem based management Tools through NOAA Coastal Services Center
Colin Lawson, Jill Farrell	11/12/2009	UNH Dairy Bar, Durham, NH
Jill Farrell, Theresa Walker (Rockingham Planning Commission)	11/13/2009	Rockingham Planning Commission Offices, Exeter, NH
Jean Eno, Jill Farrell	12/14/2009	Southeast Watershed Alliance Meeting, Brentwood Community Center
Josh Kline, Jen Holton (Ecostream Consultants), Colin Lawson, Jill Farrell	1/11/2010	Society for the Protection of New Hampshire's Forests Conservation Center, Concord, NH
Colin Lawson, Jill Farrell	2/3/2010	UNH Library, Durham, NH
Colin Lawson, Jill Farrell	3/8/2010	UNH Library, Durham, NH
Colin Lawson, Josh Kline, Jen Holton, Jill Farrell	3/19/2010	Society for the Protection of New Hampshire's Forests Conservation Center, Concord, NH
Jean Eno, Colin Lawson, Jill Farrell	3/22/2010	Jean Eno's residence, Greenland, NH
Jean Eno, Colin Lawson, Jill Farrell	4/15/2010	Jean Eno's residence, Greenland, NH
Jean Eno, Colin Lawson, Jill Farrell	5/3/2010	Jean Eno's residence, Greenland, NH
RIVERWALK & FAMILY BBQ KICKOFF EVENT	5/15/2010	Weeks Brick House & Gardens, Greenland, NH
Theresa Walker, Josh Cline, Jean Eno, Jill Farrell	6/10/2010	Rockingham Planning Commission Offices, Exeter, NH
Josh Cline, Jean Eno, Jill Farrell	6/11/2010	Society for the Protection of New Hampshire's Forests Conservation Center, Concord, NH
Josh Cline, Colin Lawson, Jean Eno, Jill Farrell, Cheri Patterson (NH Fish & Game Dept), Kevin Lucey (NH Dept. of Environmental Services, Coastal Program), Karen Anderson (Greenland Town Administrator), Chip Hussey (Greenland Conservation Commission),	7/15/2010	Greenland Town Offices, Greenland, NH
Josh Cline, Jean Eno, Colin Lawson, Jill Farrell	8/3/2010	Society for the Protection of New Hampshire's Forests Conservation Center, Concord, NH
Josh Cline, Jean Eno, Colin Lawson, Jill Farrell	9/2/2010	Society for the Protection of New Hampshire's Forests Conservation Center, Concord, NH

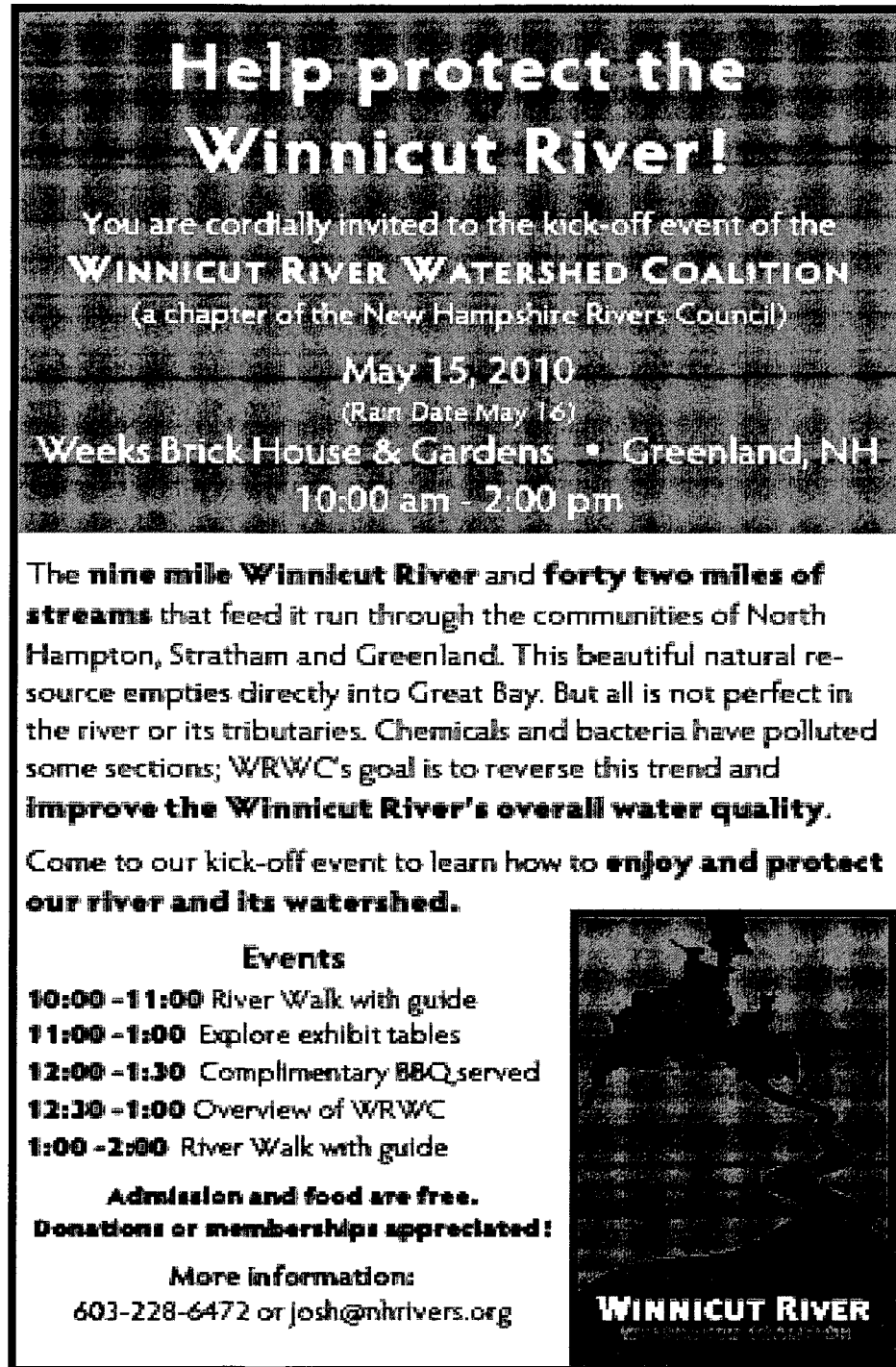
Stratham Public Meeting – Town of Stratham Conservation Commission: Pat Elwell, Donna Jensen, Tim Copeland, Edie Barker, Jaime Marsh, and Bob Keating; Lincoln Daley, Jean Eno, Colin Lawson, Jill Farrell, Theresa Walker	9/8/2010	Stratham Town Offices, Stratham, NH
Jean Eno, Josh Cline, Jill Farrell, Kevin Lucey, David Anderson (NH Dept. of Environmental Services, Coastal Program)	9/9/2010	New Hampshire Dept. of Environmental Service, Coastal Program Offices, Portsmouth, NH
Josh Cline, Jean Eno, Colin Lawson, Jill Farrell	9/10/2010	Society for the Protection of New Hampshire's Forests Conservation Center, Concord, NH
North Hampton Public Meeting: Town of North Hampton Conservation Commission: Chris Ganotis, John Peterson, Shirley Carter, Stanley Knowles, Patricia O'Connor, Brian Chevalier; Jean Eno, Colin Lawson	9/14/2010	North Hampton Town Offices, North Hampton, NH
Public Meeting #1	9/15/2010	Wiggin Memorial Library, Stratham, NH
Public Meeting #2	9/21/2010	Hugh Gregg Center, Greenland, NH
Public Meeting #3	9/29/2010	North Hampton Public Library, North Hampton, NH

The Winnicut River Watershed Coalition Riverwalk and Family Barbeque Kickoff

A primary objective in the implementation phase of this study was to plan and organize a community supported 1 day celebration to mark the launch of the WRWC – The Riverwalk and Family Barbeque. The planning team felt a community celebration would be an effective way to publicly launch the Winnicut River Watershed Coalition. Lawson had background in producing community road race events and Eno had strong connections to area businesses being a business owner so it was determined that a community event that would attract families and citizens would be the best way to engage citizens in the efforts beginning in the Winnicut River Watershed and begin to inform them about their river and its declining health. With funds secured from the New Hampshire Charitable Foundation Eno, Lawson and Scahill Farrell were the primary

organizers while Cline oversaw the resource allocation and administrative duties for the event. The planning process for the event began in January 2010 with weekly meetings throughout the months leading up to the May 15 event.

Promotional Tactics:



Help protect the Winnicut River!

You are cordially invited to the kick-off event of the
WINNICUT RIVER WATERSHED COALITION
(a chapter of the New Hampshire Rivers Council)

May 15, 2010
(Rain Date May 16)

Weeks Brick House & Gardens • Greenland, NH
10:00 am - 2:00 pm

The **nine mile Winnicut River** and **forty two miles of streams** that feed it run through the communities of North Hampton, Stratham and Greenland. This beautiful natural resource empties directly into Great Bay. But all is not perfect in the river or its tributaries. Chemicals and bacteria have polluted some sections; WRWC's goal is to reverse this trend and **improve the Winnicut River's overall water quality.**

Come to our kick-off event to learn how to **enjoy and protect our river and its watershed.**

Events

10:00 - 11:00 River Walk with guide
11:00 - 1:00 Explore exhibit tables
12:00 - 1:30 Complimentary BBQ served
12:30 - 1:00 Overview of WRWC
1:00 - 2:00 River Walk with guide

**Admission and food are free.
Donations or memberships appreciated!**

More information:
603-228-6472 or josh@nhrrivers.org

WINNICUT RIVER
WATERSHED COALITION

Figure 4-2. Flyer distributed to communities announcing Riverwalk Event.
(Cline and Scahill Farrell, 2010).

Figure 4-2 is the flyer that was produced by Josh Cline and Jill Scahill Farrell incorporating the logo and input from the planning team. The flyer was distributed via

email to all teachers in the School Administrative Units (SAU) 16, 50 and 21 which represents the K-12 school districts for Stratham, North Hampton and Greenland. The flyer was hung at the following locations:

- Greenland Town Hall
- Stratham Town Hall
- North Hampton Town Hall
- Greenland Post Office
- Stratham Post Office
- North Hampton Post Office
- Wiggin Public Library, North Hampton
- Weeks Public Library, Greenland
- North Hampton Public Library
- Greenland Central School
- Me & Ollies, Greenland
- Joe's Meat Shoppe, North Hampton
- Sweet Dreams Bakery, Stratham
- Mizuna, Greenland

The flyer in [Figure 4-2](#) was placed as an advertisement in the May 12, 2010 issue of *The Wire* newspaper out of Portsmouth. A similar advertisement was placed in *The Portsmouth Herald's* May 14, 2010 issue. Community calendar listings in *The Portsmouth Herald*, *Foster's Daily Democrat* and *The Wire* were also printed.

A letter to was mailed to Town Administrators, Planning Board members, Conservation Commissioners and Select Board members in all three communities as well as a researched list of 85 key stakeholders, decision makers, social network nodes, community leaders and concerned citizens ([Figure 4-3](#)). The letter was mailed to a list of shoreland and riparian zone property owners that was developed by Farrell using each town's Tax Assessment records and overlaid onto a GIS map aligning which street addresses on the Tax record were also on the shores of the Winnicut. These addresses received a letter.



**ECOLOGICALLY SOUND
MANAGEMENT OF NEW
HAMPSHIRE'S RIVERS
AND WATERSHEDS.**



ANNOUNCING CHAPTER

FACT: The 9.1 mile Winnicut River begins in North Hampton, flows through Stratham and Greenland emptying into Great Bay.

FACT: The Winnicut River serviced more than eight sawmills and gristmills since 1660.

FACT: The Winnicut River Watershed has 17.9 miles of drainage and 42 miles of streams that flow into it.

FACT: The Town Landing was developed in 1688. Located where the Winnicut meets Great Bay it was the base for handling lumber and barrelled goods from upstream to Great Bay and the sea.

FACT: The US Environmental Protection Agency has declared the Winnicut River unsafe for swimming, fishing or immediate contact due to high levels of bacteria and chemicals.

Dear stakeholder,

Enclosed is an invitation to participate in the recovery of the Winnicut River and to share your voice and lend your hand in its management and restoration. The Winnicut River Watershed Coalition (WRWC) is beginning to organize and believes that strong stakeholder participation and involvement is the best way to reach success in protecting this valuable natural resource.

The Watershed Coalition is thrilled to announce an inaugural community event, a River Walk & Family BBQ on Saturday, May 15th from 10:00 am – 2:00 pm. The WRWC would like to request your support and attendance at this exciting gathering taking place at Weeks Brick House & Gardens on Route 33 in Greenland. The event will include two guided River Walks along the banks of the Winnicut River, vendor tables, family fun and education, a complimentary barbeque lunch and presentations on how to join the Coalition's collaborative effort. The event is free and will propose a variety of options on how to participate in saving the Winnicut River. We hope you will join us in this groundbreaking and important watershed effort.

The Winnicut River watershed encompasses the 9.1 mile long Winnicut River, 17.9 square miles of land and 42 miles of tributary streams. In 2008, the US EPA declared the Winnicut River and many of its tributaries as impaired, or otherwise polluted. The main stem of the river is unsafe for swimming, fishing or primary contact recreation due to the high level of bacteria and chemicals. This historic and culturally important community river is threatened, and without widespread cooperative action, degradation will continue to impact our local water quality and ecosystem health. Now is the time to pool our resources and collaborate to define the problem, identify causes and formulate solutions – together.

The New Hampshire Rivers Council (NHRC) has embraced the Winnicut River Watershed because of its historic and ecological importance in the greater Great Bay region. The Rivers Council, partnering with a dedicated group of local citizens, has begun to organize the WRWC and invite all who are affected by or interested in the river to have a seat at the table and a voice that will be heard. We encourage you to take part in this important process.

For more information on the Winnicut River Watershed Coalition visit www.nhrivers.org.

Or contact Josh Cline at:
New Hampshire Rivers Council
54 Portsmouth Street, Concord, NH 03301
603-228-6472
josh@nhrivers.org / www.nhrivers.org

Thank you for your willingness to collaborate, your involvement is the key to success.

Sincerely,
The Winnicut River Watershed Coalition Planning Committee

Figure 4-3. Stakeholder Invitation Letter mailed to stakeholders.

The Winnicut River Watershed Coalition and Social Media

A major tactic used in promotion of the Riverwalk event as well as raising awareness of the ecological condition of the river and the establishment of the coalition was to utilize Internet social media outlets. Facebook pages, a website and a blog were established for the Winnicut Coalition's efforts as a way to engage people in the places they spend a lot of their time – online. A 2009 Anderson Analytics study estimated that 110 million Americans, more than a third of the population, regularly use online social networks (O'Malley 2009). These methods of promotion were easy to set-up, cost nothing and were able to virtually reach a far wider audience than traditional mass media tactics.

The screenshot shows a Facebook event page for the 'Winnicut River Watershed Coalition Riverwalk & BBQ'. The event is scheduled for Saturday, May 15, 2010, from 10:00am to 2:00pm at Weeks Brick House & Gardens, Route 33, Greenland. It was created by Jill Scahill Farrell. The event description mentions a 9-mile river walk and a BBQ lunch, with a goal to improve water quality. A schedule of events is provided, including a river walk with a guide, exhibit tables, a complimentary BBQ lunch, an overview of the WRWC, and another river walk. Contact information for more details is also listed. On the left, a list of 8 attendees is shown, including Molly Troup, Jill Scahill Farrell, Seth McNally, Colin Lawson, Valerie Maloy McNally, and Bjorn Turnquist. The right sidebar features 'Friends' Events' like 'Impact Circle's Big Event' and 'NOMO @ THE EMPTY BOTTLE', a 'Sponsored' ad for 'Hot Shoes' from shoedazzle.com, and a 'Members Project' from American... The page also shows a 'Like' button with 596,967 likes and a 'Chat' button.

Figure 4-5. Facebook Event Page created for the Riverwalk Event.
Source: (Facebook com July 11, 2010)

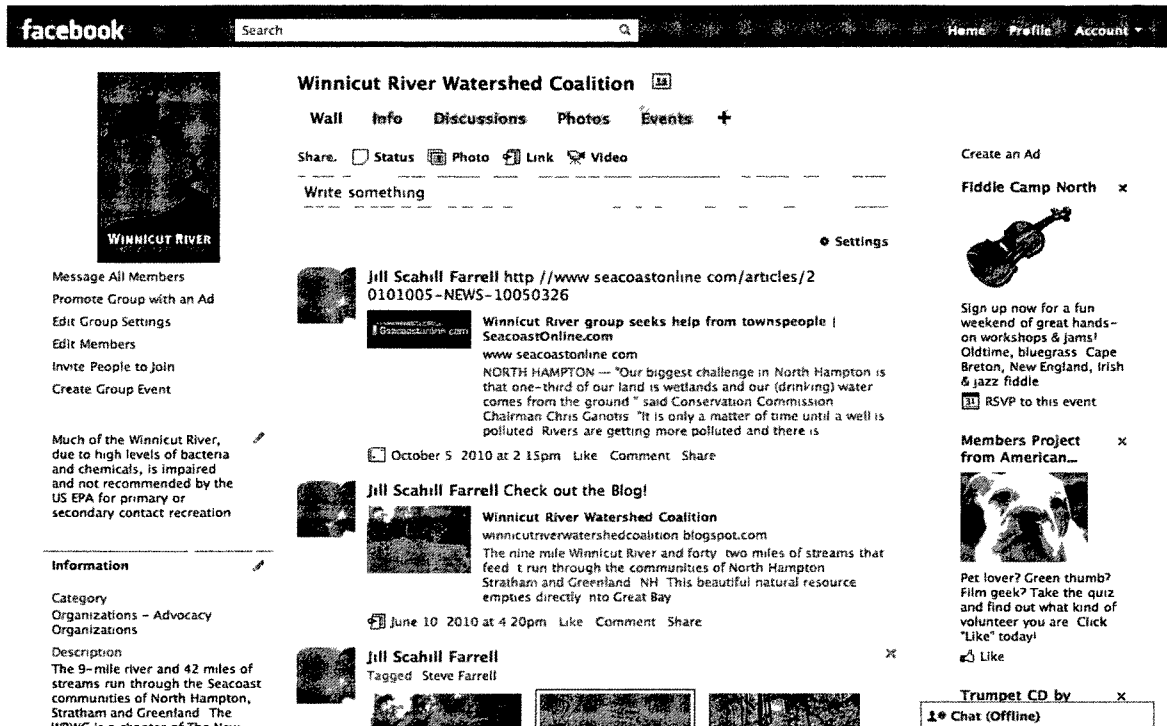


Figure 4-6. Facebook Group Page created for the Winnicut River Watershed Coalition. Source: (Facebook.com, Nov 1, 2010)

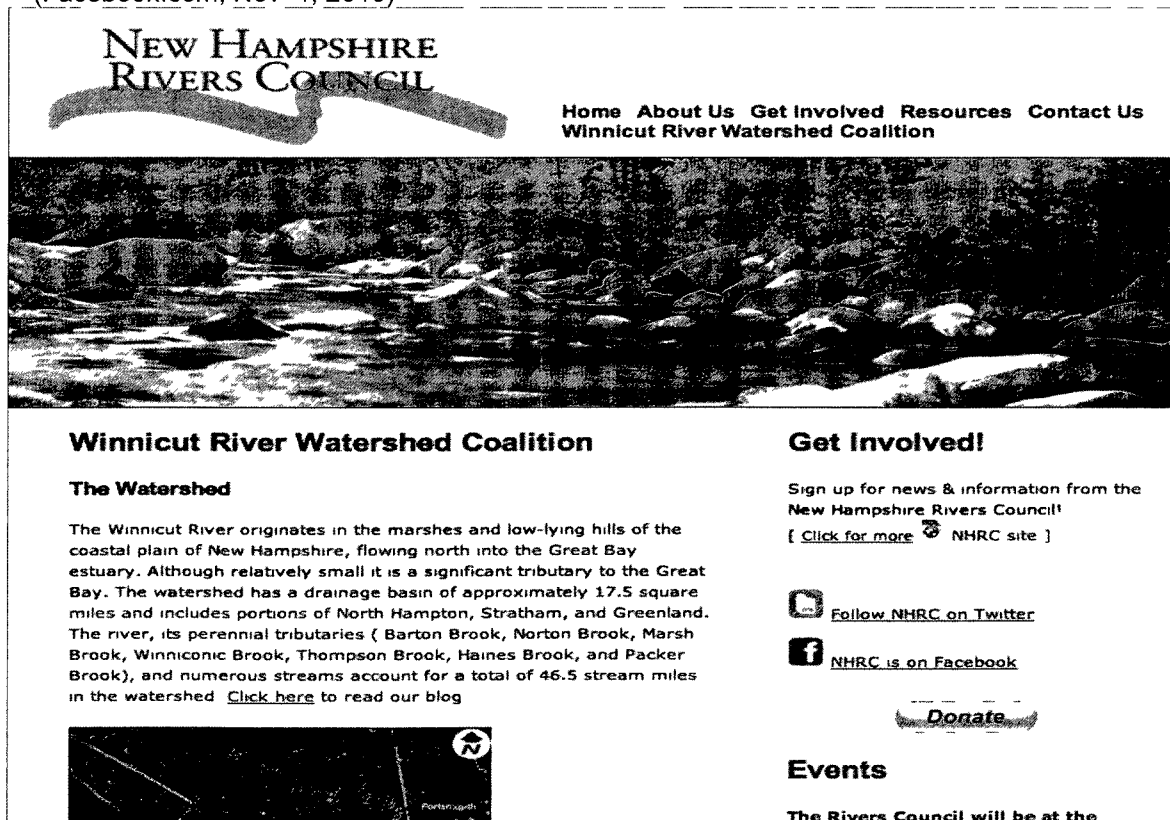


Figure 4-7. Screenshot of the Winnicut River Watershed Coalition's webpage on the New Hampshire River Council's website
Source: (nhrrivers.org/Winnicut; Nov. 7, 2010)

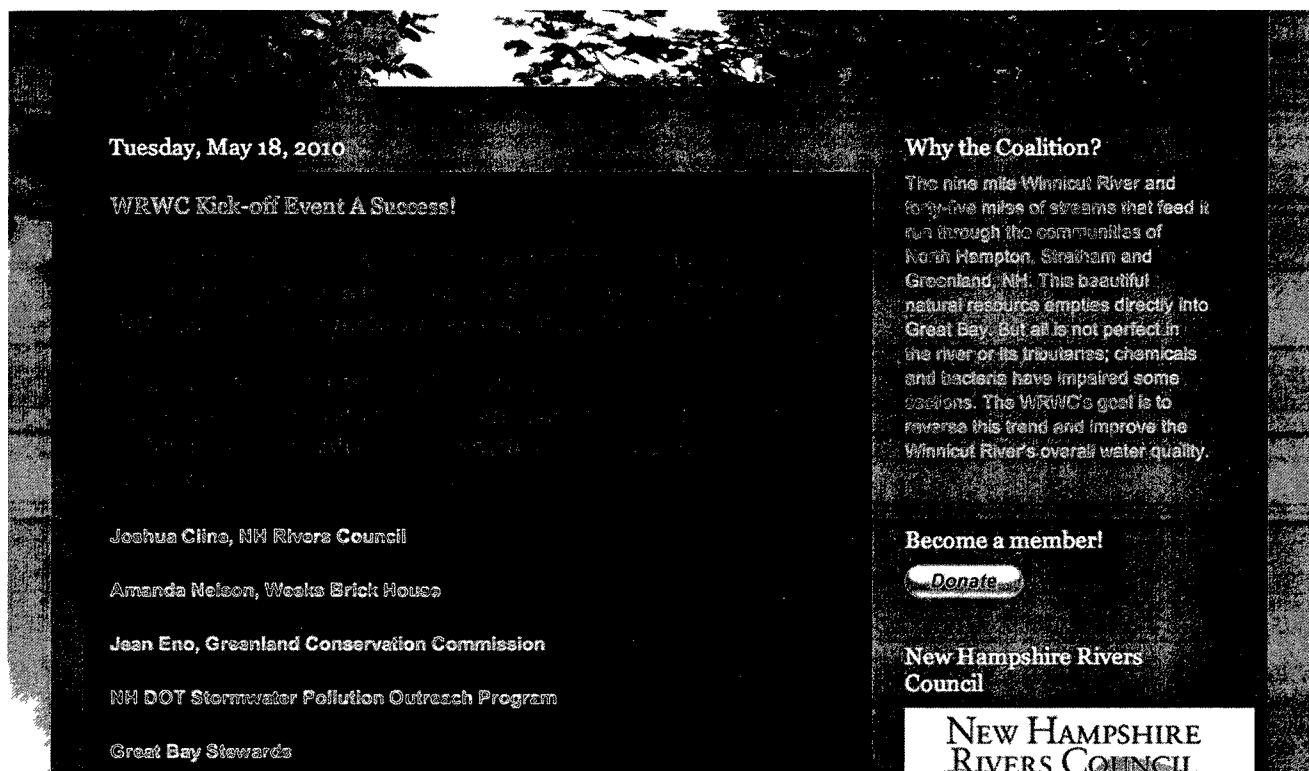


Figure 4-8. Screenshot of the Winnicut River Watershed Coalition's Blog, updated weekly.
Source: (Blogger.com; June 7, 2010)

Community Involvement with Riverwalk & Family BBQ Event

A key task associated to the Riverwalk event objective was to ensure wide community involvement and this proved to be a success of the May 15th, 2010 Riverwalk event as it helped to lead to the establishment of partnerships with community groups, businesses and people. The event was aimed to be a family orientated afternoon complete with a free barbeque lunch and guided Riverwalk to learn more about the Winnicut and its watershed. Food for the barbeque was largely donated by area businesses and many groups had tables with displays. Another task associated with the Riverwalk event objective was to make the event zero waste as the organizers felt it helped reinforce conservation ideals and provided an opportunity for further learning. Using all compostable paper goods and silverware the event was able to achieve a zero waste status with help from Eco-Movement Consulting and Hauling. Informative signage

alerted guests to the practices entailed with zero waste, compost and recycling and its benefits to the planet and the Winnicut River.

Table 4-2. List of businesses and organizations involved with the Winnicut Riverwalk and Family BBQ event, May 15, 2010, Greenland, NH.

Name	Involvement	Area Represented
Weeks Brick House & Gardens	Site for the event, table for information	Greenland
New Hampshire Dept. of Transportation Pollution Outreach Program	Enviroscape Display for interactive lessons on non-point pollution and stormwater runoff	State of New Hampshire
Great Bay Stewards	Table with information	Great Bay Region
Cheri Patterson – New Hampshire Fish & Game	Winnicut Dam Removal table of information	State of New Hampshire
Boy Scout Troop 158	Led riverwalks with information on ecology and history of river and surrounding area	Greenland
Artist Hal Kirby	Table with art for sale; donated 2 paintings for raffle items	Stratham
Artist Anthony D'Allesandro	Art sale and donated 1 painting for raffle item	North Hampton
New Hampshire Audubon	Riverwalk Guide	State of New Hampshire
New Hampshire Coastal Protection Partnership	Table with information on stormwater pollution and raffle for rain barrel	Coastal New Hampshire
Suds 'n Soda store	Raffle item – fishing rod & reel, t-shirts	Greenland
Photographer Ann Reid	Raffle item – photograph	Greenland
Joe's Meat Shoppe	Donated Hamburgers, hotdogs, buns and condiments	North Hampton
Mizuna Market & Café	Donated pasta and potato salads	Greenland
Sweet Dreams Bakery	Donated brownies, cookies and sweets	Stratham
Eco-Movement Consulting & Hauling	Donated compost barrels and recycling bins to make even ZERO WASTE	Portsmouth Region



The Winnicut River Watershed

Fact: The 9.1 mile Winnicut River begins in North Hampton, flows through Stratham and Greenland emptying into Great Bay.

Fact: The Winnicut River is fed by 7 perennial tributaries: Barton Brook, Norton Brook, Marsh Brook, Winniconic Brook, Thompson Brook, and two unnamed streams

Fact: The Winnicut River serviced more than eight sawmills and gristmills since 1660.

Fact: The Winnicut River Watershed has over 17.9 miles of drainage, 27% of Greenland flows into the Winnicut. 42 miles of streams flow into it.

Figure 4-9. Fact Sheet that was distributed to all attendees of the Winnicut River Watershed Coalition's River Walk and Family BBQ even, May, 15, 2010, Greenland, NH.



BIOLOGICALLY SOUND
MANAGEMENT OF NEW
HAMPSHIRE'S RIVERS
AND WATERSHEDS.



AN NHRC CHAPTER

FACT: The 9.1 mile Winnicut River begins in North Hampton, flows through Seabrook and Greenland emptying into Great Bay.

FACT: The Winnicut River served as one of the eight main rivers and tributaries since 1661.

FACT: The Winnicut River Watershed has 17.7 miles of drainage and 42 miles of stream that flow into it.

FACT: The Town Landing was developed in 1968. Located where the Winnicut meets Great Bay it was the base for handling lumber and lumber products from upstream to Great Bay and the sea.

FACT: The US Environmental Protection Agency has declared the Winnicut River unsafe for swimming, fishing or immediate contact due to high levels of bacteria and chemicals.

Dear Winnicut River Walk participant,

It is with great joy and success that we write to thank you for participating in the inaugural River Walk and Family BBQ event held Saturday, May 15, 2010. More than 60 people from local communities, organizations and groups participated throughout the day.

With the sun shining and wind blowing, participants had a chance to mingle under the exhibitor's tent to learn about the many water quality issues within the Winnicut River and its tributaries. Participants also had the opportunity to hear about the Winnicut dam removal, find their home on specially created GIS watershed maps, talk with Greenland Conservation Commissioners, enter a raffle for a variety of prizes donated from area businesses, and become familiar with research and restoration projects the Great Bay Stewards are involved in.

The New Hampshire Coastal Protection Partnership provided an opportunity to purchase rain barrels. Two local artists, Hal Kirby and Anthony D'Alessandro of Newmarket, had their beautiful landscape and wildlife paintings on display and the Weeks Brick House and Gardens members explained the history and story of the site. New Hampshire Department of Transportation also engaged visitors with a traveling hands-on interactive stormwater display.

On top of all this, local Boy Scout Troop 158, along with Greg Tillman from New Hampshire Audubon, led two River Walks along the trails of the Weeks Brick House conservation lands providing ecological knowledge and great vistas of the Winnicut River and its marsh system. Visitors were also treated to a fantastic barbeque lunch with food contributed from Joe's Meat Shoppe, Mizuna Market & Café and Sweet Dreams Bakery. The event was organized as a "zero waste" event with Eco-Movement Consulting & Hauling providing compost barrels and recycling bins. See some great photos of the event at: <http://winnicutriverwatershedcoalition.blogspot.com>.

Above all else, participants had the opportunity to learn more about the newly forming Winnicut River Watershed Coalition (WRWC) and the New Hampshire Rivers Council. The WRWC will be holding a series of public informational meetings over the next few months to gather input from community members on how to improve and protect this wonderful river resource. The ongoing effort of the WRWC will be to figure out the most effective way to protect the long term health and quality of the Winnicut River. To succeed, your help and support is needed. An email about meeting dates will be sent out shortly to let you know where and when they will take place. We hope you can join us to share your concerns, ideas and vision of this watershed's future.

To keep informed about upcoming events and to join the Coalition, contact Josh Cline at New Hampshire Rivers Council (josh@nhrrivers.org) and visit: <http://www.nhrrivers.org/winnicut>

All the best,
The Winnicut River Watershed Coalition Planning Committee

Figure 4-10. Thank you letter mailed to all community participants in the Riverwalk Event.

The Riverwalk Event brought approximately 65 people to the Weeks Brick House on May 15, 2010 and resulted in 25 new volunteers and members for the Winnicut River Watershed Coalition.

Community Meetings

A primary objective in the training phase of this collaborative learning project was to initiate awareness and foster buy-in from key stakeholders, decision makers and opinion leaders in the watershed communities. The team organized a 5-month strategic plan of community meetings to reach out to the municipal officials to report on the success of the community event, garner support and ask for participation.

- *July 15, 2010 – Greenland Town Hall, Municipal Leader Meeting*

This meeting was a collaborative effort amongst the WRWC planning team, Cheri Anderson of New Hampshire Fish and Game Department, Kevin Lucey of the New Hampshire Department of Environmental Services Coastal Program and Theresa Walker from Rockingham Planning Commission. The intention of this meeting was to invite the 13 chairs from the nine land use boards (Conservation Commission, Planning Board and Select Board) of the three towns as well as the three town administrators ([Figure 4-11](#)). However, only the Greenland Town Administrator and a member of the Greenland Conservation Commission and a co-chair of the Greenland Planning Board were in attendance. The meeting consisted of a multi-part PowerPoint presented by Anderson, Lucey and Cline that laid out the work that has occurred in the Winnicut River, the status of the dam removal project, the intention of the restoration efforts and the plans for the WRWC. The WRWC got approval from Greenland Town Administrator to erect a display ([Figure 4-12](#)) at the site of the Winnicut Dam Removal to better explain to

citizens the process of restoration and how they can learn more about the ecological progressions being undertaken by the river system.

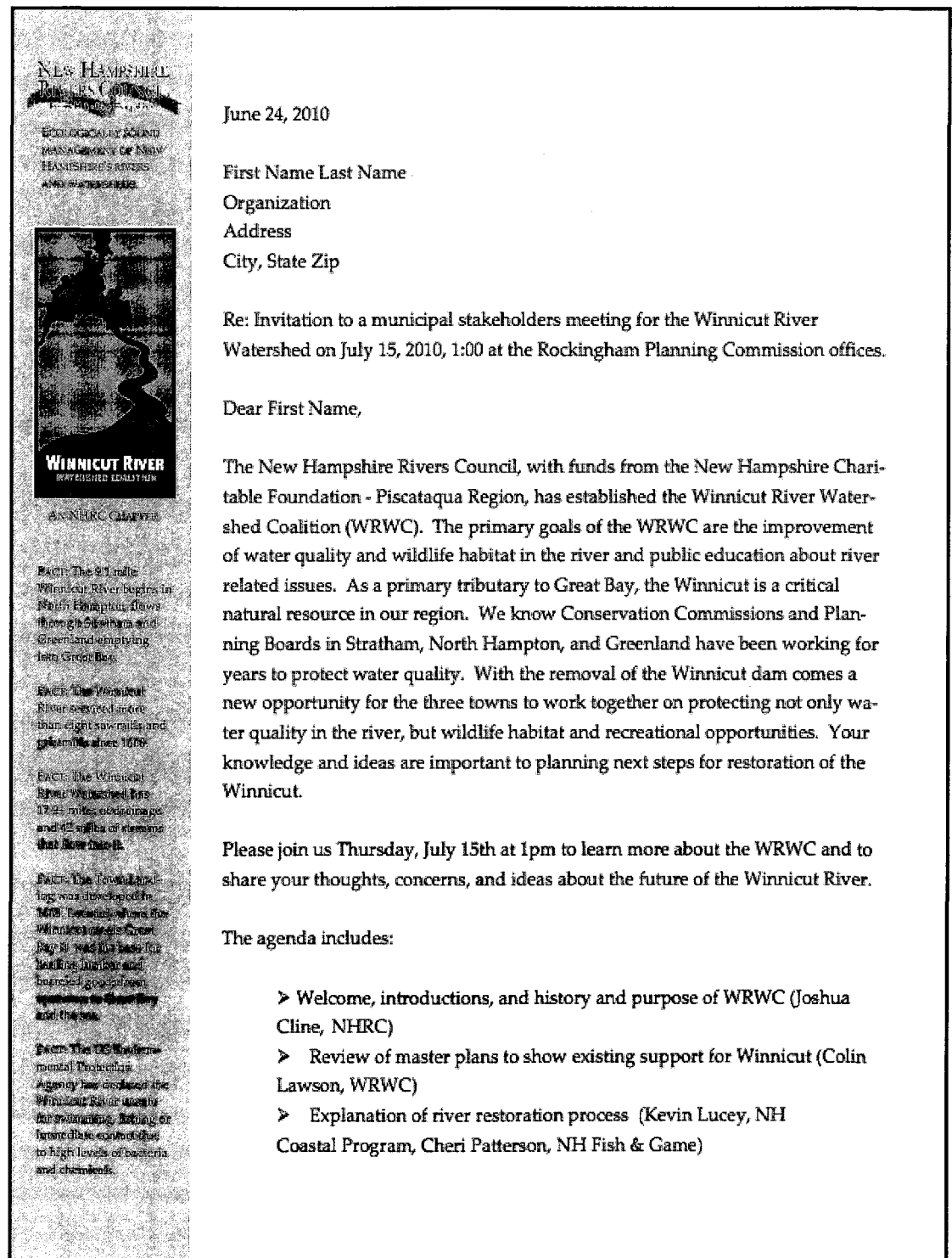


Figure 4-11. Letter mailed to 13 municipal stakeholders inviting them to a meeting on the restoration plans for the Winnicut River.

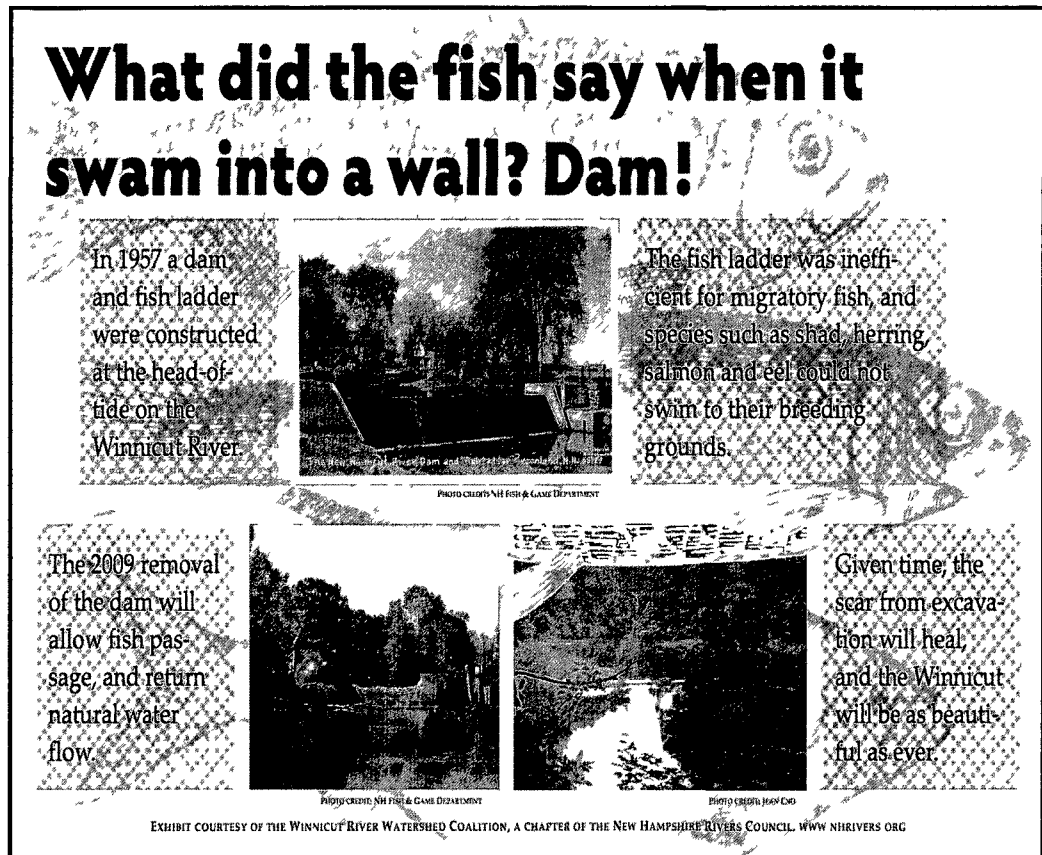


Figure 4-12. Restoration exhibit slated to be erected at the site of the previous Winnicut River Dam courtesy of the Winnicut River Watershed Coalition. (produced by Cline, J)

- *Conservation Commission Meetings*

September 8 – Stratham

September 14 – North Hampton

The WRWC planning team obtained placement on the agendas of both Stratham and North Hampton’s Conservation Commission’s September meeting. The intent of these meetings was to report on the developments of the WRWC and ask for the Conservation Commission’s support and help in promoting the upcoming public meetings to their community members. The meetings consisted of a PowerPoint presentation laying out the impairments to the Winnicut River, the development of the WRWC and the opportunity the WRWC gives the Commission to help them in their work in the communities. Appendix C contains an article from *The Portsmouth Herald*

covering one of these presentations. The Stratham commission expressed support for the efforts, commended the planning teams' enthusiasm and expressed gratitude that there was a resource they could refer to for information regarding water quality in the Winnicut River. The primary investigator, Scahill Farrell, was unable to attend the North Hampton commission meeting but Eno reported similar interest and support.

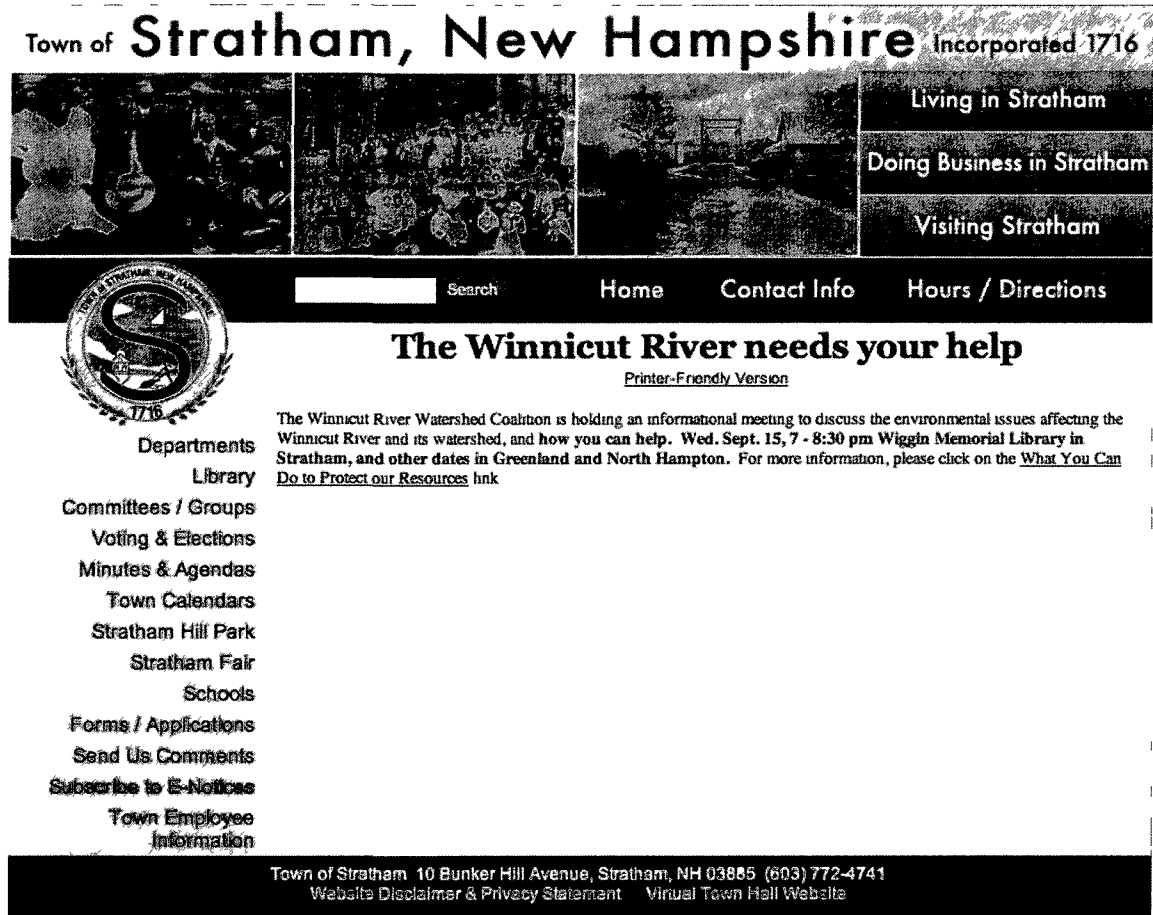


Figure 4-13. Screenshot of the Town of Stratham's website promoting the upcoming Winnicut River Watershed Coalition's public meetings.

Source (strathamnh.gov, Sept 9, 2010)

A second stated objective of the implementation phase of the collaborative learning project was to plan and organize a series of 3 community meetings in each of the 3 towns to follow up on the River Walk's interest and to recruit more citizen volunteers.

- *Public Meetings*

September 15 – Stratham Library

September 21 – Hugh Gregg Conservation Center, Greenland

September 29 – Wiggin Library, North Hampton

The series of 3 public meetings was designed to give all citizens in the watershed a chance to attend a meeting and not have them be limited geographically. The meetings were led by Jean Eno, who as of September 1, 2010 had taken over the director's role of the WRWC from Josh Cline. Scahill Farrell was unable to personally attend the meetings, but Eno's personal recorded notes are reflected in this section. Each meeting held generally the same format which included a PowerPoint presentation that introduced the impairments to health in the Winnicut River, the potential sources of pollution, the proposed restoration plan that includes citizen volunteer water quality monitoring, biological monitoring and invasive plant control and why and how the WRWC needs citizen involvement. Each meeting allowed time for a question and answer session. There was the distribution of follow up contact information including the URL for the website and blog and Jean Eno's email and phone number. At each meeting there was the opportunity for a citizen to sign up as a volunteer for water quality monitoring, biological monitoring, invasive plant control or help administratively with WRWC. Recruitment for these meetings consisted of a poster that was hung in numerous public places (Figure 4-14) and was advertised in the local paper, emailed to key stakeholders, sent to municipal leaders and distributed via social networking. There was no level of involvement from municipal stakeholders. This was surprising due to the fact that the planning team made it a point to go to each municipal board's meeting and announce these public meetings and to ask for their involvement. The citizen volunteers were the primary target for these public meetings but it would have been ideal to have municipal leader involvement as well.

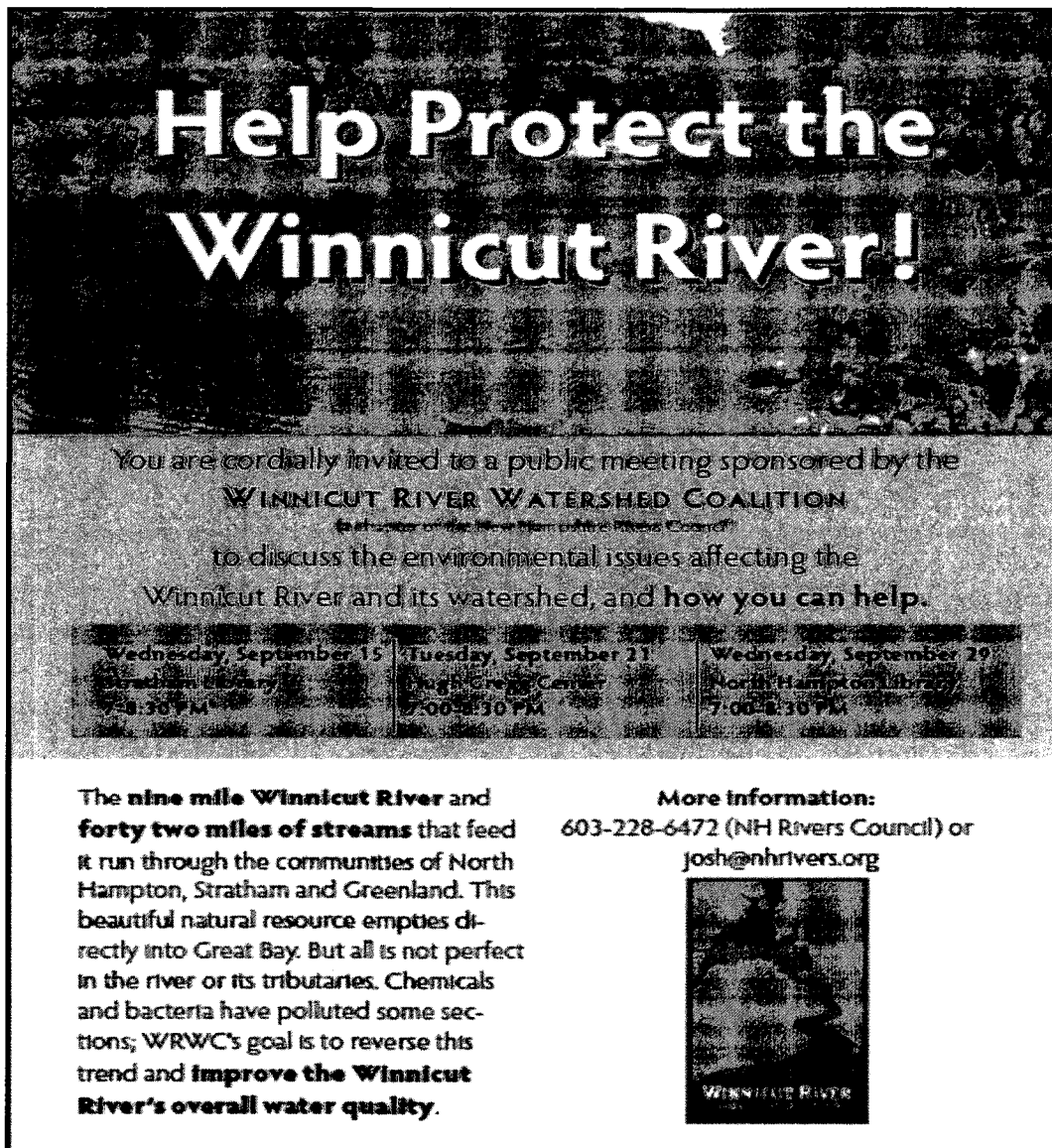


Figure 4-14. The poster that was distributed widely in the watershed communities announcing the series of public meetings.

The three public meetings had relatively low attendance but those that did attend got engaged with the WRWC. Attendance: 5 at Stratham's, 6 at Greenland's, and 15-16 at North Hampton's meeting. The attendance was mostly citizens, no municipal leaders attended and nobody representing the business community, which were both specified objectives in the project design. The *Portsmouth Herald* ran a story about the public meeting in North Hampton (Appendix D). A total of ten people signed on to be involved

with the Volunteer River Assessment Program (VRAP) for the Winnicut. The VRAP program was started by New Hampshire Department of Environmental Services in 1998 and it was intended to promote awareness and education of the importance of maintaining water quality in rivers and streams. The VRAP program not only intends to raise awareness but it also educates the public about water quality and ecology while also helping to increase water quality monitoring state-wide. NHDES will take a group of volunteers that are willing to be involved with VRAP and provide technical support, loan water quality monitoring equipment and facilitate trainings. VRAP data is used by NHDES in their reporting to the US EPA regarding New Hampshire's fulfillment of the Clean Water Act. The Winnicut River has never had any VRAP data collection as it has never had a dedicated group of volunteers in the region. The VRAP for the Winnicut is due to begin in summer 2011 following the required training from NHDES.

CHAPTER 5

THE BIG PICTURE:

CONTEXTUAL AND SOCIAL PROCESS MAP AND PROBLEM SITUATION OF THE WINNICUT RIVER WATERSHED

Organizational structure of stakeholder groups at work in the watershed

In order to best understand the current social processes at play in the Winnicut River Watershed and to comprehend the particular social context(s) in which the problems facing the watershed are embedded it is vital to conduct a social process contextual mapping exercise (Clark et.al. 2000). The problems facing the Winnicut River watershed and the Great Bay region were not a result of linear reactions but rather the problems are a result of interactions amongst people and their actions and values in respect to policy, regulations and enforcement. No social problem such as that facing the Winnicut River watershed is devoid of people and organizations' values and strategies. People act based upon their values, it is their values that underlie their perspective or "lens" on the world (Clark et.al. 2000). That is why engaging in a social process mapping exercise helps to identify the known perspectives and prepare for understanding and engaging potential competing interests.

Clark, et. al. (2000) describes social process as: "...the interaction of people as they influence the actions, plans or policies of other people, even if they are unaware of one another." Social process context mapping requires the identification

of participants and their perspectives, situations, base values, strategies as well as each person's expected outcomes and effects of these (Clark, et. al. 2000). This section contains 6 subsections that lay out the social process map for the Winnicut River watershed in the context of the larger Great Bay watershed. The mapping exercise was designed based upon insights gained about groups or organizations currently working in or having stake in the larger Great Bay watershed region, of which the Winnicut River watershed is a sub-basin. The Great Bay watershed consists of a 52 towns across southeastern New Hampshire and Southern Maine. Groups and organizations, rather than individuals, were targeted in this social process map because the intent was to form another organization and the WRWC planning team wanted to determine what groups were already at play in the region and map their values, situations and perspectives. The groups and organizations were identified and then assessed as to what their target stakeholder group was perceived to be, what their primary activities and strategies were, how they were funded, what their base values were perceived to be using one or a combination of eight categories: power, wealth, enlightenment, well-being, affection, skill, respect and rectitude (Clark, et.al. 2000 (Lasswell and Kaplan 1950; Lasswell and McDougal 1992)). These groups were then organized into four primary and two secondary categories: Treetops/Policy, Technical/Professional, Grassroots/Public, Umbrella and two that are in between. These categories are based off of each group's primary priorities as stated in their mission statements, goals and/or priority action plans.

This social mapping exercise helped better understand in what realms each group was operating and is useful for categorizing where each organization stands in the context of others. The understanding gleaned from this mapping exercise allowed for the WRWC planning team to better target the intended audience for

outreach and engagement. It provided a tool for insight in the ongoing process of clarifying and securing common interests (Clark, et.al. 2000). Also understanding which groups were doing what tasks helped to clarify what tasks and goals were missing in the landscape and informed the development of the WRWC mission. As public participation tools were employed the social map helped to inform what other groups were targeting the general public and for what purpose, in particular what groups were targeting Greenland, Stratham and North Hampton in particular. Determining each group's funding structure will help the WRWC as it moves forward with grant seeking as they will understand what other groups in the region will be their competition or their collaborators. Determining the base values of each group or stakeholder helps to inform the WRWC what types of reasoning and background people have when it comes to their natural resources and governance. It is interesting to note the "Umbrella" groups as those groups were developed to help coordinate and encourage collaboration amongst all the other groups, showing that the landscape is very crowded with like-minded organizations and could potentially benefit from collaborative efforts.

The second part to this policy sciences methodology following a social process map is a decision process map. That exercise was not completed for this study but it seeks to map, describe and analyze the description the decision-making process that is part of all policy problem-solving processes (Clark et.al. 2000, (Lasswell 1971; Lasswell and McDougal 1992)). This process will undoubtedly be undertaken in the months and years to come for the WRWC as it begins to engage in enacting change at the municipal regulatory level. For the purpose of this participatory action study the social process context in regards to stakeholder organizations was most important to understand, as this was the initial grassroots organization and recruitment of citizens stage. As the Coalition moves forward it will

be essential to understand the regulatory and decision making process at play in each of the three communities as well as the at the state and federal level in order to enact better regulatory protections and enforcements on the Winnicut River.

Table 5-1. Social Process map for the Treetops/Policy category for the Winnicut River Watershed and greater Great Bay Region, May 2010.

<u>Treetops/Policy Level</u> Those groups who cite advocacy and policy change as a top priority.				
Organization Participants	Target/Stakeholder Group Perspective	Activities Situations/Strategies	Base Values	Funding Source(s) Strategies
Conservation Law Foundation	Legal, media, voters, legislature	Advocacy, litigation, public relations	Power, well-being, respect, rectitude	Private
The Nature Conservancy	Legislature, international media, worldwide citizens	Research, advocacy, public relations, lobbying	Respect, well-being, skill	Private
Society for the Protection of NH Forests (SPNHF)	Legislature, citizens, media, partner organizations	Land conservation, policy advocacy, land management	Respect, power, enlightenment, well-being	Private
Clean Air Cool Planet	Legislature, businesses, campuses, regional opinion leaders	Consultancy, education, outreach, policy advocacy	Power, rectitude, respect, enlightenment	Private corporations and foundations
Clean Water Action	Legislature, public	Community organizing, policy advocacy, policy research	Rectitude, power	Private citizens, corporations and foundations

Table 5-2. Social Process Map for the groups in-between Policy/Treetops and Experts/Technical for the Winnicut River Watershed and greater Great Bay region May, 2010.

<u>In-Between Treetops & Experts:</u> Those groups who advocate, regulate and have technical expertise.				
Organization Participants	Target/Stakeholder Group Perspectives	Activities Situations/ Strategies	Base Values	Funding Source(s) Strategies
U.S. Fish & Wildlife Service –Great Bay National Wildlife Refuge	Visitors, legislature	Management, volunteer recruitment, data collection, grant making, permits	Power, Respect, Skill, Rectitude	Federal
US Environmental Protection Agency (EPA)	Regulators, states, municipalities, federal government, citizens	Regulations, permitting, rulemaking, restoration, conservation	Power, Respect, Skill, Rectitude, Well-Being	Federal
NH Dept. of Environmental Services (NHDES) & Coastal Program	All state municipalities and citizens	Regulatory, grant making, education and coordination	Respect, Skill, Power, Rectitude	State, federal and permits
Ducks Unlimited	Legislature, researchers, hunters	Conservation, policy advocacy, research	Skill, Respect, Enlightenment, Well-Being	Private easements, federal and state grants, private donations
NH Fish & Game Department	All state municipalities, recreational visitors	Managing, regulating, grant making, education & coordination for state's fish, wildlife & marine resources & their habitats	Respect, Skill, Power, Rectitude, Well-being	
Trout Unlimited	Legislature, researchers, anglers	Research, policy advocacy, lobbying, conservation and restoration.	Skill, Respect, Enlightenment, Well-Being	Private, federal grants, state grants

Table 5-3. Social Process Map for Technical/Professional category for the Winnicut River Watershed and greater Great Bay Region, May 2010.

Technical/Professional: Those groups who cite research, monitoring and data collection as a top priority. Those groups who have a specific technical skill or task that they are relied upon to supply. Groups who are considered “experts” on particular subject matters				
Organization <i>Participants</i>	Target/Stakeholder Group <i>Group Perspectives</i>	Activities <i>Situations/Strategies</i>	Base Values	Funding Source(s) <i>Strategies</i>
Great Bay National Estuarine Research Reserve	Scientists, other conservation organizations, citizens, regulators	Research, collaboration, education and outreach	Skill, Respect, Enlightenment, Rectitude, Well-Being	Federal and Private
New Hampshire Charitable Foundation	All state municipalities, organizations and citizens	Grant giving	Respect, Power, Wealth, Well-Being	Private
Trust for Public Land	State and town governments and local area NGO's, landowners	Land conservation, grant seeking, collaboration, research, education and outreach	Respect, Skill, Well-Being, Rectitude	Private individuals, private foundations
Southeast Land Trust of New Hampshire	Landowners, Municipalities, Citizens	Land conservation, Monitoring, Purchase of land, grant seeking	Skill, respect, rectitude, Power	Private, State, Federal
University of New Hampshire – Jackson Lab, Gregg Lab, Chase Lab, Marine Program, NREN Dept., NRESS, Office of Sustainability, CICEET, IEOS, NERRS S.C.	Researchers, students, professional publications	Research, education, publication, grant seeking	Skill, Respect, Enlightenment, Power, Rectitude, Well-Being, Wealth	Private, state, federal,
US Dept. of Agriculture, Natural Resource Conservation Service (NRCS)	Landowners, farmers, ranchers, municipalities	Research, conservation planning, education, outreach, grant giving	Skill, Enlightenment, Well-Being, Respect	Federal

Rockingham County Conservation District	Landowners, municipalities, NGO's	Research, technical expertise, conservation, grant seeking, grant giving, education and outreach	Skill, Enlightenment, Well-Being, Rectitude	State, county
Piscataqua Region Estuaries Partnership	Municipalities, state and federal regulators, bureaucrats, citizens	Research, monitoring, data distribution, restoration, grant giving	Skill, Respect, Power, Enlightenment, Rectitude	Federal and private

Table 5-4. Social Process Map for in-between Technical & Grassroots Category in the Winnicut River & greater Great Bay Region, May 2010

In-Between Technical & Grassroots: Those groups who have technical expertise but whose main target group is citizens, landowners & municipalities				
Organization <i>Participants</i>	Target/ Stakeholder Group <i>Strategies</i>	Activities <i>Situations/Strategies</i>	Base Values	Funding Source(s) <i>Strategies</i>
Rockingham Planning Commission	Municipalities	Advisory role to local governments to promote coordinated planning, orderly growth, efficient land use, transport access and environmental protections	Skill, Respect, Enlightenment, Well-Being, Wealth	Private, grants, federal and state grants, municipality members
UNH Cooperative Extension – NROC, SeaGrant, Great Bay Coast Watch	Municipalities, citizens	Disseminating university research-based education and information to help communities make informed decisions regarding natural resources, economy and families	Skill, Respect, Affection, Well-Being	Federal, State, Country, Private
New Hampshire Audubon	Landowners, citizens, municipalities, bird watchers	Conservation, research and wildlife monitoring, land conservation, advocacy, education, outreach	Skill, respect, rectitude, well-being	Members, private foundations, donations
3 towns' Planning Boards	Citizen Volunteers, home/landowners, taxpayers, voters, Circuit Rider, Planner	Decision making regarding permits, site reviews, ordinance drafting, plan reviews, warrant drafting	Respect, power, well-being, affection	Town, State, county, private
3 towns' Select Boards	Citizen Volunteers, taxpayers, voters other town Boards, Town Staff	Decision making regarding fiscal expenses, administrative decisions, taxes, elections	Power, respect, well-being	Town, State, County

3 towns' Zoning Boards of Adjustment	Citizen Volunteers, Planning Board	Decision making regarding permits, zoning ordinance variances	Power, respect, well-being	Town
3 towns' Conservation Commissions	Citizen Volunteers, Citizens, Planning Board	Advisory board on decisions regarding permitting, ordinances, warrants and land use, monitor and control town's natural resources	Rectitude, Power, Well-Being, Respect	Town, county

Table 5-5. Social Process Map for the Grassroots/Public category for the Winnicut River Watershed and greater Great Bay region, May 2010.

Grassroots/Public: Those groups that rely on memberships and private support for the majority of their funding. Those groups that cite education and outreach as their top priorities.				
Organization Participants	Target/ Stakeholder Group Strategies	Activities Situations/Strategies	Base Values	Funding Source(s) Strategies
Conservation Law Foundation	Voters, Citizens, other NGO's	Advocacy, Litigation, public relations, protests, education, outreach	Respect, Power, Skill, Rectitude	Private
The Nature Conservancy	Citizens, Landowners	Research, Conservation, Advocacy, Public Relations, lobbying, Education, Outreach	Skill, Power, Respect, Well-Being	Private
The Gundalow Company	Citizens, Schools	Education and outreach	Skill, Enlightenment, Respect, Well-Being	Private
Great Bay Stewards	Citizens, Schools	Education and Outreach, Funding support for GBNERR, dissemination of research from NERR	Enlightenment, Skill, Well-Being, Respect	Private
New Hampshire Coastal Protection Partnership (NH Coast)	Citizens, legislature, businesses	Education, outreach, legislative tracking, rain barrels and rain gardens, grant seeking	Enlightenment, Power, Skill, Rectitude, Well-Being	Private, State Grants
Coastal Conservation Assoc. of NH	Citizens, Anglers, Businesses	Education, Outreach, Conservation, Restoration, Oyster Shell Recycling Program	Enlightenment, Skill, Respect, Well-Being, Rectitude	Private
Blue Ocean Society for Marine Conservation	Citizens	Education, Research, Advocacy, Beach Clean ups	Rectitude, Enlightenment, Skill, Power	Private
Surfrider Foundation	Citizens, Businesses, Surfers, Anglers	Education, Outreach, Advocacy, Beach Clean ups	Rectitude, Enlightenment, Respect	Private

Seacoast Science Center	Citizens, Schools, Businesses	Education, Outreach, Volunteer and member recruitment	Enlightenment, Respect, Skill, Well-Being	Private, State, Grants
Other Local Watershed Groups from Great Bay Region	Citizens, Local Government, Shoreline Property owners, Schools, Community Groups, Businesses, Schools	Education, Outreach, Volunteer Recruitment, Restoration, Conservation, Water and Biological Monitoring, Invasive Plant Control, Awareness raising	Enlightenment, Skill, Respect, Rectitude, Well-Being, Power	Private, County, State, Federal, Town
<i>Lamprey River Local Advisory Committee</i>				
<i>Lamprey River Watershed Assoc.</i>				
<i>Exeter River Local Advisory Committee</i>				
<i>Cocheco River Watershed Coalition</i>				
<i>Oyster River Watershed Assoc.</i>				
<i>Bellamy and Oyster River Watershed Assoc.</i>				
<i>Hodgson Brook Restoration Project</i>				

Table 5-6. Social Process Map for the Umbrella Category for the Winnicut River Watershed and greater Great Bay Region, May 2010.

<u>Umbrella Groups</u> Those groups who cross stakeholder boundaries due to their membership and/or priorities.				
Organization Participants	Target/Stakeholder Group Perspectives	Activities Perspectives/Strategies	Base Values	Funding Source(s) Strategies
Great Bay Resource Protection Partnership	State and regional conservation groups	Collaboration, conservation, land protection, restoration	Rectitude, Skill, Respect, Power	Varied
Partnership to Restore New Hampshire's Estuaries	Conservation organizations	Collaboration, cooperative restoration, conservation	Power, Wealth, Skill, Respect	Varied
Southeast Watershed Alliance	Municipal decision makers	Collaboration on land use planning that protects water quality and protects clean water	Power, Respect, Well-Being, Skill	State mandated, grant seeking

The overall social process maps show a very crowded landscape that ranges widely in values, perspectives and strategies. It is important to note the number of grassroots/public organizations in relation to those comprised of technical/experts and treetops/policy levels – 16 to 16. This shows that there is not a vacuum of energy at any one level and some organizations, such as Conservation Law Foundation and The Nature Conservancy supersede categories, they operate at all scales. There is a question of whether more is better or more simply dilutes and splinters the population. However, it does appear that there is no lack of the presence of and success in citizen level, grassroots organizations. There is the public support and community capacity for these groups to begin and to be sustained showing that the local level, regional associations are a way of life in this region. The WRWC would be a local level, grassroots association involving three towns in the landscape that does not show any other local groups, so it would fill a watershed constituency void in the landscape.

As important as mapping the groups is discussing the interactions amongst the groups. It can be assumed that with a landscape that is as crowded as this one appears to be there is no lack of interactions and exchanges amongst the groups particularly with technology and information sharing and volunteer and leadership involvement. The larger national or international groups such as The Nature Conservancy, Conservation Law Foundation, Trust for Public Land, Trout and Ducks Unlimited are bound to have overlaps in membership with local groups and this is an important interaction to note. The groups that fall in the in-between categories are highly interactive with both the categories above and below them. Groups like the US EPA have involvement in policy level discussions and decisions as well as in funding the research and data collection of the expert/technical groups such as the Piscataqua Region Estuaries Partnership (PREP). PREP grants money

to grassroots/public groups and towns with policy/treetops funds, thus the interactions are trifold in that relationship. NH DES establishes state level policy rules and also funds and conducts water quality monitoring and research. UNH Cooperative Extension has expert level researchers and presents to town boards so they are interacting above in the technical sphere and below in the grassroots sphere. The three town land use boards, Planning, Conservation and Zoning have technical expertise in understanding what it takes to lead a town, interact with citizens, answer to selectmen and they understand possibly more than any other group the context of their town both politically but also ecologically. These boards are made up of citizen volunteers so they have a presence in the grassroots/public sphere as well. Interactions amongst the groups occur both observably such as that with PREP and the EPA and covertly such as the Great Bay Stewards serving as the advocate, public support and fundraising arm for the Great Bay National Estuarine Research Reserve.

The volunteer and leadership sharing is another more covert interaction amongst the groups. This occurs heavily in the Umbrella Groups due to their nature. Having the same person or persons providing leadership or volunteer support to multiple groups and organizations brings with them the values, situations and strategies of each group to the other group. This can often times affect the priority setting and planning of a group if the one individual is extremely vocal and it can become a concern if the group is swayed too far away from its own mission. It is important that these people identify their biases, other affiliations and intentions up front and be prepared to recuse themselves if need be. Many “super-volunteers” serve on their town's conservation commission, are members of the Coastal Conservation Association and Trout Unlimited, volunteer for the Gundalow Company, give funding support to the Conservation Law Foundation and are

members of the Nature Conservancy and may also have a professional capacity that interacts with the issues as well. Specific examples include the president of the Coastal Conservation Association who also serves on the board of Trout Unlimited and serves on PREP's Management Committee. Another is a planner for the Rockingham Planning Commission serves as PREP's Management Committee's Chair and on the Exeter River Local Advisory Committee's board.

The municipal boards reside in between experts and grassroots because they do possess the skill and more importantly have power over decisions, but they must remain accountable to the citizen voters. These boards, comprised of citizen members, are primary key stakeholders as they hold the most power in regards to decision making that can affect the Winnicut River's future. The leverage point to engaging these stakeholders is to engage their constituencies, the citizens. The capacity for watershed based management may not initially be something the local officials understand or are engaged in doing but when the citizens of the three towns begin to appear at their towns' board meetings asking for their leaders cooperation and holding them accountable the tide will turn. It is going to require the citizens to learn the issues and to develop a common language in order to message the same way to each town's board regarding watershed based management. The WRWC will be the vehicle to provide needed foundations and language, and to provide the space in which the concerned citizens can meet, engage and empower one another to act.

Other primary key stakeholders for the Winnicut River Watershed are the fellow watershed associations and groups. These groups have gone through the process of organizing and recruiting and have established respect and a local knowledge of their watershed's citizens. Surprisingly, these groups do not traditionally interact with one another. The Exeter River Local Advisory Committee

has been established since 1995 when a group of concerned citizens succeeded in enrolling the river into the New Hampshire Rivers Management and Protection Plan (ERLAC 2011). This group has been able to stay organized and lead through numerous shifts in municipal governments and ebbing tides of focus on environmental issues. The Lamprey River Watershed Association has been established since 1980 and it too can provide a model of sustained leadership and unified efforts through great turnover of municipal leadership and increased development pressure especially since its watershed is six times the size of the Winnicut watershed and has 14 towns within its basin (LRWA 2011). These groups can play an essential mentoring role to the WRWC as it forms and begins to assess and define the problems and solutions needed to restore health to the watershed. These groups can aid in recruitment tactics, administrative support and constant encouragement.

Additionally, the primary Great Bay water focused groups – Great Bay Stewards, Gundalow Company, Coastal Conservation Association, Trout Unlimited and Ducks Unlimited will prove to be key stakeholders for the WRWC to partner with in its recruitment of volunteers and leadership. Those groups may be able to provide lists of members who reside in the three town area of the Winnicut watershed and could align and partner with the WRWC in a Great Bay centered event or outreach campaign.

The technical expertise coming from the University of New Hampshire, Great Bay National Estuarine Research Reserve and PREP provide an irreplaceable resource to the WRWC as it develops its restoration plan and begins its volunteer water quality monitoring program. These organizations can help to provide previous studies conducted and identify data gaps in the sets as well as translate the science for the WRWC members. The WRWC will want to be sure that any and all research

conducted in the Winnicut River going forward be registered and recorded in a central location so that the increasing baseline intelligence regarding the river can be accessed, added to and amended. The regulatory agencies such as NHDES and US EPA must be engaged in order to foster buy-in and for potential grant support for future on the ground restoration projects the WRWC wishes to implement. Fostering relationships with the land conservation professionals such as the Southeast Land Trust of New Hampshire, Trust for Public Land and The Nature Conservancy will prove beneficial for the essential actions of riparian protection and wetland conservation. The Winnicut River Watershed contains large wetland complexes that are largely under private ownership, partnership with land conservation organizations may lead to permanent protection of these essential reaches of the watershed.

Policy and Decision Making Framework for the Winnicut River Watershed

Clark, et.al. (2000) describe problem orientation as a strategy to address problems and invent solutions and it consists of five tasks: goal clarification, trend description, condition analysis, trend projection, alternative invention, evaluation and selection. The social process maps in the previous section help to clarify the goal of creating a Winnicut River Watershed Coalition to address the problem of water quality degradation in the Winnicut River by mapping the social process for the watershed's problem context. The problem did not arise suddenly and therefore the process for addressing it will not be something that can occur quickly. The problem orientation process looks at the historical and current trends, identifies the factors that have contributed to these trends and projects those trends into the future if the status quo is upheld. For this study, it was deemed appropriate to dissect the historic and current trends of the problem of degrading water quality in

the Winnicut River and identify the factors at play in those trends. A focus was placed on the regulations and planning tools in place in the three watershed communities as well as in the state of New Hampshire to gain better insight on the reasons for some of the pollution problems in the river and to identify places for leverage for the future plans of the WRWC. This section lays out the regulatory and decision making framework of the problem situation.

Jurisdictions & State & Federal Regulations:

The Winnicut River Watershed is under the jurisdiction of three towns, one county, Rockingham, and one state, New Hampshire. The three towns are represented by nine representatives in the New Hampshire House, two State Senators, two United States Senators and one United States House Representative. The three towns are each governed by a Board of Selectmen. Most of the protections for water quality particularly in terms of land use for the Winnicut River fall under local municipal regulations. These regulations are a result of a drafting process by the Planning Board that represents the town's overall Master Plan, its current voted upon zoning ordinance and its current building code. The zoning ordinances are developed by the Planning Board, reviewed and edited by both the Conservation Commission and Board of Selectmen and voted upon by the town at Town Meeting and enforced by the Code Enforcement Officer. Once the zoning ordinance is put in place any permits from a developer or homeowner that goes against the ordinance will come before the Zoning Board of Adjustment which will be asked to grant a variance based on hardship or no alternative solution to the issue at hand. The duties of the Planning Board are identified as:

- Prepare and update the Town master plan;

- Prepare recommendations for programs for municipal development, programs for the erection of public structures, and programs for municipal improvements;
- Prepare and draft recommendations for amendments to the zoning ordinance and zoning map;
- Prepare and update the capital improvements program; and
- Prepare and administer land development regulations such as subdivision regulations and site plan review regulations (Town of Stratham 2011).

At the federal level the Winnicut River is protected by the Clean Water Act (CWA) as it is considered to be a surface water of the United States as is defined in the CWA. The water quality standards set forth in the CWA are regulated and enforced by the EPA. However, states, territories, and designated tribes can, using their own authorities, adopt standards for additional surface waters. (USEPA 2011). New Hampshire is unique as it is one of only 6 states that still have permitting decisions rest with the US EPA, the state has not been delegated permitting power. Federal Clean Water Act Section 404 Permit and Section 401 Water Quality Certification in New Hampshire requires a General Permit through the U.S. Army Corps of Engineers for activities involving dredge or fill in waters of the State and work affecting navigable waters. This excludes certain activities and is generally limited to minor or controversial activities. Projects which require a Section 404 permit from the Corps must also obtain a Section 401 Water Quality Certificate from NHDES Water Supply and Pollution Control Division (CRJC 2011). New Hampshire was required by the CWA to establish water quality standards to “protect the public health and welfare, enhance the quality of the water, and serve the purposes of the Clean Water Act.” (NHDES 2011(a)). It was these water quality standards that designated various uses to the waterbodies of New Hampshire and then in turn determines the level of water quality to be achieved in order to meet the goals of the CWA. The Winnicut River’s designated uses are: aquatic life, fish consumption, primary contact recreation, secondary contact recreation and shellfishing – all of

these uses are impaired in all reaches of the river system resulting in a Category 5 Surface Waterbody and a 303(d) listed waterbody in the September, 2008 Surface Water Quality Status by the US EPA see Figure 5-1.

Another federal jurisdictional regulation concerns the communities of Greenland and North Hampton which are Small Municipal Separate Storm Sewer System (MS4) general permit regulated towns. The MS4 program is part of the US EPA's National Pollution Discharge Elimination System (NPDES) Program. Small MS4's is a publicly owned conveyance or system of conveyances from ditches, curbs or underground pipes that divert stormwater into the surface waters of the state (NHDES 2011). MS4's most commonly occur in urbanized areas but the EPA can make the determination that small MS4s operators located outside urbanized area be required to obtain a MS4 General Permit if there exists or there is a potential for significant water quality impairment (NHDES 2011). U.S. towns and cities fall under one of two permit categories in this program: Large MS4 Individual Permit (municipalities with populations over 100,000) and Small MS4 General Permit (municipalities under 100,000). The Towns of Greenland and North Hampton are enrolled in the Small MS4 General Permit program. Under this permit the towns strive to fulfill the suggested Best Management Practices (BMP) for six required minimum control measures. These six measures include: Public Education and Outreach; Public Participation and Involvement; Illicit Discharge Detection and Elimination; Construction Site Runoff Control; Post Construction Runoff Control; and, Pollution Prevention/Good Housekeeping (Walker, 2009).

Since the river is a third order stream it is not protected under the state of New Hampshire's Comprehensive Shoreland Protection Act. The wetland complexes that make up a large portion of the watershed are under the protection of New Hampshire RSA 482-A which is enforced by New Hampshire Department of Environmental Services Wetland Bureau. The law stipulates a

difference between “major” projects and “minor” projects in terms of a wetland fill or dredge permit. Other major components of RSA 482-A include:

- “Major” projects in sand dunes, tidal wetlands, or bogs, within 100 feet of the highest observable tide line, >20,000 sq. ft., > 20 cu.yds. from waterways, 200 linear feet of shoreline/stream – mitigation required.
- Minor and minimum impact projects require permit but often no mitigation
- Mitigation may be creation, restoration, in lieu fee, preservation of uplands
- 100 foot wetland buffers required on designated prime wetland (State of New Hampshire 2011(a)).

The Winnicut River also falls under NHDES Rule Env-Wq 1000 which is enforced by NHDES Subsurface Systems Bureau that states a minimum septic setback from waterways as 75 feet (NHDES 2008). New Hampshire is only one of a very few states that does not have permitting authority from the USEPA. All of the wetland dredge and fill permits still go through the USEPA's permitting authority which causes a extrication from local impacts or a sustained understanding of cumulative effects because the decisions are often made without any site visits or local research.

Municipal Level Regulations:

When looking at the level of protection for the river in the three watershed towns one can see vast differences. Tables 5-7 – 5-18 show the results from the Piscataqua Region Environmental Planning Assessment (PREPA) for the three watershed towns. PREPA was conducted in 2009, published in 2010 by the Piscataqua Region Estuaries Partnership (PREP). Its purpose was to identify the environmental planning and regulations in all 52 towns in New Hampshire and Maine that comprise the Great Bay and Hampton-Seabrook estuaries (Sowers 2010). The PREPA was intended to help target assistance to municipalities in making improvements over the next ten years, identify gaps and inconsistencies in protections, and inform regional planning efforts (Sowers 2010). The PREPA

contained data from regional planning commission staff that had assessed each town's municipal planning documents as well as conducted interviews with municipal representatives. PREPA had 80 questions associated with municipal regulatory and non-regulatory approaches to resource management and included the best known benchmarks and recommendations for actions to improve natural resource protection (Sowers 2010). The questions were broken into theme areas including: land protection, wildlife habitat, stormwater management, erosion/sediment control, wetland and shoreland protections, floodplain management and drinking water source protection.

Table 5-7. Wetland Conservation Assessment for three Winnicut River Watershed Towns based on PREPA.

Municipality	Wetlands Protection Ordinance?	Indirect Wetland Impact Considered?	Designated Prime Wetlands?	Vernal Pools Protected?	Wetland Inventory Done in past 15 yrs.
Greenland	YES	NO	NO	NO	YES
North Hampton	YES	YES	NO	NO	YES
Stratham	YES	NO	NO	YES	YES

Source: (Sowers 2010)

Table 5-8. Impervious Surface Limits (%) in Zoning Districts of 3 Winnicut River Watershed Towns with callouts to the 2 areas with substantial allowable impervious.

Municipality	Aquifer Protection Area	Rural Zone	Residential Zone	Urban	Commercial	Agricultural
Greenland	20	ND	ND	ND	ND	ND
North Hampton	20	ND	ND	ND	ND	ND
Stratham	20	ND	20	60	40	20

Source: (Sowers 2010)

ND = Not Determined.

Table 5-9. Stormwater Management Standards from the three towns of the Winnicut River Watershed.

Municipality	Low Impact Development (LID) Required?	Mimic Pre-development Site Hydrology?	Maximize On-Site Infiltration?	Require Bond From Developers?	Stormwater Utility Fee?
Greenland	NO	YES	NO	NO	NO
North Hampton	NO	NO	NO	NO	NO
Stratham	NO	NO	YES	YES	NO

Source: (Sowers 2010)

Buffers and Setbacks for Wetlands and Different Size Water Bodies:

Riparian buffer zones adjacent to wetlands, rivers, streams and shorelands are the simplest and surest way to protect water quality in the water body. Leaving an area of undisturbed native vegetation acts as a filter for pollutants, provides wildlife habitat and helps keep the stream or river cool by providing shade.

Preserving and restoring these riparian buffers is essential to surface water quality protection (NHDES, 2008). The regulatory structure as well as the best management practices surrounding buffers can be quite complicated as certain buffer widths provide different services for the waterway. Figure 5-2 shows the variable widths of buffers and their corresponding ecosystem services.

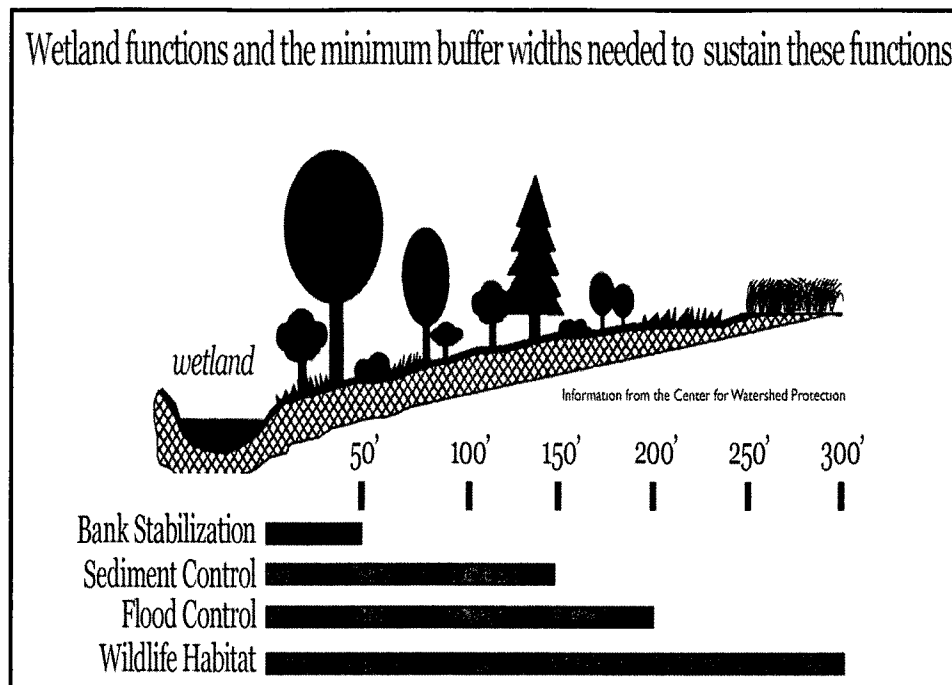


Figure 5-2. Buffer widths in relation to ecosystem services provided.
(Adapted from the Center for Watershed Protection, 2003)

The three towns of the Winnicut River Watershed vary greatly in their regulatory structure in regards to riparian buffers (Sowers 2010). A 2008 study of the Winnicut River performed by Lenny Lord and Bill Arcieri from Vanasse, Hangen and Brustlin, Inc. for the North Hampton Conservation Commission notes that the Winnicut River system contains many large wetland complexes which provide significant capacity for flood storage/attenuation, water quality renovation and wildlife habitat. The headwaters of the Winnicut River occur in Line Swamp in the southwest corner of North Hampton, much of the land in North Hampton west of Interstate 95 is a large wetland complex associated with the Winnicut River (Lord and Arcieri, 2008). Only the upper portion of the Winnicut River watershed is located in North Hampton so the community of Greenland in the lower portion of the watershed to the north stands to be significantly impacted by North Hampton's buffer regulations and any proposed development adjacent to buffers. The high flood attenuation of the currently intact wetland complexes could be undermined if

North Hampton's regulations allow development patterns to infringe on the buffers and thus could pose large flooding risks for the downstream community of Greenland. The fiscal and public safety repercussions resulting from flooding events are of utmost concern to a community, which is why Greenland's officials would be wise to concern themselves with North Hampton's buffer protections.

The Winnicut River is one of five tributaries flowing directly into Great Bay. The 2009 *State of the Estuaries* report cited 65% of the total nitrogen loads to the Great Bay estuary as coming from tributaries and runoff (PREP 2009). The tidal portion of the Winnicut River is contained in Greenland and therefore Greenland's regulations should reflect differences in regards to freshwater and tidally influenced surface waters. Greenland's buffer regulations and development patterns can directly impact what flows into Great Bay then subsequently into the Piscataqua River and out to the Gulf of Maine. The larger the buffer the better the protections. There are two different types of riparian buffers and the distinction rests in the actions allowed in the buffer zone – no vegetation disturbance and managed vegetation. No vegetation disturbance buffer is an area where only minimal disturbance to natural soil and vegetation is allowable. Removal of hazard trees and maintenance of small footpaths is allowed, but otherwise the area is left in a natural vegetated condition (Sowers 2010). "Managed buffer" is an area generally intended to support a well distributed functional cover of trees, shrubs and groundcover, but tree thinning, landscaping and some accessory structures (decks, gazebos, etc.) may be allowed. Setbacks are another term used to imply a protected area between a building structure and a waterbody. Again there is variability in how big a setback should be but it has been researched that portions of nitrogen are more consistently removed with wider buffers (> 50 m) than with narrow buffers (0-25 m) (Mayer et al.

2007) So a regulatory measure regarding a fertilizer application setback of at least 100' from wetlands and waterbodies can be scientifically proven (Sowers 2010)

Tables 5-10 – 5-18 lay out the Winnicut River Watershed towns' regulatory mechanisms in regards to buffers and setbacks for different types and sizes of waterbodies as reported in the 2010 Piscataqua Region Environmental Assessment (Sowers 2010)

Table 5-10. No Soil or vegetative disturbance buffer widths for wetlands in the three Winnicut River Watershed Towns

Municipality	Buffer Width (feet)
Greenland	25
North Hampton	NS
Stratham	25

Source (Sowers 2010)

NS = Not Specified, Suggested Protective Standard = 100 feet

Table 5-11. Septic, Primary Building and Fertilizer application setbacks from wetlands in the three Winnicut River Watershed towns

Municipality	Septic (feet)	Building (feet)	Fertilizer (feet)
Greenland	50	50	NS
North Hampton	75	100	NS
Stratham	50	50	NS

Source (Sowers 2010)

NS = Not Specified Suggested Protective Standard = 100 feet

Table 5-12. No vegetative disturbance buffer widths for tidal wetlands in the three Winnicut River Watershed towns

Municipality	Buffer Width (feet)
Greenland	25
North Hampton	NS
Stratham	75

Source (Sowers 2010)

NS = Not Specified, Suggested protective Standard = 100 feet

Table 5-13. No disturbance buffer widths for third order (Winnicut River) and fourth order and higher streams (Tributaries) in the three Winnicut River Watershed towns.

Municipality	Buffer Width (feet) for 3rd Order Steams – Winnicut River	Buffer Width (feet) for 4th Order Streams and Higher - Tributaries
Greenland	25	25
North Hampton	NS	NS
Stratham	50	50

Source: (Sowers 2010)

NS = Not Specified; Suggested minimum if used with combination of managed buffer area = 25 feet.

Table 5-14. Managed buffer widths for third order (Winnicut River) and fourth order and higher (Tributaries) in the three Winnicut River Watershed towns.

Municipality	Buffer Width (feet) for 3rd Order Steams – Winnicut River	Buffer Width (feet) for 4th Order Streams and Higher - Tributaries
Greenland	50	50
North Hampton	NS	NS
Stratham	100	100

Source: (Sowers 2010)

NS = Not Specified; Minimum for second order streams and higher = 100 feet.

Table 5-15. Buffer/Setback for 3rd order stream (Winnicut River) and 4th order stream (Tributaries) for Greenland and North Hampton, NH.

Municipality	Buffer/Setback Width (feet)
Greenland	75
North Hampton	100 for 4 th order and higher only

Source: (Sowers 2010)

Suggested Width = 100 feet.

Table 5-16. Septic System setback distance from 3rd order and 4th order or higher streams in the three Winnicut River Watershed towns.

Municipality	3rd order stream setback (feet)	4th order and higher stream setback (feet)
Greenland	50	50
North Hampton	NS	NS
Stratham	NS	NS

Source: (Sowers 2010)

NS = Not Specified; Suggested distance = 100 feet.

Table 5-17. Primary Structure setback distances for 3rd order and 4th order and higher streams in the three Winnicut River watershed towns

Municipality	3rd order stream setback (feet)	4th order and higher stream setback (feet)
Greenland	50	50
North Hampton	NS	NS
Stratham	NS	NS

Source (Sowers 2010)

NS = Not Specified, Suggested distance = 100 feet

Table 5-18. Fertilizer application setback distances for 3rd order and 4th order and higher streams in the three Winnicut River watershed towns

Municipality	3rd order stream setback (feet)	4th order and higher stream setback (feet)
Greenland	NS	NS
North Hampton	NS	NS
Stratham	NS	NS

Source (Sowers 2010)

NS = Not Specified, Suggested distance = 100 feet

It is clear that the regulations in place to protect the Winnicut River vary from town to town which complicates any watershed-wide effort as the watershed crosses political boundaries. The Winnicut River being a 4th order stream also leaves it up to greater vulnerability as most towns' regulations do not apply or are much less stringent the smaller the river. Of greatest concern to water quality in the Winnicut is the small or unspecified "no soil or vegetative disturbance buffer zone regulations" in the three towns (Tables 5-10, 5-12, 5-13). Greenland has it set at 25 feet, Stratham at 50 and North Hampton does not specify, meaning they do not have one. This could pose a great risk to the quality of the surface water in the Winnicut River because the recommended standard is 100 feet and could be even greater for the smaller stream reaches such as the Winnicut. A thick, vegetated riparian buffer acts as a filter for pollutants, fertilizers and sediments and can provide great protection to the river from non-point source pollutants, including stormwater runoff.

Additionally, the small or non-existent setback for septic systems or structures in the three towns is of concern (Table 5-16, 5-17). If a home with a

septic system is permitted to build within 50 feet of the Winnicut River there could be grave implications to water quality resulting from the day-to-day homeowner actions and the septic system's leach field. Approximately a quarter of the town of Greenland is on the Portsmouth public sewer system but the rest of the watershed residents are on private on-site septic systems.

Lawn fertilizers are also a great concern in residential neighborhoods such as those in Greenland, Stratham and North Hampton as they contain nitrogen that has been identified as the primary limiting nutrient to algae growth thus an influx on nitrogen in saltwater systems causes algal blooms and could lead to eutrophication and fish kills in Great Bay. Leaching septic systems do not have the ability to remove nitrogen and therefore it enters the groundwater and will eventually enter the drinking water sources or come into the surface water and again flow into Great Bay.

It is important to note the complete lack of specificity in North Hampton's regulations. North Hampton provides the headwaters for the Winnicut River and contains the large wetland complex, Line Swamp that combines to form the start of the flowing river. North Hampton's protections for the headwaters are of utmost importance for the Winnicut River's overall health because if development and pollution are permitted upstream in the headwaters the potential of pollution downstream is intensified. North Hampton's municipal officials have shown an interest in providing better protections to the Winnicut River. In 2008, the North Hampton Conservation Commission hired VHB, Consultants to conduct a Review of the Scientific Literature Regarding the Importance of Wetland Buffer Analysis and to assess the wetland and surface water resources in North Hampton in regards to buffers (Lord and Arcieri 2008).

Of even higher importance is the fact that a majority of Greenland, Stratham and North Hampton residents receive their drinking water from wells along the Winnicut River and within its watershed. Greenland's largest aquifer is located in the Town's center, south of Route 33. The other three aquifers within town are smaller stratified drift aquifers. The first of these is located in the southwest corner of Town in the vicinity of Barton Hill and the Winnicut River. The second is between Norton Brook and Barton Brook along the Town's southern border. The third aquifer is located in the southeast corner, at the base of Breakfast Hill (Walker, 2009). Greenland residents get their drinking water almost entirely from groundwater sources. Approximately half of the Town's residents have individual dug or drilled wells and the remainder is on a public or private water company well system (Walker 2009). In 1899 by court decision the City of Portsmouth was given rights to extend into neighboring communities to acquire water. The city drilled a well into to the largest of Greenland's aquifers and provides water to city residents as well some Greenland residents along Post Road (Walker, 2009). Aquarion Water Company in North Hampton provides drinking water for 9,000 homes or 25,000 residents in North Hampton, Hampton and Rye from wells that are in the Winnicut River Watershed (Aquarion Water Company 2011). Aquarion has permitted withdrawal rights for 17 wells in North Hampton, Hampton, Stratham and Rye so it is of utmost importance that both Greenland and North Hampton ensure the protection of the land above and surrounding these wells.

Organizational structure of Municipal Governments:

The three towns of the Winnicut River Watershed operate based upon Master Plans. A master plan is a planning document that serves to guide the overall character, physical form, growth and development of a community. It should contain

the how, why, where and when to build or rebuild a town (SNHPC 2004). Master Plans are required under New Hampshire RSA 674:1 which states that a municipal planning board has the duty “to prepare and amend from time to time a master plan to guide the development of the municipality” (SNHPC 2004). RSA 674:2 describes the Master Plan Purpose:

To set down as clearly and practically as possible the best and most appropriate future development of the area under the jurisdiction of the planning board, to aid the board in designing ordinances that result in preserving and enhancing the unique quality of life and culture of New Hampshire, and to guide the board in the performance of its other duties in a manner that achieves the principles of smart growth, sound planning and wise resource protection
(State of NH, 2011).

The adoption of a master plan is a prerequisite in order for a municipality to establish a zoning map. According to RSA 674:2 a Master Plan includes 12 sections, two of which were added in May 2002. The sections are:

1. General Statement of objectives and principles
2. Land use
3. Housing
4. Transportation
5. Utility and Public service
6. Community facilities
7. Recreation
8. Conservation and Preservation
9. Construction materials
10. Vision
11. Land Use – to include references to Smart Growth
12. Community can add up to 13 other sections as specified in legislation
13. Appendices/Maps/Reports

For the purpose of this study the focus will be on the Town of Greenland's Master Plan. This decision was made because this town represents 60% of the watershed and it has the most high-risk land uses adjacent to the river of any of the three towns and the development pressures present in the town of Greenland pose the greatest threats to the quality of the Winnicut River. It was important to look at the foundational document for the town of Greenland to

better understand how the development came to be built without consideration given to the river's protection.

The Town of Greenland's first Master Plan was adopted in 1970, Updated in 1986, 1988, 1999 and 2007. The 2007 update involved a community-wide visioning process developed by the University of New Hampshire's Cooperative Extension Program which helped to establish a "Community Profile" in winter of 2006. A Community Master Plan survey was developed and distributed in spring 2006 and results were evaluated and included in the master plan update. The survey in combination with the community profiles was what helped develop the Visions chapter of the 2007 Greenland Master Plan. In regards to Natural Resources there were quite a few things mentioned by community members that have a direct impact on the Winnicut River and its watershed.

Table 5-19. Community Profiles resulting from town visioning session, Town of Greenland, NH 2006.

Future Land Use Visions:	Future Community Facilities Vision:	Future Natural Resource Visions:	
Support recreational bike and walking trails	Develop town landing at Tide Mill Road (on the Winnicut River)	Allow access and preservation of natural resources by promoting recreation trails, boat ramp and conserving land and wildlife	Protect ground and surface waters in town
Preserve & Protect open space	Water and sewage needs have to be planned for as town grows	Protect the water	Protect wildlife habitats in town
Promote access and preservation of natural resources (Great Bay)	New recreation trails and sidewalks	Keep the green in Greenland by developing a master plan that emphasizes natural environment protection	Monitor the need to institute greater wetland buffers between development and wetlands
More public access to the bay		Preservation and use of Great Bay and the Winnicut River	
		Protect wetlands	

Chapter 7.0: Sustainability of the Greenland 2007 Master Plan focuses quite intensely on water quality and environmental protections in town which lays the groundwork for greater protections on the Winnicut River. The chapter stipulates nine priorities to achieving sustainability in town:

1. Preserve environmentally sensitive areas and link them together with other undeveloped open space into a network of beneficial corridors and large land areas for a diverse mix of wildlife and plant to flourish.
 2. Encourage in-fill development in appropriate built areas.
 3. Promote best forest management practices.
 4. Utilize best management practices to minimize construction impact around prime and important agricultural soils.
 5. Implement water quality monitoring programs, develop plans to protect those resources, and protect water quantity.
 6. Encourage diversity in housing opportunity and promote the logical placement of new housing developments throughout town.
 7. Use low impact development strategies in retrofitting existing developments and in designing new developments.
 8. Design new facilities and retrofit existing facilities to provide for efficient energy use and better air quality.
 9. In order to prevent depletion of resources, match the intensity of development with the carrying capacity of natural resources.
- (Town of Greenland 2008).

Chapter 2.0 “Existing Land Use” addresses development constraints in town and specifically lays out protections for impacts from development for wetlands, buffers on wetland and river corridors which should lead to stricter land use regulations in town in regards to the Winnicut River. The operative word being “should” because Master Plans are not legally enforceable documents but are more a planning document that is relied upon to help *guide* future regulation drafting and enforcement. The zoning code must incorporate specific provisions for legal enforceability to become a reality. Towns lay out the desired optimal amount of protections, but the details and on the ground actions to implement such protections are stipulated in the zoning ordinance, subdivision regulations and site plan review regulations. All of those regulations are subjective to the Zoning Board of Adjustment which can decide to grant waivers for any

regulations they deem fit. The Planning Board in Greenland is made up of 7 members who are elected at March's town meeting for three year terms. The Board meets the first Thursday of each month for a workshop meeting which most often focuses on drafting ordinance and zoning language, crafting warrant article language and administrative tasks. The board meets the third Thursday every month for a regular meeting at which time they will hear public permitting issues, discuss permitting decisions, review site plans, schedule site visits and open the discussion for public comments. Both workshop and regular meetings are open to the public unless previously announced otherwise. A circuit planner from the Rockingham Planning Commission is also an active participant at Planning Board meetings. The circuit rider is in place because Greenland does not have a full-time town staff planner. The circuit rider assists in providing model ordinance language, GIS map creation and explanation and lends technical expertise to the board. The Town of Greenland pays the Rockingham Planning Commission a fee for these services.

Conservation Commissions in the state of New Hampshire do not hold any decision making power, they are an advisory board to the Planning Board and Board of Selectmen. NH RSA 36-A defines the purpose of a conservation commission is to ensure: "the proper utilization and protection of the natural resources and for the protection of watershed resources of said city or town" (State of New Hampshire 2011(b)). They are to acquire and keep an inventory of the town's natural resources. They may also serve as the steward of conservation commissions held by the town. The Town of Greenland's Conservation Commission has completed work on a Natural Resource Inventory in November 2009 with help from the Rockingham Planning Commission. The

NRI is still yet to be published as it is awaiting further GIS mapping work from the Rockingham Planning Commission.

In 2003, Danna Truslow from the Seacoast Land Trust in cooperation with David McGraw from the Society for the Protection of New Hampshire's Forests secured a grant from the New Hampshire Estuaries Project to develop a GIS mapping and analysis of natural resource characteristics and land parcel conservation analysis within the town of Greenland. Outreach regarding the findings was conducted to town decision makers, citizens and landowners.

There were 7 primary purposes of the study:

1. To assist SLT and Town of Greenland in understanding the natural resources of the town.
2. To involve representatives of several Town of Greenland boards in the Seacoast Land Trust activities and the Land Prioritization Process. It was hoped that included *local representatives would allow for mapping customization based on local concerns.*
3. To develop a set of maps that illustrated the natural resources of the town and that illustrated the "co-occurrence" or overlap of these resource features.
4. Using the co-occurrence results, to rank the land parcels to provide the Town of Greenland and Seacoast Land Trust with a blueprint for land conservation in the area.
5. To develop intriguing visual aids to illustrate threats to natural resources of Greenland and to the potential for protection of remaining resources. In addition, the maps will help to illustrate the efforts and purpose of the Seacoast Land Trust and to educate landowners and residents about their land's resources.
6. To reach out to the landowners and acquaint or remind them of available voluntary land conservation options.
7. To place sensitive open lands in these areas in permanent conservation (Truslow and McGraw 2003).

Table 5-20. Language from Chapter 2.0 of Town of Greenland 2007 Master Plan that affects the Winnicut River and its watershed.

Wetlands	Buffer areas around wetlands	Buffers along river corridors
<p>The importance of preserving and protecting wetlands is well established in other sections of this plan. They are generally recognized to contribute vital natural resource and ecological functions, as well as their aesthetic value for open space and passive recreation. Future land uses should be directed away from wetland areas to the greatest extent possible. It is equally important to prevent building in such areas because of the potential negative impact on water quality, public health, and protection from flood hazards. The Town's existing Wetlands Conservation Ordinance will continue to regulate future development with regard to wetlands.</p>	<p>A wetlands ordinance that prohibits development in wetlands does not necessarily protect wetlands from harmful uses occurring immediately adjacent to them. For those uses permitted within close proximity to wetlands, adequate buffers are necessary in order to insure the protection of the wetland. The Town's Zoning Ordinance establishes a 75' buffer around tidal influenced lands, and 50' around inland or isolated non-bordering wetlands. There is a procedure for obtaining a Special Exception from the Zoning Board of Adjustment for the erection or expansion of a structure within a wetland area. There is also a procedure for the planning board to grant a conditional use permit to fill a certain square feet of surface area of wetlands for the construction of roads, access ways, pipelines power lines, and other transmission lines within the district. Natural vegetation should be protected or restored in all buffer areas as much as possible.</p>	<p>The Establishment of buffers along rivers and streams is important for many of the same reasons as wetlands. Protecting river shorelines helps preserve wetlands, reduces flooding damage, serves to maintain important wildlife travel corridors and preserve scenic beauty of any river. The Town follows the State of New Hampshire Shoreland Protection Act in regards to regulating building activities along shorelands throughout the Town. However, by developing a Town wide Shoreland Protection District or Conservation Overlay District along tidal influenced rivers, Great Bay, and inland water ways should be considered and is mentioned in greater detail in this plan as a way to limit pollutant discharge into these water ways and Great bay.</p>

Source: (Town of Greenland 2008: LU-1-LU-3).

It is clear that there is no lack of regulatory framework and background to support protection of the Winnicut River Watershed and Great Bay as a region and there is a great amount of interest and engaged organizations in the wider Great Bay region that are concerned with water quality issues and watershed protection. The question is – is there capacity in the towns of Greenland, North Hampton and Stratham to collaborate and address the water quality issues in their own river? It seems that the information compiled, assessed and contained in this study might prove to provide the tools needed for that collaboration to work.

Historically, there has not been a singularly focused document on the Winnicut River Watershed that contains all pertinent regulations, stakeholders, water quality data, jurisdictions or social context. The three towns operated mutually exclusive from one another making decisions that did not take account of their upstream or downstream implications. However, through the process of this study as well as the framing of the problem through a Winnicut Watershed lens, an effective resource for collaboration now exists. The formation of a collaborative Winnicut River Watershed Coalition based upon the social process and regulatory mapping conducted in this study has the capacity to provide never before synthesized information focused entirely on the Winnicut River Watershed. The main regulatory problems have arisen from town-by-town regulations that do not take a watershed-wide approach to managing the Winnicut River. The social context challenges have existed because there has not been an organization or entity focused upon the Winnicut River Watershed, groups have a Great Bay centered ethic that includes the Winnicut but no group of engaged citizens from the 3 towns of the Winnicut River has existed before this study commenced.

New Hampshire has a long-standing tradition of fierce localism and native pride. The structure of town government, town meetings and local chapters of

regional organizations has always been a way of life in New Hampshire – it is the “New Hampshire Way”. Regional tactics that do not connect to on the ground local resources or people are often not as popular as the more grassroots, locally centered efforts. The WRWC must aim to be locally grown and locally centered with local leadership and a priority focus on the local river and local watershed that connect the three towns while at the same time always consider the bigger picture, the collective impacts of people’s activities in all the watersheds of the Great Bay region and ultimately of the Gulf of Maine because tidal water flows both ways. The WRWC must aim to promote the river and its history and uses in order to build a pride from the residents of the three towns and ignite that fierce local loyalty. This type of collaboration has seen great success in New Hampshire historically. There are seven existing local river watershed groups in the Great Bay watershed as of 2010 so the model works.

The challenge for the WRWC will be to engage the citizens and leaders of North Hampton and Stratham as much as those engaged in Greenland. With 60% of the watershed occurring in Greenland and the main stem and tidal portions, as well as the pre-dam removal impoundment fishing spot and then with dam removal all occurring in town there is a heightened awareness from the Greenland community about the river and its state. Additionally, Greenland is a smaller community in land area and population than North Hampton or Stratham. In Greenland, the Winnicut is the only primary surface fresh water resource in town, beyond some brooks, bogs and small tributaries to Great Bay and a man-made pond. North Hampton has two primary surface rivers – the Winnicut and the Little River. Stratham has the Winnicut and the Squamscott/Exeter River. The Winnicut only winds through the far eastern border of Stratham and the drainage area is a very small percentage of the entire town’s land area so many residents of Stratham are not in the watershed and

therefore are not going to be prone to be involved with the WRWC. North Hampton being the headwaters and deriving its drinking water from the watershed provides a greater opportunity for collaboration and a heightened concern for the watershed's health. Furthermore, whatever North Hampton permits in its headwaters will affect the communities downstream in regards to flooding risk and pollution so it is in the best interests of both Stratham and Greenland to work together with North Hampton.

There will need to be a greater investment in determining what sort of information and political will is needed in North Hampton to develop specific regulations in regards to buffers, setbacks and development. Without specified regulations North Hampton stands at risk of being preyed upon by opportunistic developers. Would a greater presence from the constituency at Planning Board warrant article drafting sessions be effective? Does the change need to occur within the Master Plan or Planning Board itself? Would technical expertise from the expert/technical stakeholders in drafting ordinance language prove to be effective? How could the WRWC serve as the intermediary to facilitate that technical transfer? These are all key questions that are vital to the sustainability and future success of the WRWC.

CHAPTER 6

CURRENT INITIATIVES, FUTURE STEPS, RECOMMENDATIONS & LESSONS LEARNED

Current Initiatives

At the end of 2010 the Winnicut River Watershed Coalition (WRWC) had engaged 20 volunteers, had a dedicated Director and had just received a sizable grant from New Hampshire Department of Environmental Services Coastal Program's Competitive Coastal Grant Program to design and implement a water quality testing program under the Volunteer River Assessment Program (VRAP) for the Winnicut River. The water quality testing program will begin in Spring 2011 with a minimum of six monitoring stations set up throughout the Winnicut River watershed and will include water quality parameters such as dissolved oxygen, pH, turbidity and nutrient testing for Nitrogen, E-Coli and fecal coliform (Winnicut River Watershed Coalition 2011). According to the New Hampshire Department of Environmental Services' Coastal Scientist there are data gaps in the water quality record throughout the Winnicut River and a lack of good baseline data (Murphy and Lucey 2010). WRWC Director, Jean Eno, has been involved with a North Hampton 7th grade science class project and has recruited 6 students from the class to assist with the VRAP for the Winnicut (Eno 2011). In addition, Eno has developed a biological monitoring project that will be implemented in spring 2011 as well. The biological monitoring program will coincide with an upcoming project led by the Great Bay National Estuarine Research Reserve and New Hampshire

Fish and Game to develop and monitor invasive species dashboard indicators to allow for better control of invasive species (Eno 2011, Jan. 24, 2011).

The Winnicut River Watershed Coalition's affiliation with the New Hampshire Rivers Council has afforded the Coalition the ability to be at the forefront of legislative debates at the state level surrounding shoreland and river protection. In early 2011 there were three bills introduced to the New Hampshire Senate floor (State Bills 19, 20, 21) that focus on eroding or completely doing away with the Comprehensive Shoreland Protection Act (RSA 483-B). Although the CSPA does not apply to the Winnicut River as it is a third order stream, it does affect the health of the river as it is a tidally influenced river and if the shoreland surrounding Great Bay and its larger tributary rivers lose protections the Winnicut River stands to be at greater risk. The WRWC Director accompanied members of the New Hampshire Rivers Council to testify against these bills in Concord. In addition, the director testified in support of two bills that are focused upon nominating the Oyster and Lamprey Rivers into the NH Rivers Management and Protection Program. This nomination would then trigger far greater protections for those rivers and dedicated local advisory committees that would then be able to have a voice on any proposed actions that could affect the river or its buffer corridor. It is a future goal of the WRWC to also seek nomination for the Winnicut River into the Rivers Management and Protection Program.

The director represents the WRWC at various watershed management trainings and workshops such as the New Hampshire Department of Environmental Services' Watershed Managers Roundtable ([Table 6-1](#)) that occurred on October 7, 2010 (Eno 2011, Jan. 24, 2011). The Winnicut watershed had never before been represented in these types of roundtable discussions and therefore many of the needs and issues facing the three watershed towns were not being heard. Attendees included approximately 50 past, current, and future 319 Watershed Assistance and Restoration

grantees, private consultants, and representatives from several EPA Programs and the DES Watershed Management Bureau. During the workshop participants were provided with updates on communication management strategies that were developed following the 2009 roundtable including a new online blog hosted by DES to keep managers connected. Attendees took part in a 1 ½ hour long roundtable discussion of project successes and trials and tribulations in their watershed. Additionally, the event involved a bus tour to visit the Hodgson Brook Restoration Project, Portsmouth, Cain's Pond Restoration Project, Seabrook, and the Cocheco River project at School Street School in Rochester (NHDES 2011). Table 6-1 is an excerpt of notes from the 2010 New Hampshire Watershed Managers' Roundtable (2nd Edition) hosted by NHDES.

Table 6-1. Excerpt from Notes from the October 7, 2010 Watershed Managers Roundtable.

2010 NH Watershed Managers' Roundtable October 7, 2010 Summary of the Roundtable Discussion	
Summary Overview During the Roundtable, participants discussed challenges they face in developing and implementing watershed management and restoration projects. The discussion covered tools and suggestions for ways to build capacity for watershed projects. Roundtable participants identified four key areas of interest during the discussion:	
<ul style="list-style-type: none"> • Enabling Best Management Practice (BMP) implementation at the local level • Establishing partnerships with NH DOT and local DPWs • Streamlining the local & state regulatory process to enable restoration and BMP implementation • Winter road maintenance practices 	
For each key area of interest, participants discussed barriers, benefits, and recommendations for follow-up action. A summary of the participants' discussion for each topic follows.	
Enabling BMP Implementation at the Local Level Barriers: <ul style="list-style-type: none"> • Finding contractors to install Low Impact Development (LID) BMPs can be a challenge • For some development projects, communities will hold LID to a higher standard than traditional stormwater management practices • Sometimes engineers don't want to stamp LID BMP plans because they are afraid of liability for "new" practices • In some communities, there is a negative perception that LID stormwater management practices are "new and untested" 	

Recommendations:

- Develop a certification program for LID installers & designers (look at Maine's program as an example)
- Create LID incentives – pay people to put in LID BMPs
- How about setting up local LID BMP “funds” at the local level—similar to the nuisance aquatic species funds that towns set up to fight infestations on lakes
- Be specific when identifying problems; avoid abstractions—make the problems “real” so that people will understand the issue
- Let's find ways to persuade people to do “simple” stormwater fixes (the Youth Conservation Corps is a model); often, smaller projects do not need permits
- Provide quick access to funding to fix BMPs if they fail or don't function properly after installation

Source: (NHDES 2011(c)).

As stormwater has been identified as a primary problem in the Great Bay coastal watershed many different agencies and organizations are conducting workshops, trainings and events focused upon different aspects of mitigating stormwater pollution. The WRWC director has represented the coalition at many of these related events including: the University of New Hampshire Stormwater Center's Rain Garden Training and BMP technology demonstration workshops and the Great Bay National Estuarine Research Reserve's Coastal Training Program Workshops (Eno 2011, Jan. 24, 2011). The director also had a table with information and volunteer recruitment materials at the 2011 New Hampshire Water and Watershed Conference at Plymouth State University, March 26-27, 2011. The winter and spring of 2011 goal for the WRWC was to raise awareness of its existence, to educate about its purpose and to recruit volunteers for the coalition's upcoming VRAP efforts.

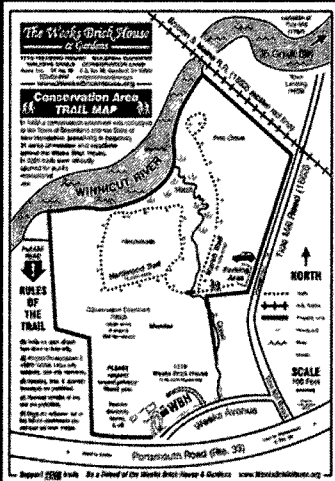
The Director has been updating the volunteers and members of the coalition on the activities she is participating in via the Winnicut River Watershed Coalition Blog. The blog has served as an active and engaging place for those citizens interested in the WRWC and the Winnicut River to log onto and engage with what is going on, learn the issues, find opportunities to participate and learn about the natural areas. [Figure 6-1](#) is a screenshot from an April 5, 2011 blog entry that provides information and maps for all

the public access walking trails in the watershed in Greenland, North Hampton and Stratham so that citizens have information to get and out explore and enjoy the river and watershed in the nicer spring weather (Winnicut River Watershed Coalition 2011).

Tuesday, April 5, 2011

Trail Walking Within the Winnicut River Watershed

NOW'S the time to get out and see spring coming to life at the Weeks Brick House conservation trails. Turkeys are strutting, fox are hunting small prey to feed their kits, the earliest of migratory birds are appearing...and if you look hard, you may even see trout lilies emerging up from the earth underneath the hardwoods!



Click here to view the Weeks Brick House trail map online

IN Stratham , there are wonderful trails at the Stratham Hill Park area to take the family, including the family dog (please remember those doggie waste baggies!). On clear,

Why the Coalition?

The nine mile Winnicut River and forty-five miles of streams that feed it run through the communities of North Hampton, Stratham and Greenland, NH. This beautiful natural resource empties directly into Great Bay. But all is not perfect in the river or its tributaries; an increase in impervious surfaces (parking lots, roads, roofs, lawns and other compacted grounds) are contributing to stormwater runoff, resulting in chemical and bacterial impalments in sections of the river. The WRWC's goal is to reverse this trend and improve the Winnicut River's overall water quality - for you, our children, and our wildlife.

New Hampshire Rivers Council

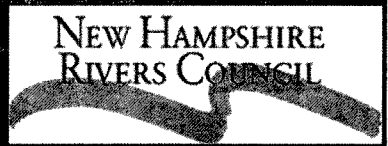


Figure 6-1. Screenshot of April 5, 2011 Blog entry from WRWC blog.

Source: (Winnicut River Watershed Coalition, April, 4 2011 <http://www.winnicutcoalition.blogspot.com/>)

Future Steps

The future plans following the Winnicut Dam removal project also promise some valuable data generation for the Winnicut River and its watershed, which will only serve to help the WRWC's efforts in developing a watershed-wide restoration and management plan. As an obligation from the federal stimulus funding from the National Oceanic and Atmospheric Administration's (NOAA) grant for the Winnicut Dam project New Hampshire Fish and Game and the New Hampshire Department of Environmental

Services were required to develop a long-term Monitoring Plan. The ten year plan will be used to assess the success of the restoration project in regards to fish passage for river herring and spawning habitat for smelt, two target species identified by NOAA (NHCP and NHFG 2010). The monitoring plan also includes protocols for photo-monitoring, wetland/riparian plant community characterization and water quality monitoring to help to answer questions/concerns from the community about the impact of the project to other species and habitats (NHCP and NHFG 2010). For years one, three and five following the installation of the fish passage NHCP and NHF&G, will monitor the response of smelt, both adults and eggs, and herring in the Winnicut River. There will also be vegetation monitoring upstream and downstream of the former dam at cross sections to capture changes in vegetation communities (Lucey email, Sept. 10, 2010). There are many data gaps in the baseline data for the Winnicut River and without a comprehensive and current picture of the baseline data for the watershed a meaningful and effective restoration and future management plan can never be developed. Additionally, with more baseline data collection, the more directed and comprehensive the citizen science VRAP and biological monitoring programs can be, as they will be designed to monitor necessary parameters that fit into a wider picture and understanding of the watershed. The more effort and interest the Winnicut watershed can receive the better, it will complete the essential baseline required for its future restoration. Overall, NHDES has expressed great support for the WRWC effort in an August 11, 2010 email from NHDES's David Murphy and Kevin Lucey to Josh Cline they wrote:

"We applaud you for starting the Winnicut River Watershed Coalition under the banner of the NH Rivers Council. A need for grassroots support in the Winnicut Watershed has existed for a long time and we are looking forward to working with you in the future."
(Murphy and Lucey email, Aug. 11, 2010)

Recommendations

The recommendations provided in this section are framed from direct involvement in the formation of the WRWC, as well as from the research conducted regarding the social and ecological context of the watershed and are in keeping with the literature surrounding participatory action and citizen engagement in watershed management. The recommendations are formed based from the insights gained about institutional and regulatory capacity gleaned from the analysis of the social process maps in Chapter 5. The lessons gleaned from mapping the problem situation and understanding the context in which the problem is embedded into has resulted in the development of recommendations for the WRWC about its future engagement and actions. The recommendations are aimed at achieving greater public involvement and measurable successful outcomes in regards to water quality, regulatory protections and restoration plans from the public participation efforts in the Winnicut River Watershed.

Watershed-wide Involvement and Planning

The Winnicut River Watershed Coalition has filled an evident void in the region; it is the last of the tributaries to Great Bay to establish a citizen advocacy organization. The Great Bay is a part of the larger Coastal Watershed stretching from Wakefield, NH and Acton, ME in the north to Deerfield and Candia, NH in the west to Kensington in the south. As a basin in the watershed, the Winnicut plays a role in the issues affecting the bay as well as the suite of solutions that may be proposed for restoration. With a seat at the table for issues surrounding Great Bay, the Winnicut region now has a voice in the anticipated debates and discussions surrounding the issues of stormwater pollution and wastewater treatment. The Winnicut River watershed citizens can now represent the WRWC, support and help to implement the collaborative solutions that will be necessary to address the complex issues facing the Bay. The watershed is also now entitled to

receive any funding that may be given to the region to institute solutions. The WRWC provides the last piece of the region wide citizen supported effort surrounding the coastal watershed. Without the WRWC there was no organized effort in the Winnicut River watershed and therefore no funding could be awarded to the area. As the research and data identifying the sources and hot spots of the non-point source pollution are published by New Hampshire Department of Environmental Services the Winnicut River Watershed will be identified. It is vital that the WRWC remain engaged in the region-wide dialogue surrounding this research and be sure to speak on behalf of the citizens of North Hampton, Greenland and Stratham in support of efforts to address the pollution sources.

Involve Regionally; Connect Locally

The WRWC must focus on attaining more balanced watershed-wide participation and representation. Having a balanced number of participants from all three watershed towns will prove to be the most effective tool in garnering political support for watershed-wide management. The WRWC cannot speak for the entire watershed if one of the towns is not represented in the coalition. The WRWC must continue to balance its focus and its presences amongst the three towns, holding its meetings in each of the three towns, be in communication with each of the three towns' leaders and establish its water quality monitoring strategy with equal representation in the three towns. The WRWC must consider and reflect an understanding of the unique set of circumstance in each town in its recruitment and engagement tactics. Stratham having a much larger watershed, the Squamscott, within its borders makes its focus harder to steer towards the Winnicut, therefore they must be engaged with a narrower focus. North Hampton's Line Swamp providing the headwaters gives it priority in terms of buffer and setback protections in order to control flooding and contamination. Greenland sitting on 60% of

the watershed and seeing intense development pressure along its Route 33 corridor must be engaged regarding impacts of development on water quality. The WRWC must be sure to develop a suite of tools and research to engage each town's citizens and leaders that speak to their specific concerns and circumstances.

The WRWC will serve as the local voice for the river and watershed and the reliable information and educational resource for local citizens and officials to call upon as the complex issues of wastewater treatment and stormwater pollution are brought to the forefront of community discussions and fiscal decisions are being weighed. Effective decision-making and action cannot occur without proper, appropriate and abundant credible information concerning the problems that must be addressed. The WRWC must focus on providing the local context to the regional issues for the three communities. This is an essential role for the WRWC to fulfill in the three communities, but having the relevant, credible and most timely information available and the ability to disseminate it quickly and effectively is equally as crucial. The WRWC must be sure that each watershed town is represented equally so that dissemination to each community will occur at the same level and efficiency.

The WRWC must also rely on regional organizations with greater resources and staff to provide the newest research, facts and best management practices in a timely and effective manner so that it can then be linked to the problem situations in the Winnicut watershed and then disseminated to the three communities. Organizations like the Piscataqua Region Estuaries Partnership and the Rockingham Planning Commission as well as NHDES are regularly publishing new research and data concerning the state of the estuaries and coastal watershed, best practices and suggested behaviors and it will be imperative that the WRWC is able to acquire this newest research, translate it, apply it to the Winnicut River Watershed and disseminate it to their grassroots contacts in the three towns. Expert/Technical level groups like the

University of New Hampshire's Jackson Lab and the Great Bay National Estuarine Research Reserve provide vital research findings on the ecological conditions of the Great Bay watershed and it is imperative that the WRWC be a part of their network of communications. Staying connected with these organizations' newsletters, Facebook pages, Twitter accounts and any other public outreach tool will be a top priority for the WRWC so that the newest information and research can be quickly translated and disseminated in order to bring about adaptive and timely solutions.

Collaborate Regionally

Collaboration with the other local area watershed groups will prove to be a valuable endeavor for the Winnicut River Watershed Coalition (WRWC) as it will help the steering committee garner ideas to implement, identify and overcome barriers and support to sustain efforts. The other watershed groups can offer great guidance in the structuring of the WRWC in regards to voting, administrative duties, meeting schedules, etcetera as these groups have been through those stages and are now sustaining themselves. In addition, the WRWC can join forces with the other watershed groups to leverage funding for regional efforts and to push legislative action with a collective voice. The more the efforts of monitoring and research can align with one another across the coastal watershed the better the baseline and future management implications can be to attain region wide improvements in water quality. Each subwatershed in the coastal watershed has its own unique set of circumstances and issues depending on its social process context and problem situation so it's important that each watershed remain a separate voice and foster relevant, unique management strategies that fit the watershed's situation and water quality protection challenges. However, aligning the science to look at and monitor many of the same indicators of health across the coastal

watershed will be important to allow for greater insight on trends and results of collective effects.

In addition, the watershed groups could utilize some similar outreach and marketing language and tactics to more efficiently and effectively reach a wider audience. The WRWC would not have to use all its own resources creating educational and outreach materials but could combine its insights, contexts and efforts with resources from other watershed groups to better express the message of what behaviors are affecting the water quality and provide tips on alternative behaviors to promote. The WRWC does not have to reinvent the wheel when it comes to messaging to homeowners about behaviors that are impacting the watershed. The opportunities for the WRWC to collaborate on region wide efforts are numerous and could result in more effective and efficient solution implementation.

Focus on Cultivating and Involving Local Knowledge

There is great value in inviting and engaging the local citizens and resource users into the research and monitoring that is done on the river. Quantitative data that is a result of monitoring stations and grab samples provides a part of the ecological picture of the river but not the whole story. Firsthand observations and interactions with the river and the land provide an incomparable perspective that is essential to successful management and restoration. The Winnicut River's waterfront is almost entirely privately owned and, as such, the residents of the three towns who live along the river's edge know more about the intricacies of the waterway than many others. They will know what it takes for it to flood, what happens during low flow periods, what the bottom of the river is made up of, what types of litter and trash are found floating down the river. They can identify activities that their neighbors may be doing that are affecting the health of the river. They can provide a great perspective to the WRWC when it comes to the day-in

and day-out workings of the river. Although many of the suggestions of regulatory measures to protect the river can affect the riverfront owners' properties, it is important to gain that insight as well, to glean from them their feelings and values surrounding their land and property, and to learn what regulations they simply do not understand or will not accept. The challenge for the WRWC will be to engage these property owners to participate and share this knowledge. Tactics such as bulk mailings will not prove as successful as a personal letter or invitation to a dialogue. Perhaps connecting the river's water quality and health to their property values may prove to be a successful engagement tactic. Additionally, being poised to capitalize on any flooding events that occur and the heightened awareness of the river that results from the damage will be essential in engaging these homeowners.

Additionally, The WRWC would be wise to reach out to the local fishermen and hunters who use the river and its tributaries to recreate. It is common for these types of resource users to have a long history fishing or hunting on the river and they could provide great insight into the types of fish species, bird species, vegetation and overall river dynamics that they have witnessed over their time span along the river. These local knowledge keepers can provide a view into how the river used to look or act and what types of values and resources it historically provided the community. Many possess a temporal scale of the river and watershed that is important to represent when developing a restoration plan and moving forward with implementation.

In that same vein, connecting these local knowledge keepers to the next generation through engagement of the younger residents is equally as important. Efforts focused on school children, scouting groups and high school groups will help to build up an engaged and informed citizenry to sustain the efforts into the future. The recent social trends of video games and television have resulted in children who are unconnected to the land and environment around them and without a connection to the water and the

watershed there will be no one who will want to inherit the responsibility and leadership of the restoration and management. It is vital that young citizens are taught to care and how to care so that they can inherit the responsibility for restoring and then wisely managing their watershed. Additionally, what is shared and taught to children is most often shared and taught to their parents at home so fostering watershed stewardship and awareness in schools and scouting groups will quite often result in those same behaviors being shared and practiced in homes.

Employ a Systems Approach

The group should look towards a wider timescale and consider the vision for the watershed's health and the group far into the future. Employing a systems thinking visioning session may prove quite beneficial as a first act for the group to undertake together. The planning team for the formation of the WRWC undertook this process early on in the formation of the team to help to understand the situation into which the outreach and engagement tactics were going to be employed. The act of physically diagramming the parts and players of the system and what is affecting what and how is quite beneficial to getting a wider, more holistic understanding of the complexities at play. Now that there is a group of volunteers for the WRWC in place the act of doing the diagramming themselves would provide greater insight and inspiration for action. The group could also begin to identify any leverage points, places in a complex system where a small shift in one thing can make big changes in everything (Meadows 1999). The group as a whole would benefit from utilizing the information gleaned in this study and bringing their own perspectives to diagramming the system as a whole and beginning to understand where in the system their efforts are most effective.

Overall the insight I gleaned from this study is that the Winnicut River is fundamentally undervalued by those who live around it and those who are in charge of

protecting it. The citizens and leaders alike have undervalued the resource historically and have treated it with a common disregard potentially due to not fully understanding its connection to a larger system. The river itself is small when compared to the other tributary rivers such as the Lamprey or Exeter and potentially that led to the perceived lack of value. The WRWC would be wise to focus on the undervaluation of the river as being a primary leverage point in the system. Helping the residents and leaders understand the river's abundance in ecosystem services, especially flooding control, it's interesting and vital history in the region, its connection to the wider Great Bay estuary. All of these values of the river must not be allowed to be understated or misunderstood any longer and a primary role of the WRWC is to reverse that behavior; to build the value of the resource back into people's minds and into the societal norm.

Monitor for Success and Sustainability

Jean Eno has proven to be a tremendously enthusiastic and effective leader for the group securing a large grant, updating the members through traditional and new media, advocating for legislation. However, no leader can sustain their energy alone. In order to ensure resilience for the group and long-term sustainability Jean must get help and support as a leader. Potentially a co-chair or a steering committee would be the best technique, a group she can depend upon to help with the tasks and planning, which if the group expands further will only prove to be more arduous and time consuming. Additionally, if Jean decides to move on or ends up having to cut back her time commitment to the group, having additional leaders in place will prevent a vacuum of energy and progress from occurring. Building in a structure to the group that could be self-perpetuating may give it the best chance for success and sustainability. The problems facing the Winnicut did not occur overnight and the solutions to addressing them and to restoring the river will not be implemented overnight so ensuring long-term

sustainability is vital at this stage of the group's foundation. If the group forms with the goal of being active 100 years from now it is better than relying on current enthusiasm and opportunism. Complex systems like ecosystems and social systems are dynamic and constantly changing so resilience and sustainability become paramount. Investment in resources, both financial and social, is of utmost importance for resilience. Continually adding energies, skill sets and resources will prove the best tactic to ensuring long-term action and solution seeking.

Equally as important is developing a system for monitoring success. What does success look like for the organization? Is it active municipal engagement or larger constituency involvement at board decisions? What are measurable successes? Is it entirely about the water quality? Or might it also involve social factors such as reduction in fertilizer use or increase in buffer areas along properties on the river? And, what is the alternative to action? What if the group fails? What does the river, the social landscape look like without the group? The development of indicators for success are essential to helping the group stay on task and enthusiastic because when goals are achieved there is a shared sense of celebration and a renewed energy which will only perpetuate sustainability. Additionally, it could be helpful to have each participant develop their own personal finite goals for their involvement. This allows each member to have his or her own priorities and victories and will help sustain their personal involvement as well as share in the group successes.

Lessons Learned About the Results

The development process of the Winnicut River Watershed Coalition had its successes and there were a series of setbacks. The lessons arising out of those setbacks are important to note because it can help instruct future implementation of this model approach. The successes serve as important lessons as they help to shape the

baseline necessities of what it takes to engage in an effort of this nature. It is important to note that this approach was intentionally unique and was based upon the context of the social process and problem situation in this particular watershed. Any implementation of this model must include the detailed mapping exercises performed in this study in order to develop appropriate and pertinent tactics for engagement and evaluation.

Lack of Participation

A substantial setback was a lack of participation from local decision makers from Planning Boards and Boards of Selectmen. There were no members present at the Riverwalk event or any of the public meetings though they received personal invitations in the mail one month prior, emails two weeks prior and phone calls to the chairs one week prior. These boards are the decision making bodies who implement the land use determinations that can protect or harm the river such as buffer widths and setbacks. Local land use boards are made up of volunteers and it is a challenge to get involvement beyond their already committed time. A predetermined strategy on how to specifically engage these members of the community would be an important tool in future applications of this approach. Perhaps, it is best to approach the boards during their regularly scheduled meeting with a briefing regarding the event and the proposed dates and ask for feedback on their availability and schedule. The involvement from the public was not as strong as the planning committee had intended with low turnout at the three public meetings and a mediocre turnout at the Riverwalk event. The Riverwalk turnout may have been affected by competition from the Friends of Weeks Library Annual Plant Sale, Bake Sale and Chili Lunch at the Greenland Central School which was occurring at the same time. This community event is an annual town tradition and draws a lot of support. Greater research on other community events on the same date might have

helped the WRWC planning team pick another date that did not have competing events. It is also important that the WRWC be sure the Riverwalk becomes an Annual Event so that it can begin to build up community support year to year.

Sustained Leadership

At the very conclusion of this study the WRWC went through a major shift in leadership and direction with New Hampshire Rivers Council Director's departure. Jean Eno was named the Director for the WRWC and began to take on more leadership roles within the New Hampshire Rivers Council. However, there was a loss of institutional memory with Cline's departure and what he had laid out in the scope of work for both the New Hampshire Charitable Foundation and New Hampshire Coastal Program grants was left to Eno without the knowledge that helped draft those scopes. Cline's strategic planning initiatives mostly rested with his position at New Hampshire Rivers Council and thus when he left, the efforts sustaining the WRWC began to falter. Eno has quite been adept at taking over the reins and directing the WRWC in a progressive direction with guidance from 2010's public meeting input. Working with the New Hampshire Coastal Program to redesign the scope of the grant she has been able to develop a water and biological monitoring program that meets both the Winnicut Watershed's citizens' needs as well as New Hampshire Department of Environmental Services' data shortfalls. The shift in leadership was not ideal for the sustained energy and recruitment of the WRWC but it also coincided with the winter season when things undoubtedly slow down because there is no ability to conduct field work.

Financial Backing

The financial backing from the New Hampshire Charitable Foundation's grant was indispensable as it allowed the planning group the ability to purchase advertising

space, produce banners, fliers and information sheets and buy refreshments for the various meetings and the Riverwalk event. The ability to host a free BBQ lunch for the public made the event more attractive for citizens to attend. Having capital support gave the effort credibility and showed the public that the effort was legitimate and professional. In order to build social capital, which is what this effort was attempting to do, requires the investment of financial capital in the beginning and the NHCF was able to provide that. Having a dedicated financial pool is something that proved to be essential and would be required in any other attempt at implementation of this model.

Community-wide Sponsorship

A great success of the Riverwalk event in particular was the sponsorship and involvement from a wide variety of community businesses and organizations. The food donated from local businesses allowed for the businesses to lend support to the cause while also gave them an advertising outlet. Citizens recognized those businesses and were more drawn to the event due to the network of support it boasted. Engaging the Greenland Boy Scout Troop to help lead the River Walks gave a successful platform for the process of social learning to occur. The Boy Scouts learned more about their local river and watershed through the pre-walk training they received and they were able to share their knowledge of dendrology, ecology and wildlife while fulfilling their organizational mission of being active participants in citizenship. Local artists were given a display space for their artwork while they too learned more about the impairment issues facing their watershed. The artwork displays imparted culture and a visual richness to the setting which drew more citizens to attend.

The Value of Collaboration

A significant value of this study was the ability for the principle investigator to collaborate with community members and professionals in the field. A grassroots effort such as the formation of a watershed coalition relies on the varied talents, contacts and abilities of many to leverage the most resources and have the widest reach.

Traditionally, Master's degree candidates' research is far less applied in terms of community impact or collaboration outside of the university setting. This project proves the great value in having a student work with and learn from those in the field and community. The grassroots effort in the Winnicut River watershed was a true joining of forces to fill a void in the landscape and it was quite beneficial to have a Master's thesis study be a part of the process as it helped organization, accountability and transparency. Grassroots organizing and community engagement is essential across the planet in order to begin to reverse the environmental degradation that is currently occurring. The citizens, the users of the resources, must be informed, engaged and held responsible for their actions on this earth and be empowered to lend their efforts, abilities and resources to the common good of preserving clean water for future generations. Graduate students in Environmental Conservation are training to be future leaders in the field and would gain great benefits from deeper engagement outside of the university setting, as this study proves.

The organization and founding of the WRWC was no small feat but the greater challenge and opportunity lies in the future of the WRWC and its next steps and efforts. Vigilance must be paid to the recruitment of a wider group of citizen volunteers and to the collaborative development of a short-term and long-term watershed management and restoration plan that the group can begin to implement. Sustaining the energy surrounding the initial establishment of the group must become top priority in order to rally wider support and ensure more successful implementation. Diligence must be paid

to constantly connecting the citizens with the town boards and engaging dialogue as that will bring about the best chance for noticeable changes to local regulatory protections for the river. Town boards must be able to see that their constituencies are in support of adopting greater restrictions and protections over the river and the watershed. Citizen volunteerism will suffer if they are stifled or feel ineffective or underutilized thus the WRWC must collaboratively design a strategic, implementable management plan with pre-determined goals, objectives, tasks and means.

Lessons Learned About the Methods

The limitations of a participatory action research (PAR) approach are numerous and varied when compared to a traditional research approach. First is the risk that it might not work out. What if the effort did not end in a group being formed? How would that have affected the methods or results? The large chance of failure in a field like natural science that is designed to be largely risk averse makes PAR interesting and engaging. It is extremely time intensive, the researcher is almost constantly in the role of researcher throughout daily life. This study took close to three years to complete in its entirety and involved endless hours of meetings, conversations, planning and events and there is still much more to do. In addition, the researcher's objectivity is challenged when embedded into a working environment. It is a challenge to remain entirely objective when you are part of the conversation, the event, the meeting. This was a challenge to keep in check and I relied heavily on triangulation through conversations with others and reference documents and data. Another limitation is that research is occurring constantly but you cannot always record every word uttered or phrase spoke so there is heavy reliance on impressions, views, reactions and feelings. This is why triangulation and explicit transparency are so fundamental.

In this particular study it was a challenge to balance a natural inclination towards activism and advocacy with the necessity to retain objectivity and neutrality. Grassroots organizing efforts such as the one initiated in this study rely upon being extraverted advocates, activists and leaders that inherently believe in the way things ought to be and this is in direct contrast to the role of a researcher which is largely introverted, uninvolved and indifferent. Balancing between the two feelings was a challenge but having the planning team helped because there could be the more extraverted outspoken leaders such as Jean and Josh and that allowed Colin and me to remain more objective researchers.

This particular participatory action study also employed the collaborative learning approach which is undertaken by a collaborative team of people and inherent in any group work is a large reliance on remaining opportunistic and adaptable. Remaining open and adaptable allows for the greatest chance of getting things accomplished because you allow yourself to build consensus. Rigidity and adherence to a strict methodology would have not allowed me to take part in group efforts that veered from the plan and thus I would have lost value in the study and the eventual outcomes.

This study had a plethora of great benefits and it is why I am so satisfied with the learning experience. First, the process of a Masters student's research being applied in the community with community leaders & organizations allowed for a far greater learning experience and social benefit than if the research were strictly university based. This study allowed for the linking of university expertise and skill with community needs & efforts. The technological sharing and social learning that occurred is essential to a garnering a greater, more informed citizenry and community. As a student the study provided a much larger context to natural resource problems by being able to engage with municipal boards, business owners, citizens and others I understood firsthand the challenges and roadblocks that exist in society for natural resource problem solving. It

provided a realistic, hands-on education in the world outside of university coursework and lectures and that is priceless for future job prospects and career paths. In addition, it allowed for a sharing of skill sets and greater networking for future endeavors in the region. Many of the people that I met and worked with through this project I am actively engaged with in my current position as the Community Impact Program Manager for the Piscataqua Region Estuaries Partnership. Overall, as a capstone to my graduate work this study provided the most effective means to fully understanding all that I had learned in coursework from the issues and the contexts to the roadblocks and the solutions. Furthermore the fact that my Masters research resulted in a tangible, applied change in the landscape that is still active provides me with a great sense of satisfaction and accomplishment.

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APPENDICES

APPENDIX A
INSTITUTIONAL REVIEW BOARD APPROVAL

University of New Hampshire

Research Integrity Services, Office of Sponsored Research
Service Building, 51 College Road, Durham, NH 03824-3080
Fax: 603-862-3564

11-May-2010

Scahill, Jillan
Natural Resources & the Environment, Nesmith Hall
297 Post Road
Greenland, NH 03840

IRB #: 4742

Study: Participatory Action Research and Citizen Engagement in the Winnicut River Watershed

Approval Expiration Date: 17-Feb-2011

Modification Approval Date: 05-May-2010

Modification: Additions per 5/4/10 memo

The Institutional Review Board for the Protection of Human Subjects in Research (IRB) has reviewed and approved your modification to this study as indicated above with the following comment(s):

The researcher may use information gathered at the community event as outlined in the May 4, 2010 modification request, including photographs, without consent but only from/about adults (individuals over 18 years of age).

Further changes in your study must be submitted to the IRB for review and approval prior to implementation.

Approval for this protocol expires on the date indicated above. At the end of the approval period you will be asked to submit a report with regard to the involvement of human subjects in this study. If your study is still active, you may request an extension of IRB approval.

Researchers who conduct studies involving human subjects have responsibilities as outlined in the document, *Responsibilities of Directors of Research Studies Involving Human Subjects*. This document is available at <http://www.unh.edu/osr/compliance/112.htm> or from me.

If you have questions or concerns about your study or this approval, please feel free to contact me at 603-862-2003 or julie.simpson@unh.edu. Please refer to the IRB # above in all correspondence related to this study. The IRB wishes you success with your research.

For the IRB,


Julie F. Simpson
Manager

cc: File
Becker, Mimi

APPENDIX B
INSTITUTIONAL REVIEW BOARD APPROVAL
EXTENSION

University of New Hampshire

Research Integrity Services, Service Building
51 College Road, Durham, NH 03824-3385
Fax: 603-862-3564

14-Feb-2011

Ferrell, Jillian S
Natural Resources & the Environment, Mesnick Hall
P.O. Box 278
New Castle, NH 03854

IRB #: 4742

Study: Participatory Action Research and Citizen Engagement in the Winnicut River Watershed

Review Level: Expedited

Approval Expiration Date: 17-Feb-2012

The Institutional Review Board for the Protection of Human Subjects in Research (IRB) has reviewed and approved your request for time extension for this study. Approval for this study expires on the date indicated above. At the end of the approval period you will be asked to submit a report with regard to the involvement of human subjects. If your study is still active, you may apply for extension of IRB approval through this office.

Researchers who conduct studies involving human subjects have responsibilities as outlined in the document, *Responsibilities of Directors of Research Studies Involving Human Subjects*. This document is available at <http://www.unh.edu/osr/compliance/irb.html> or from me.

If you have questions or concerns about your study or this approval, please feel free to contact me at 603-862-2003 or julie.simpson@unh.edu. Please refer to the IRB # above in all correspondence related to this study. The IRB wishes you success with your research.

For the IRB,



Julie F. Simpson
Director

cc: File:
Becker, Mimi

APPENDIX C

WINNICUT RIVER WATERSHED COALITION TASK SEPARATION LIST

February 28, 2010

1. Overall goals:
 - stimulate community interest and involvement in watershed projects
 - create local awareness of water quality issues
 - solicit community driven ideas on how to improve watershed water quality
2. Long-term success:
 - when there is a noticeable degree of improvement in water quality
3. Short-term success:
 - sustain enough community interest to maintain a viable watershed association
 - volunteer teams organized to monitor / sample river effectively
 - develop enough interest to nominate the Winnicut River into the RMPP
4. Work needing to get done:
 - develop Gantt chart outlining initial responsibilities of who will address specific parts of the grant project
 - organize three community presentations: Greenland, North Hampton, and Stratham
 - communicate with town administrators
 - organize venues locations / dates
 - create mailing / email lists
 - contact media to publicize
 - produce flyers / distribute
 - community visioning process
 - invite those interested and key individuals to brainstorm
 - create dynamic format to achieve complete participation
 - form sub-committees for various projects
 - organize a revolving meeting schedule
 - facilitate meetings
 - River Walk
 - select appropriate sites
 - gain permission for access
 - communicate with media
 - organize location access, parking, dates, meeting times, and agenda
 - produce flyers / distribute
 - web-based collaboration tool
 - establish host web link
 - determine who will administer
 - post weekly updates / responses
 - monitor site

APPENDIX C continued

- meeting with community leaders to discuss watershed association development / needs
- contact and meet with each town administrator (need by-in from towns)
- establish a system of communications (e.g.: web tool)
- organize monthly update meetings / emails (possible online “GoToMeeting”)
- develop wish list that the towns might be able to help with

- organize the VRAP program
 - begin to solicit possible volunteers / coordinators
 - work on a training program
 - write up manual for Winnicut (basic one exists from DES)
 - determine sampling locations / dates
 - coordinate field work educational materials / distribute
 - conduct actual field training for volunteers

- create watershed association website
 - select host; sign up
 - solicit input for site information
 - write up copy
 - update programming calendar
 - coordinate all appropriate links
 - emphasize how to get involved
 - administer site

Source: (NH Rivers Council 2010)

APPENDIX D
NEWS ARTICLE APPEARING IN *THE PORTSMOUTH HERALD*

Article appearing in The Portsmouth Herald covering the WRWC presentation at North Hampton's Conservation Commission meeting, Sept. 14, 2010 (Haberman, S. 2010).

Group warns of pollution problems in Winnicut River

By Shir Haberman; news@seacoastonline.com

September 24, 2010 2:00 AM

NORTH HAMPTON — Some time ago, the town was alerted to situations causing pollution problems in the Little River. Now a group is forming in an attempt to deal with similar problems in the community's other major river, the Winnicut, which flows through Stratham and Greenland.

"The river has been found to have severe impairment from several sources that affect aquatic life and recreational uses, such as swimming and fishing," Jean Eno, director of the newly formed Winnicut River Watershed Coalition, told the Conservation Commission earlier this month. "If we don't start taking a stand now, we're going to be in big trouble later."

Eno and watershed ecologist Colin Lawson attended a commission meeting to urge members to become involved in protecting the river. The coalition, part of the New Hampshire Rivers Council, is also urging Greenland and Stratham to help stem the flow of pollutants into the river, Eno said. "There is a huge disconnect (in water quality protection regulations between the three towns)," she said.

The Winnicut's water quality is not just a problem for the three towns, but also for the Great Bay watershed into which the Winnicut flows.

"What we really wanted to stress was the need to work together as a watershed," Lawson said. "We need to come together to improve the quality for the entire watershed."

Lawson said one of the biggest sources of pollution is untreated runoff from impervious surfaces, such as driveways and buildings. Development has increased pollutants entering the river, he said. Lawson said the scientific threshold for impervious surfaces within a watershed is 10 percent. If that threshold is exceeded, runoff becomes a major source of pollution.

APPENDIX D continued

"All three towns are over that threshold," he said. "Stratham has a threshold, but it's quite high, and North Hampton and Greenland don't have thresholds."

The goal, he said, is to have common regulations in the three towns concerning what can be built and how in the watershed. The coalition aims to develop regulations to cover low-impact building methods, erosion prevention techniques, establishment of wetland setbacks and buffer zones, methods used to identify prime wetlands, and how land is conserved and protected in the watershed.

Eno said she remains upbeat about stemming pollution problems in the river and Great Bay. "With community involvement, we're going to make a difference," she said.

The 9.1-mile Winnicut River watershed has more than 17.9 miles of drainage and 42 miles of streams that flow into it, according to the coalition's Web site. The U.S. Environmental Protection Agency has declared the river unsafe for swimming, fishing or immediate contact due to high levels of bacteria, particularly E. coli, and chemicals.

Eno and Lawson have already held public meetings in Greenland and Stratham to alert citizens of issues impacting the Winnicut. A similar meeting for North Hampton residents is scheduled for Wednesday, Sept. 29, in the town's library on Atlantic Avenue.

APPENDIX E
ARTICLE APPEARING IN *THE PORTSMOUTH HERALD*

Article appearing in The Portsmouth Herald covering the September 29th, 2010 WRWC public meeting (Haberman, S. 2010a).

Winnicut River group seeks help from townspeople

Pollution also affecting Greenland and Stratham

By Shir Haberman; hamptonunion@seacoastonline.com

October 05, 2010 2:00 AM

NORTH HAMPTON — "Our biggest challenge in North Hampton is that one-third of our land is wetlands and our (drinking) water comes from the ground," said Conservation Commission Chairman Chris Ganotis. "It is only a matter of time until a well is polluted. Rivers are getting more polluted and there is no enforcement."

Ganotis made those comments at a public meeting hosted by the Winnicut River Watershed Coalition at the town's library on Wednesday, Sept. 29. Approximately a dozen people attended the event, at which WRWC Program Director Jean Eno of Greenland outlined her organization's reasons for forming and asked for help from townspeople in dealing with the problems the river is facing.

"Most of what I'll offer is on a watershed scale," Eno said, referring to the area that includes the nine-mile long Winnicut River, its 42 feeder streams and involves the towns of North Hampton, Greenland and Stratham. "E-coli (bacteria coming from human, bird and animal feces) is showing up throughout the system and there are other issues with pH (acidity)."

Ultimately, the Winnicut drains into Great Bay, and concerns about issues in that body of water have been making the news fairly regularly, Eno said.

"I'm really concerned about Great Bay," she said. "It's a quality of life issue."

The initial goal of the WRWC is to begin to gather more details about the watershed ecosystem as it currently exists, Eno said. She spoke about citizens in the three impacted towns taking part in several programs that would monitor the overall health of the watershed and begin the work necessary to protect it.

Eno pointed to the state Department of Environmental Services' Volunteer River

APPENDIX E continued

Assessment and Volunteer Biological Assessment programs, VRAP and VBAP, respectively. VRAP trains and equips volunteers to do water quality testing, while VBAB focuses on the health of invertebrates, fish and vegetation living in or around the watershed.

Another program Eno is looking to take part in under the auspices of the coalition is the New Hampshire Rivers Council's River Runner Program, which targets invasive species in watersheds. The coalition also needs volunteers to be involved in watershed-wide educational and outreach programs, as well as perform various administrative functions ranging from event planning to media relations, the program director said.

The long-range goals of the coalition, Eno said, included watershed protection and changes in local land-use policies.

"We want to do anything we can to designate as much of the river as we can through the Rivers Management Protection Program," she said. "Our towns are not talking to each other and their land-use decisions are not connecting."

Eno said she is hoping citizens within the three towns who are familiar with the watershed can help identify where water quality and biological testing should be done. She said that initially her organization is planning on setting up at least six monitoring locations on the river and has set spring of next year as a start date.

Wednesday's meeting was the last in this series, with previous events having been held in Greenland and Stratham.

Individuals interested in becoming involved with the Winnicut River Watershed Coalition are asked to contact Eno at 431-7009 or via e-mail at winnicut@gmail.com.

Those interested in learning more about what is happening in throughout the Winnicut River watershed can go to www.winnicutriverrivershedcoalition.blogspot.com, access the New Hampshire Rivers Council Web site at www.nhrivers.org, or go to the New Hampshire Department of Environmental Services Web site at www.des.nh.gov and type in "Winnicut River."