Watershed Management: A Comparative Study of Recreational Use Conflicts and Community Involvement

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( ABSTRACT)

The link between land and its impact on water quality is critical. Most land lies in one
watershed or another and this is where human activity is concentrated. Human use of
land and their activities can have far reaching impacts on the quality of water. Broadly
the uses of watersheds are recreational, commercial and natural resource uses. These
uses depending upon their intensity, affect the watershed and thereby the local
population. Over the years steadily declining water quality in several waterbodies has
created the need for management and conservation of this resource. In response to this
need the U.S.EPA developed the Watershed Protection Approach as a framework for
managing water resources by focussing efforts on a watershed level. The Lynnhaven
Watershed located in the City of Virginia Beach and the South Santiam Watershed
located in the Willamette river basin are two watersheds that share several similarities
and at the same time are different from one another. This paper presents a descriptive
analysis of the two watersheds, the use of resources, resulting conflicts, existing
management/conservation strategies and community involvement. Finally the paper
presents an evaluation of what went on in each watershed in terms of conservation
strategies, what worked, what did not and the possible reasons why and attempts to draw
policy implications for watershed management in the United States.
Acknowledgements:

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Chapter 1: Introduction

1. What is a watershed? Why is it significant?

Water is one of the most important natural resources required for the sustenance of life on Earth. Approximately 71% of the surface area of this planet is covered by water (Intergovernmental Oceanographic Commission, 1998). The area of land that drains into a lake, river, estuary, streams or other waterbodies is referred to as a watershed.

Activities of humans on land and the manner of their use impact the quality and quantity of water and other natural resources.

“Healthy watersheds are vital for a healthy environment and economy” (Conservation Technology Information Center, 1998). All of us live in one watershed area or another. As a source of water for drinking, irrigation and industry they form an integral part of our lives. Human use of land in the watershed has far reaching effects on the quality of water in a region. More than half of all waters not meeting the required standards for safe water quality are affected by non-point source water pollution, which is mainly caused by land based activities (Randolph, 1998). Therefore, it is very important to manage land in a watershed in order to protect and improve the quality of water.

The link between the use of land and its effects on water resources is critical and has been a point of emphasis by the U.S. Environmental Protection Agency which developed the watershed protection approach as a framework to aid in protecting water quality. Watersheds are ways to delineate areas for more effective study and designing their protection and management. Wetlands are waterbodies like lakes and streams, and,
therefore, protection of watersheds requires the protection and management of wetlands too. As a part of the watershed region wetlands by themselves are of enormous significance. They aid in the effective functioning of the entire ecosystem in numerous ways (SEVPDC, 1988): flood mitigation, coastal hazard protection, acting as sedimentation barriers, groundwater recharge, trapping pollutants in runoff, habitat for fish and wildlife species and recreational activities.

Waterbodies are used for a variety of purposes, including water for irrigation and livestock, power generation, recreational activities, boating, fishing, and domestic water supply. Riparian areas are used for timber harvest and other plant resources. We are greatly dependent on the watershed areas and the resources they provide to fulfill the daily needs of our life. The quality of water or the health of a watershed is a direct measure of how it is used and the impact it will have on the well being and health of the local populations.

2. *The need for watershed management/protection*

Over the years uncontrolled and unregulated use of the land has led to point source and non-point source pollution problems and a degradation of the environment and quality of water in several watershed areas. Clearing of riparian vegetation for development and urbanization, dredging and filling of wetlands, agricultural runoff, unregulated fishing and use of recreational crafts and boats are a few of the activities that have a profound impact on the well-being of watersheds. Over the years, several non-point source pollution programs have been launched and best management practices have been
implemented. However, the watershed management/protection approach has provided the most ideal framework for protecting water and the land surrounding it by providing an opportunity for all stakeholders to participate in the efforts. Not only does stakeholder involvement help in identifying all the problems in an area, but also helps people to work together towards solutions and streamlines efforts towards a common goal. Factors that affect the quality of water and its environment invariably have an impact on the health and vitality of the local population and watershed area. Local awareness about the impacts of adverse resource use over the past few decades have led to “know your watershed” campaigns, restoration efforts and water quality monitoring programs in several states (e.g. Mississippi river basin).

3. **Evolution of the concept of watershed protection**

The concept of managing watersheds as a part of the water resources management originated in the 1890’s with the work of the U.S. Inland Waterways Commission. Over the next several decades, the aim was to manage water resources for irrigation, navigation, flood control, drinking water and energy production (EPA, 1998). To maintain water quality in face of the rapid development and growth of residential areas, the Clean Water Act (CWA) was passed in 1972. This included a Federal permitting program under which each discharger receives a permit to discharge wastewater containing effluents within limits that can be treated. The act also provided funding for wastewater treatment and state water quality programs. These steps set the base for early surface water protection efforts. The CWA was followed by the Safe Drinking Water Act (SDWA) in 1974, which attempted to integrate several programs aimed at protecting
public health. Despite these measures, rapid urbanization and evolution of hazardous waste dump sites further contributed to the deterioration of water over time. According to EPA, “a comprehensive approach to water resources management is needed to address the myriad water quality problems that exist today from non-point and point sources as well as from habitat degradation.” (EPA, 1998). This led to the development of the concept of Watershed Protection Approach (WPA).

As mentioned earlier, the link between land and water is crucial. To effectively manage and protect water, it is essential to manage the land. Because watersheds are defined by natural hydrology, they represent the logical basis for managing water resources. The resource becomes the focal point, and managers are able to gain a more complete understanding of overall conditions in an area and the stresses, which affect those conditions. Increasingly, State and Tribal water resource professionals are turning to watershed management as a means for achieving greater results from their local water quality protection programs, because managing water resource programs on a watershed basis is environmentally, financially, and socially beneficial. The following section is a concise summary of the WPA, its basic features and framework.

4. Objective of the paper and methodology

The objective of this major paper is to present a descriptive analysis of the management of two watersheds: South Santiam watershed in Oregon and the Lynnhaven watershed in the Hampton Roads region of Virginia. First, the paper briefly reviews EPA’s WPA and then presents the two case studies with a focus on recreational use and community
involvement. The aim is to draw lessons on the practice of the WPA approach and its implementation, to compare one watershed management case against the other, and to identify problem issues that threaten the health of the watershed, and draw lessons for the future. The reasons for selecting these watersheds are:

1. The two watersheds are located in geographically different regions of the country, one on the East Coast and the other on the West Coast of the United States.

2. The South Santiam Watershed is located in a predominantly rural setting and the Lynnhaven watershed is primarily urbanized. It would be interesting to study and compare the issues faced and the programs implemented in these two regions.

3. There are several striking similarities between the two watersheds: both cover vast areas, service a large population and are parts of a larger watershed area. Both provide a variety of economic, recreational and natural resources use to the inhabitants of the region. They support several species that are endangered and some of the threats faced by the watersheds are similar like unmanaged recreational use, leakage of septic tanks and urban sprawl. Although both watersheds are supported to different degrees by several organizations and agencies in their protection efforts, the progress achieved is markedly different.

4. Preliminary investigation indicated that there is community involvement in the watershed protection and restoration efforts in both regions.

There are several issues involved in the deterioration of a watershed and in its management and protection efforts. However, describing all the issues is beyond the scope of this paper. Therefore, the paper will specifically focus on recreational use
conflicts, community involvement in restoration and protection efforts, and the watershed management process being used.

The source for background information on the watershed protection approach is the U.S.EPA. Sources of information on the Lynnhaven include the City of Virginia Beach Planning Department (documents, reports and the comprehensive plan), papers and reports by the Alliance for the Chesapeake Bay and the Chesapeake Bay Foundation, local newspaper articles, report of the Hampton Roads Planning District Commission and, personal communications with Mr.Clayton Bernick of the City Environmental Management Center. Information sources for the South Santiam watershed include EPA, USGS, State Department of Parks and Recreation, Local Watershed Council, and reports on use patterns of the watershed by the State Water Resources Department, published textbooks on the water resources of Oregon and personal communications with Dr.John Bolte of The Oregon State University.

The issues reviewed for each of the watersheds are:

- Resources of the watershed, their use, associated conflicts and their impact on the watershed: Essential in order to develop appropriate conservation and protection strategies and determine the stakeholders with interests in the watershed.

- Threats to the health of the watershed and pressures affecting it: This evaluation will enable the development of suitable measures to counteract the potential threats and will be invaluable in enumerating the barriers to successful conservation efforts.
• Strategies adopted so far to preserve and protect the resources: Necessary to evaluate effectiveness of the current watershed management plans.

• Local and community involvement, which is essential for the success of any plan, aimed at preserving natural resources.

• How does the current plan measure up to the WPA as described by the EPA:
  Theoretically the WPA appears to provide the ideal framework for protecting and managing watersheds. Therefore, the paper compares the existing plan to the WPA to determine if this approach is being used.

Tables on various features are presented in order to compare the two watersheds and identify the similarities and differences in their basic features and management strategies. The conclusions present an assessment of what went on in terms of protection efforts in each of these watersheds, what worked, what didn’t and why. Finally the lessons learned from studying these cases have been summarized.
Chapter 2: EPA’s Watershed Protection Approach (WPA)

“The WPA is a management approach for more effectively protecting and restoring aquatic ecosystems and protecting human health” (EPA, 1998). Traditionally, water quality improvements have focused on specific sources of pollution, such as sewage discharges, or specific water bodies, such as a river segment or wetland. While this approach may be successful in addressing specific problems, it often fails to address the more subtle and chronic problems that contribute to a decline in water quality and the surrounding land over time. The approach aims at specifically targeting water sources such as watersheds and aquifers (EPA, 1998). It focuses on all aspects of water quality, which includes chemical parameters (toxicants and pollutants), physical quality parameters (temperature, flow etc.), habitat quality, biological health and biodiversity and subsurface geochemistry. Watershed Protection can offer a stronger foundation for uncovering the many stresses that affect a watershed. The result is management better equipped to determine what actions are needed to protect or restore the resource (EPA, 1998).

The four basic components of the WPA, which form its framework, include:

- **Identification and prioritization of the watershed problems**: all the issues or activities that may have an impact on the health and wellbeing of life forms are identified. Problems that may specifically pose health or ecological risks in the watershed include all wastewater discharges, waste dumping, non-point source pollution, wetland loss, and modification of the hydrology and atmosphere of the area. These problems are first identified and then listed in the order of their
significance i.e., the magnitude of the impact they have on the watershed and the main focus goals for the watershed.

- **High level of stakeholder involvement in the management process:** The stakeholders often include federal, state and local agencies and commissions, private conservation groups, local interest groups, representatives from the public, representatives from the industrial sector and members of the academic and scientific community. The stakeholders as a group reach an agreement on the goals and approaches to solving the problems of the watershed, the action plan to be adopted, the co-ordination of the whole program and the final evaluation.

- **Input and expertise from several agencies and individuals are used to propose solutions:** this includes setting of standards, financing, controlling permits for developments, education and technical assistance, restoration and protection of critical areas and habitats, emergency response and monitoring.

- **Success of the program evaluated by monitoring and data collection.** The stakeholder group establishes certain ecological and administrative indicators and these parameters are constantly monitored to evaluate the success of the program.

Although the process of establishing a WPA framework may differ from state to state, the key challenges faced are the same. It essentially is comprised of establishing a common direction, managing the transition from existing programs, identifying barriers such as existing policies or non-cooperation of some affected individuals and documenting the approach for further references or protection of other watersheds statewide.
There are five main approaches to environmental management as characterized by Colby, 1991: Deep Ecology (DE), Frontier Economics (FE), Resource Management (RM), Environmental Protection (EP) and Eco-development (ED). The concept DE is totally biocentric, FE on the other hand is anthropocentric and believes in the market driven use
of resources. RM recognizes sustainability as a constraint to economic growth and basically tries to economize ecology. EP recognizes the importance of protecting the environment but advocates only measures such as addition of a pollution control unit to combat pollution and has not developed as a very effective concept for environmental management. ED is the approach the advocates development in harmony with nature, conservation of resources for the future and developing stewardship for nature.

Watersheds across the country have subjected to one or other of the above approaches.

The WPA can be characterized as close to the concept of Resource Management. It aims to achieve conservation and protection of the watershed on one hand, while on the other hand it takes into account and tries to represent the interests of all the stakeholders in the watershed. As a result, often market values enter into the picture and tradeoffs have to be made. In representing the stakeholder interests and trying to achieve a balance between stakeholder interests and the watershed interests, the WPA may promote programs that have greater benefit to the people in the watershed than the watershed environment itself.

Watershed approaches have a positive effect on the environment of a watershed. Besides the environmental pay-off, watershed approaches can have the added benefit of saving time and money. Whether the task is monitoring, modeling, issuing permits, or reporting, a watershed framework offers many opportunities to simplify and streamline the workload. Often Public involvement is increased and innovative solutions are encouraged.
On the downside, the WPA is theoretically a very good approach but its practical applied success is questionable. For the WPA to be successful, an enormous amount of cooperation and coordination is required between all the people and agencies associated with the watershed. Transition from existing programs not only requires vast inputs in terms of expertise and money, but also requires willingness on the part of the watershed inhabitants to participate. Often it is extremely difficult to establish a monitoring and data collection system with qualified individuals. While participation and inputs from all stakeholders is a key feature, setting up common goals and directions towards which all individuals wants to work is difficult since stakeholders may have conflicting interests. Key terms in the WPA, such as “success” are difficult to quantify and are subject to varied interpretations.

On the positive side of the WPA, efficiency (defined as optimum use of money and time) is increased once all agencies with natural resource responsibilities begin to work together to improve conditions in a watershed. Watershed protection engages all partners within a watershed, including Federal, State, Tribal and local agencies. By coordinating their efforts, these agencies can complement and reinforce each other’s activities, avoid duplication, and leverage resources to achieve greater results. Data collection is one such activity the quality which can be enhanced by greater coordination. For example, a state can reduce its own monitoring costs by factoring in the monitoring activities of the U.S. EPA, the U.S. Geological Survey (USGS), the National Oceanic and Atmospheric Administration, and the National Resource Conservation Service. In addition, permittees and other stakeholders that generate ambient monitoring data can form basin-monitoring
consortiums to pool resources and provide the State with greater consistency in collecting and reporting data. States can use watershed planning to help simplify the CWA Section 404 wetlands regulatory program in several ways.

- Advanced identifications or similar watershed planning tools can identify areas within the watershed as either suitable or unsuitable for development, improving the predictability of permitting decisions.

- Watershed plans can lead to greater use of general permitting. The CWA allows use of general permits to authorize activities that have only minor individual or cumulative environmental impacts. Impacts can be evaluated best when a complete understanding of all resources and conditions within the watershed is available.

- Watershed plans can facilitate collective wetlands permitting procedures among government agencies. Such collective permitting allows local, State, regional, and federal permitting to be processed in tandem to avoid duplicative requirements and unnecessary delays.
Chapter 3: Lynnhaven Watershed, City of Virginia Beach, Virginia

1. **Introduction** This section is a case study of the Lynnhaven watershed. It describes the location, resources of the area, their use and resulting conflicts, the institutional framework in place, community involvement and the evaluation of the management process with the WPA.

   a. **Geography:** In the state of Virginia, along the coast are several small watershed areas and their tributaries forming a part of the main Chesapeake Bay. The Lynnhaven is a 51,000 plus acre watershed located in the City of Virginia Beach and represents one-fifth of the area of the City of Virginia Beach and performs vital functions to the city and its residents (VA Beach planning Dept, 1985).

   b. **Topography:** The land is at sea level. The area surrounding the watershed is primarily urbanized. There are several old established neighborhoods in the bayfront area and several high-density new residential establishments with extensive networks of streets. The inlet to the bay houses a marina and a big fueling station for boats. The watershed area includes the Lynnhaven River, Broad Bay, the Linkhorn Bay waterbodies and their tributaries. Refer figure 2. Within this watershed area are miles upon miles of shoreline and hundreds of acres of marshes and wetlands.
The Lynnhaven lies within the areas on the map indicated by Bayfront, Bayside, Little Neck and Great Neck.

Figure 2: The Lynnhaven Watershed Area

c. **Hydrology:** The Lynnhaven watershed lies adjacent to the watersheds of Elizabeth River, Little Creek Basin, Rudee Basin and the North Landing River watershed (VA Beach Planning Dept., 1985). The Lynnhaven Inlet is a tidal inlet approximately 5 miles to the west of the coastline of the Atlantic Ocean located on the southern shore of the Chesapeake Bay. At the point of inlet, the bay is more than 15 nautical miles wide and in direct contact with the waves of the ocean (Oertel, 1985). The Lynnhaven River and its watershed represent one-fifth of the area of the City of Virginia Beach and encompass a land and water area of nearly 64 square miles.

d. **Species Richness:** The Lynnhaven watershed is an extremely diverse and resource rich ecosystem. The watershed includes several planning areas, namely, the Bayfront, the Bayside, Little Neck, Great Neck and the Oceanfront. In 1993 a 3-year natural areas inventory of the City of Virginia Beach was completed by the Division of Natural Heritage, Department of Conservation and Recreation. They found 20 rare vertebrate species, 39 rare invertebrate species, 76 rare plant species and 19 types of natural communities of statewide significance (Clampitt et al., 1993). Some of them are listed in the following table.
Table 1: List of a few of the threatened and endangered species in the watershed Region

<table>
<thead>
<tr>
<th>Species name (common name)</th>
<th>DCR-DNH rank &amp; Fed./state rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Least Tern</td>
<td>n/a</td>
</tr>
<tr>
<td>Bluejack Oak</td>
<td>n/a</td>
</tr>
<tr>
<td>Spanish Moss</td>
<td>G5S2</td>
</tr>
<tr>
<td>Darlington Oak</td>
<td>n/a</td>
</tr>
<tr>
<td>Submesotrophic forest</td>
<td>n/a</td>
</tr>
<tr>
<td>Oligotrophic saturated forest</td>
<td>n/a</td>
</tr>
<tr>
<td>Coast Bedstraw</td>
<td>G5S2</td>
</tr>
<tr>
<td>Wild Olive</td>
<td>G5TS1</td>
</tr>
<tr>
<td>Bald Eagle</td>
<td>G4S2S3LE</td>
</tr>
<tr>
<td>Flat horned Ground Beetle</td>
<td>G4S1</td>
</tr>
<tr>
<td>Mirid bug</td>
<td>G3S1</td>
</tr>
<tr>
<td>Gnaphosid spider</td>
<td>G4S1</td>
</tr>
<tr>
<td>Funnel web spider</td>
<td>G3S1</td>
</tr>
<tr>
<td>Two-clawed hunting spider</td>
<td>G4S1</td>
</tr>
<tr>
<td>pineland tick-trefoil</td>
<td>G4S2</td>
</tr>
<tr>
<td>Pselaphid beetle</td>
<td>GUSU</td>
</tr>
<tr>
<td>Funnel web spider2</td>
<td>G4S2</td>
</tr>
<tr>
<td>Coyle's purse web spider</td>
<td>G3S2</td>
</tr>
<tr>
<td>Stripe winged-baskettail</td>
<td>G4S2</td>
</tr>
<tr>
<td>King's hairstreak</td>
<td>G3G4S2S3</td>
</tr>
<tr>
<td>Burrower bug</td>
<td>G4S1</td>
</tr>
<tr>
<td>Assassin bug</td>
<td>G2S1</td>
</tr>
<tr>
<td>Carolina thread legged bug</td>
<td>G4S1</td>
</tr>
<tr>
<td>Seashore mirid bug</td>
<td>GUSU</td>
</tr>
<tr>
<td>Assassin bug2</td>
<td>G3S1</td>
</tr>
</tbody>
</table>

*"G" indicates global ranking, "S" indicates state ranking

1 Extremely rare and critically imperiled; 5 or fewer occurrences
2 Very rare and imperiled; 6 - 20 occurrences
3 Rare to uncommon; 20 - 100 occurrences
4 Common and apparently secure; more than 100 occurrences
5 Very common and demonstrably secure

2. **Watershed Uses:** The Hampton Roads region, which includes the City of Virginia Beach has always been a popular holiday spot for people living all over the country. The area has several stately mansions, historic neighborhoods and summer homes of the rich. With its numerous coves and bays, the watershed has been an ideal region for recreational activities. Culturally the watershed is a landmark, which served as an anchorage for the French fleet during the era of the revolutionary war (VA Beach Planning Dept., 1997-98). As a result the watershed has been used for a multitude of reasons, which can broadly be classified into three sections: recreational, commercial and natural resource uses.

a. **Recreational Uses:** Recreational boating is very popular in the Lynnhaven. Water skiing and personal watercraft or jet skis are also prevalent activities in the waterways. In the narrower regions of the waterways, canoeing and kayaking are extremely popular. Near the bayfront region (in the area known as the “narrows”) and in Broad Bay, scuba diving can be observed. As passive forms of recreation, several people regularly go fishing or crabbing. Nature photography enthusiasts and bird watchers too enjoy the scenic beauty of nature in the extensive wetland and marsh region.

b. **Commercial Uses:** For the past several decades the Lynnhaven has been a major area for shellfish harvesting and a source of livelihood for several fishermen living along the coast. The shellfish and the oysters harvested from the bay area were internationally known and these grounds were once home to the
world-renown Lynnhaven oysters. However due to increasing urbanization and boating activity, these activities are restricted to the basin area. Problems with fecal coliform pollution have rendered the shellfish unfit for human consumption (City of Virginia Beach, 1985). The majority of the submerged land in the Lynnhaven system is still leased for private shellfishing activities (oyster- ing and clamming) (Hampton Roads Planning District Commission – HRPDC, 1998). The watershed area also houses marinas, kayak, boat and canoe launch facilities.

c. **Natural Resource Uses:** The waterways provide important breeding and foraging habitat for several species of wildlife and fish. The submerged aquatic vegetation (SAV) are also important habitat and food providers. The wetlands and their unique vegetation are used by several species of birds as their wintering grounds especially migratory waterfowl. The wetlands also act as spawning grounds and nurseries for fish and other species like the blue crab, hard clam, oyster, herring and striped bass (HRPDC, 1998). Considering the fact that the land areas surrounding the waterways are urbanizing at a rapid rate, the wetlands are invaluable in filtering out pollutants in the runoff.

During summer and spring the trees and shrubs along the waterways are used as nesting grounds by herons, songbirds and the bald eagle. Sandy beach areas form nesting grounds for terns and other birds. Other small creatures like snails and spiders also live in the wetland areas.
d. **Development around the watershed area**: Over the past few decades the development around the watershed area has been enormous. ‘The city is well known for its modern day sprawl of suburban housing’ (City of Virginia Beach Comprehensive Plan, 1997). Riparian and waterfront development consists of both water dependent uses like seafood processing plants, docks and marinas and water non-dependent uses like housing. Currently the land uses are varied and include, low-density residential homes, high-density residential homes, resort areas, military installations, market places, commercial and office buildings, government offices, agricultural, open space and parklands.

However, the city has made commitments towards maintaining adequate open space areas in the city in their Capital Improvement Programs. There is an effort to provide “..an integrated system of open space and park facilities throughout the city to enhance the physical, recreational, environmental, social and cultural well-being of its citizens and visitors alike” (City of Virginia Beach Comprehensive Plan, 1997).

The city is trying to buy as much land as possible in order to provide for more public access to open areas and the waterways and is aiming to provide more recreation facilities like canoe and kayak launch piers. A conscious effort is on to halt the rapid urban growth and deterioration of water quality and prevent total loss and destruction of the watershed area.
3. **Threats to and reasons for deterioration of the watershed:** In order to be able to protect a watershed, it is very essential to identify the sources or reasons, which contribute to the deterioration in the quality of the water and affect the overall health of the ecosystem. There are innumerable small factors that affect the quality of water and its environment one way or the other. The primary reasons are:

- The areas that are drained by the Lynnhaven basin have increased enormously over the past decade. The drainage includes 5 major land areas in the city. Over the years the volume of drainage has increase with a corresponding increase in pollution from automobiles, septic tanks, fertilizers used for lawns etc. Sewage treatment plants near waterbodies in the Lynnhaven are potential point sources of pollutants (Virginia Beach Planning Department, 1985).

- The pollutants are generally removed from the basin by tidal action. But the volume of pollutants is so high that the system is unable to function properly. Change in land use patterns directly affects water use patterns and coordination between the two is necessary to maintain the water quality of the bay area. (Virginia Beach Planning Department, 1985)

- Unregulated use of powered crafts and other motor operated recreational instruments have contributed in a big way to ruining oyster beds and SAV (HRPDC, 1998).

- In conversations with the author, between May and July 1998, Mr. Clayton Bernick, Administrator of the City Environmental Management Center, revealed that the waterfront area is mostly covered by residential property and most of the homes have pets. Uncollected pet waste gets washed into the waterways during rains contributing to the high levels of fecal coliform in the water. This renders the waters unfeasible
for fishing or swimming. Although there is a strong basis to believe that this is the reason contributing to water quality problems, no investigations have been done to evaluate it. A study of a similar problem in Mount Trashmore (located to the south of the western branch of the Lynnhaven River, Mount Trashmore is a large lake surrounded by a raised hillock, serving as a recreational park in the city) revealed waterfowl population as being the main cause for high fecal coliform counts in the lake water.
4. **Watershed Use Conflicts (focus on recreational use):** In an area as resource rich and scenic as the Lynnhaven, with limited water area, pressure from different uses and users often result in conflicts. Residents living in waterfront homes are against letting canoes, kayaks or boats in the waterways on their backyards. They feel this will disturb the scenic beauty of the place and affect their privacy. Use of motorized recreational craft vehicles is harmful to the natural resources of the area. According to the HRPDC, a general study done by the Maryland Department of Natural Resources indicated stresses on waterbodies to be of 5 different types:

a. **Disturbance of wildlife:** Motorized vehicles cause waves and wakes on the water surface which disturbs nesting and foraging birds. They leave their nest unattended thereby making the eggs more susceptible to predation.

b. **Destruction of SAV (submerged aquatic vegetation):** Propellers of motorized vehicles often cut into the sediments and cut through SAV. By disturbing the bottom sediments they give rise to algal blooms.

c. **Water quality degradation:** Boating activity, engine pollution and dumping of sewage and waste materials overboard adversely affect the quantity of dissolved oxygen in the water causing algal blooms, fish kills and introducing disease causing microbes.

d. **Shoreline erosion:** Boats and other watercrafts can cause erosion of the shoreline by generating wakes.

e. **Debris:** Very often people dump debris into the water such as plastic packets, cans, containers etc. If ingested by aquatic organisms and birds, they can cause death.
The use of the waterways and the associated conflicts can be studied in three different groups relating to the different branches of the Lynnhaven (HRPDC, 1998; conversations of the author between May and July 1998 with Mr. Bernick):

1. **Western Branch: Uses:** It is one of the popular boating areas in the Lynnhaven. This part of the Lynnhaven system is relatively narrow and shallow. As a result, several boats get grounded in the main channel at times. There has been repeated requests by the residents of the area and the people using the waterway to have it dredged.

   **Conflicts:** However, these areas have been recognized as “aquatic resource of national significance” by the EPA. The intertidal flats and shallow marshes are used as nursery and spawning grounds by fishes and as foraging habitats by other wildlife species. Increasing urbanization has led to increased deposit of sediments into the channels making it very difficult for boats to navigate there. Proposals to dredge the waterway have placed the City of Virginia Beach and the Army Corps of Engineers on one end and the USEPA and Virginia Marine Resources Commission on the other end of interest conflicts.

2. **Lynnhaven Inlet - Bay Proper - Eastern Branch: Uses:** An extremely popular boating area, the inlet is used by all boaters accessing the Chesapeake Bay or Atlantic Ocean. The bay area is popular for skiing and PWC activities.

   **Conflicts:** The inlet area is a bottleneck at peak hours and gets very congested with traffic moving in both directions and making it difficult for smaller crafts to navigate. On entering the inlet the bay has vast areas of marshland. It is in this area that the Virginia Marine Resources Commission has established oyster reefs to try and increase the
population of oysters. However boaters in the nearby channels are unaware of these reefs most of the time and the chances of the reefs being damaged by grounded boats is very high. Similar to the western branch, the eastern branch is also shallow and the problem of grounding boats and PWC’s can be solved by dredging the channels. This will negatively impact the oyster reefs, which are highly sensitive. Therefore there is a major conflict between the users and environmental restoration activists.

3. Long Creek - Broad Bay - Linkhorn Bay and tributaries: Uses: East of the Lynnhaven inlet lies Long Creek, which leads into Broad Bay. Broad Bay in turn is connected to Linkhorn Bay at its eastern end through the narrows channel. Long Creek has several facilities for boaters such as restaurants, marinas, pump-out stations, access roads etc. Broad Bay is a popular skiing, crabbing, scuba diving and PWC activity site for enthusiasts. The 64th street public ramp and sunbathing beach is located at the Narrows. This area is also a kayak-launching site.

Conflicts: Due to the numerous facilities available there, Long Creek is highly congested. As a result of being the largest expanse of water in the Lynnhaven, the number of users of Broad Bay are also many. Currently, the shoreline of Broad Bay, along the seashore State Park borders the only stand of submerged aquatic vegetation (SAV) in the Lynnhaven system. The noise made by groups of PWC’s is a source for conflict between the PWC users and the residents along the shores. PWC’s can be used even in shallow waters and this destroys the SAV beds. Dredging of the Narrows to facilitate kayak and boat launching also creates a similar problem. Linkhorn Bay too faces similar user and restoration conflicts.
5. Institutional and regulatory framework

Institutional framework: Activities on water that affect the waterbody and the surrounding environment are regulated by several federal, state and local government laws. Following is a brief description of the role played by each of them:

Federal Framework

a. U.S. Coast Guard: The USCG with primary maritime authority for “waters in the United States”. The HRPDC (1998) states:

   “Waters of the United States are broadly defined as all wetlands, all tidal waters, and any other water bodies that are currently used, were used in the past, or could be used in the future for interstate commerce. The Coast Guard’s four main missions are maritime law enforcement, maritime safety, marine environmental protection and national security”.

   The USCG is involved in activities relating to the enforcement of the Clean Water Act, safe boating practices, navigation hazard monitoring and pollution control.

b. Army Corps of Engineers: The COE is essentially involved with the construction and maintenance of waterways and this involves dredging of channels necessary to maintain its depth and navigability. Under section 404 of the CWA, Any dredging or filling activity in the watershed area including wetlands comes under its purview. The federal law requires any activity affecting the water quality or wetlands to be permitted by the COE.

c. U.S. Environmental Protection Agency: The U.S.EPA along with the COE administers the CWA. The EPA has started several programs to increase awareness about the need to save watersheds. Its WPA is one of the most significant programs which has been adopted by several states.
State Framework

The Public Trust Doctrine: It is an old body of law, which states that the title to navigable and freshwaters, the land beneath and the living resources of the water are held in a trust by the state for public good. Under this doctrine, the state is given the responsibility of managing aquatic natural resources for the use and enjoyment of the public. This right of the public is clearly stated in Article XI, Section 1 of Virginia’s Constitution. However, the management and preservation of water and its resources are shared by several agencies, which are listed below.

a. Department of Game and Inland Fisheries (VDGIF): The Virginia Department has management authority over freshwater fisheries, wildlife management and recreational boating. Its main role lies in establishing recreational boating rules, this goal however is separated from its goal of conserving wildlife habitat. The code of VA does not permit the VDGIF to consider the impacts of boating on natural resources. Therefore, the agency’s effectiveness is vastly reduced.

b. Virginia Marine Resources Commission (VMRC): The VMRC is responsible for maintaining land lying beneath tidal and freshwater areas, which includes the wetlands. It establishes limits on fish catches, fishing seasons and restrictions on fishing gear. The VMRC is also actively involved in conservation and restoration activity such as developing oyster beds etc. It also rents out land for aquaculture to private individuals. The patrol division enforces conservation laws, health laws and boating laws.

c. Department of Environmental Quality (DEQ): Administers the state’s water quality program and periodically monitors the suitability of water for swimming, boating,
crabbing etc. The DEQ establishes and enforces water quality standards based on physical, chemical, biological and radiological properties of water. Also controls permits required for discharge of wastes or pollutants into waterbodies.

d. *Department of Conservation and Recreation (DCR):* The DCR aims at conserving the state’s natural and recreational resources. All state owned parks and forestlands are managed by the DCR. The DCR prepares the outdoors plan for the city of Virginia Beach once every five years. Scenic Rivers Act works on the recommendations made by the DCR to the general assembly. Advises waterfront residents on shoreline erosion control measures.

e. *Virginia Department of Health (VDH):* monitors water quality to identify any factors that may pose a health hazard.

**Regulatory framework:** The purpose of the Lynnhaven River System Waterway Management Plan is to address boating safety issues, reduce existing and potential waterway use conflicts, preserve the natural resources of the bay and enhance the recreational experience for all users (HRPDC, 1998). One of the important points to note while designing the plan is to understand that the bay is not only an important environmental habitat and natural resource that needs to be conserved, but also that its uses form an important part of the economy of the region.

Public access to the Lynnhaven is limited. There are a few points of access currently which become extremely congested in the peak hours. According to the HRPDC, there are a total of 14 marinas in the Lynnhaven watershed area most of which are located in
the area along Long Creek near the Lynnhaven Inlet for easy access to the Chesapeake Bay (HRPDC, 1998). There are however several rules and regulations passed by the City of Virginia Beach in accordance with the federal, state and local laws on the use of water resources. The following section is included in order to provide an idea of the kind of regulations enforced in an attempt to manage the recreational activities in the City of Virginia Beach. There are specific regulations pertaining to vessel operation and non-motorized uses (City Code of the City of Virginia Beach, 1995):

**Vessel operation**

a. *Boating under influence*: section 6-122 of the city code prohibits operating a boat under the influence of alcohol or drugs. The BAC threshold level is fixed at 0.08 or more.

b. *Reckless boating, skiing, surfboarding or spearfishing*: operation of any vessel that will endanger the life or health of another individual, spearfishing while scuba diving or skindiving and boating at high speeds near swimmers is prohibited.

c. *Improper boating, skiing, surfboarding or spearfishing*: proper techniques have to be observed while doing any of these activities. Culpability is less than in case of reckless practices.

d. *Noise*: Sec. 6-109 of the city code does not permit any vessel to create any loud or disturbing noise for a prolonged period of time such that it will affect the health of other individuals and disturb the environment.

e. *Operation in designated areas*: from May 1-Oct 15 certain sections of the watershed are closed to motorized crafts and open only for swimming, wading, fishing and crabbing.

f. *Speed*: boats and vessels are prohibited from moving at speeds that cause swells in the water or leave wakes behind them that can damage the piers, shorelines and other boats (sec 6-111). Several other areas of the watershed are designated as “no wake zones” to protect sensitive aquatic organisms and habitats.

g. *Designated channels*: A channel marked from Long Creek Canal to the entrance of Linkhorn Bay is designated as a transit channel to allow vessels to pass through or cross. Any recreational activity is strictly prohibited here.

h. *Launching and landing*: specific parts of the watershed are closed seasonally to launch of any kind of boat, sailboat, PWC, canoe, kayak etc.
i. **Pollution:** Sec. 6-32 of the city code prohibits the dumping of any material except fish or crab bait into the waters.

j. **Abandoned structures or vessels:** Sec. 6-25 prohibits the abandonment of any craft or its parts like timber, logs etc into the waters.

k. **Equipment requirements:** Sec. 6-115 requires crafts to have a sound producing device that can be heard to a distance of one-half mile and that needs to be sounded whenever a craft is landing or launching along any land adjacent to the Atlantic Ocean.

l. **Water skiing:** proper equipment should be used and safety measures need to be observed.

m. **Personal Watercraft (PWC):** Sec. 120.1 of the city code adopts similar restrictions to PWC use as described in the state code. Restrictions of speed, distance from shoreline, appropriate equipment and clothing and designated areas for operation are applicable.

### Non- motorized uses

a. **Swimming:** swimming is permitted within 50 yards of the shore. Diving or jumping from piers and bridges is strictly prohibited.

b. **Fishing and/or shell fishing:** Sec. 6-23 prohibits the placement of fish nets and crab pots in specific areas of the watershed.

c. **Scuba diving:** scuba divers are required to indicate the location where they are diving with a diver’s flag. Vessels are required to maintain a minimum distance of 25 yards from the diver’s flag.

d. **Surfing:** Sec. 6-116 provides detailed instructions on how, where and when surfing should take place.

The authority to make regulations and manage the waterways ultimately rests with the City itself. The different departments of the city like parks and recreation, planning, public works etc., work together to ease the conflicts wherever they are present and to try and preserve the environment and the watershed area as a whole.
6. **Existing Watershed Management Plan**: The state of the Lynnhaven watershed has been an issue of concern for nearly the past two decades. A number of studies have been done and there has been publicity through the media about the deterioration of the watershed area. A few projects have also been implemented but the state of the watershed has continued to deteriorate and must be improved to get back to its healthy state.

In 1978 a detailed study was conducted by the Department of Biological Sciences of the Old Dominion University on the effects of non-point pollution on the benthic invertebrates (this includes oysters, clams, planktons etc) of the Lynnhaven River system. However at that point of time, the increase in the nutrient levels in the water was minor and the studies found that it did not significantly affect the population of any of the marine species found in the head waters (Dauer et al, 1978).

In November 1982, the Virginia Institute of Marine Sciences conducted a study on the water quality trends in the Lynnhaven Bay area for the Hampton Roads Water Quality Agency. This study was done after the initial study on the water quality of Hampton roads revealed several actual and potential water quality problems for the area. The study identified several sewage treatment plants in the Lynnhaven area as potential point source pollution and envisaged the elimination of all point source discharges into the bay with the operation of the Atlantic Treatment Plant in 1983. A model developed by the study indicated that treated domestic sewage provides the nutrients for phytoplankton growth and is directly responsible for low oxygen levels and degradation of the waterbody.
According to the study, non-point source pollution occurs mainly due to storm water runoffs. This has caused increased siltation in the Lynnhaven Bay area and has resulted in high fecal coliform count in the water. The study also proposed various management practices, which could be adopted for water quality management.

In 1986, the local newspaper, ‘The Virginia Beach Beacon’ ran a complete feature on the Lynnhaven River, the problems faced by the river, its history, survival and remedies to ensure its survival. The newspaper emphasized the rich culture of oyster harvesting that the bay was famous for and presented facts on why the bay is slowly but surely being degraded. It stated that the sources of pollution are widespread ranging from lawns, septic tanks, marinas, pleasure boats to waterfowls and pets. Running an article on how people pollute, the newspaper gave a few examples:

- Septic tanks that overflows into the waterways.
- Lawn fertilizers and pesticides that are washed into the waterways by the rain.
- Runoff from roads, pavements, parking lots and other non-absorbent surfaces.
- Boaters dumping trash and waste into the waters.
- Erosion and siltation from construction sites.
- Dumping of laundry and household chemicals and wastes into the ground.

Over the years these problems have only increased and gotten further aggravated. The city had planned a series of projects to try and revive the water quality in the Lynnhaven River Bay, including developing a stormwater plan for the entire area, dredging the
navigation channel in the eastern branch and attempting to use new technology to control runoffs.

In conversations with the author, between May and July 1998, Mr. Bernick revealed that, in 1989 the Resort Programs Office Intergovernmental Relations Department conducted a study regarding the development of Ocean Park Beach (land area contiguous parcel of city property adjacent to Chesapeake Bay - Lynnhaven inlet and Crab Creek) as a recreational amenity for the city. The proposed use was a boat ramp, a day use beach or both.

In 1997, the Hampton Roads Planning District Commission (HRPDC) conducted a study to identify opportunities and problems in the Lynnhaven waterway. It proposed a waterway management plan which aimed to preserve the integrity of the natural resources of the area, enhance the recreational value and at the same time prevent and resolve as many use conflicts as possible. The report came up with a series of data and tables indicating the impact of various activities on the resources and their degradation (refer table 2), the drawbacks and failings of the existing rules and regulations and the possible management techniques that could be used. The table summarizes the likely/potential and unlikely impact of various recreational activities like cruising, water skiing, sailing, fishing, crabbing, PWC, manually propelled watercraft and riparian property development.
Table 2: Activities and potential impacts (HRPDC, 1998):

<table>
<thead>
<tr>
<th></th>
<th>Cruising</th>
<th>Water Skiing</th>
<th>Sailing</th>
<th>Fishing</th>
<th>Crabbing</th>
<th>PWC</th>
<th>Manually Propelled Watercraft</th>
<th>Riparian property Development</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shallow</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water habitat</td>
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<td>0</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>-</td>
<td>0</td>
</tr>
<tr>
<td>Wildlife</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>disturbance</td>
<td>+</td>
<td>+</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>+</td>
<td>0</td>
<td>+</td>
</tr>
<tr>
<td>Water quality</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>-</td>
<td>0</td>
</tr>
<tr>
<td>Shoreline</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>erosion</td>
<td>0</td>
<td>+</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Debris/Litter</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Notes:
+ likely impact
0 potential impact
- unlikely impact

Since then the city has actively tried to get the public involved in the effort to save the watershed and a few of the recommendations made by the HRPDC have been implemented with a certain amount of success. The city is at present working on developing a full-scale plan to protect and conserve the watershed and its resources.

Being a part of the famous Chesapeake Bay area, there are several other government and non-government organizations involved in saving the bay. An effort is on to bring together the work done by each organization and develop a final plan, which will have a significant effect in saving the bay and getting the people involved in it.
7. **Community Involvement:** Since the area around the Lynnhaven is primarily urbanized and the uses of the bay area are commercial and recreational, the role played by the public is vital in trying to protect the bay. The article in the February 12th issue of Virginia Beach Beacon created awareness among the bay residents about the need to do something to save the bay. Small community efforts were undertaken to prevent dumping of garbage into the waterways or spreading the word among friends and family to adopt safe boating practices. However nothing very significant was achieved.

In April 1995, the Virginia Beach Planning department in collaboration with the Chesapeake Bay Foundation and the Alliance for the Chesapeake Bay conducted a series of symposiums titled “The Lynnhaven River: are we loving it to death? A stewardship challenge for the future”. The reason for these seminars was stated as:

“...The Lynnhaven river, once one of the most productive shellfisheries in the nation, is suffering from a problem common to many waterbodies. The system has been overloaded by those who live, work and play in its watershed. Since an informed and involved citizenry is the key to a healthy and clean future for the Lynnhaven, this symposium is oriented to those who live and learn within the Lynnhaven River Watershed. What was the area like before intense development occurred? How have the land and water uses changed and what have been the impacts of those changes?...What should the future of the river be?”  
*Extracted from the symposium pamphlet, 1995.*

The speakers at the symposium included officials from the City Planning Department, the Seashore State Park, the Virginia Historical Society, The Alliance for the Chesapeake Bay, the Department of Agriculture and the Virginia Institute of Marine Sciences.

The Chesapeake Bay Foundation (CBF) has a series of programs to involve the public in the bay conservation efforts. There are specific programs for school students, training for
teachers and student conservation projects. The CBF’s field program focuses on students and teachers from the states of Virginia, Maryland, Pennsylvania and the District of Columbia. In Virginia the programs include the study of the Hampton Roads shipping port and naval facility and its effects on the bay, The Virginia Watershed Education Program, Virginia Mobile Canoe Program and the South Bay Mobile Boat program (Chesapeake Bay Foundation, 1998).

The Alliance for the Chesapeake Bay is another non-profit organization involved extensively in the efforts to restore and protect the bay. It has three main program areas, which are watershed restoration, education and outreach and public policy. The watershed restoration program includes the Bayscapes project, habitat restoration and volunteer citizen-monitoring program. Education is through information leaflets and fact sheets brought out by the Alliance regularly. The Alliance is actively involved in several projects to conserve and restore the Chesapeake Bay and its various tributaries.

The citizen-monitoring program of the Alliance is a regional network of more than 145 trained volunteers who perform water quality tests every week to monitor the quality of the water that runs into the Chesapeake Bay. The volunteers monitor the rivers in the states of Maryland, Pennsylvania and Virginia. This program was launched in 1985 with the possibility of making it into a long-term bay-wide monitoring network. The Bayscapes Project implemented in some areas encouraged the local residents to use native vegetation to control stormwater runoff and reduce the use of fertilizers on their lands (Alliance for the Chesapeake Bay, 1998).
In 1995, the Alliance conducted specific water quality monitoring training sessions for volunteers interested in the Lynnhaven watershed. This training was open not only to people who actually lived near the water but also to those interested in the monitoring water quality. As a part of the training, each of the volunteers was given a monitoring kit, data forms and a training manual. The Alliance aimed at setting up 20 monitoring sites. This citizen water quality monitoring was done on a large scale and several sites were selected for sampling of water quality and these were spread out in the entire watershed. Sites were located in the eastern and western branches of the Lynnhaven River, in Broad Bay, Linkhorn Bay, in Long Creek and Crab Creek. A current list of the water quality monitoring sites obtained from the Alliance indicates 20 sites in the Lynnhaven watershed namely:

Table 3: Water quality monitoring sites in the Lynnhaven

<table>
<thead>
<tr>
<th>Site #</th>
<th>Latitude</th>
<th>Longitude</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>200</td>
<td>37-13-08</td>
<td>76-25-17</td>
<td>Western Branch Lynnhaven River</td>
</tr>
<tr>
<td>201</td>
<td>36-53-30</td>
<td>76-02-08</td>
<td>Broad bay</td>
</tr>
<tr>
<td>202</td>
<td>36-52-20</td>
<td>76-06-17</td>
<td>Western Branch Lynnhaven River</td>
</tr>
<tr>
<td>203</td>
<td>36-50-38</td>
<td>76-03-40</td>
<td>London Bridge Creek</td>
</tr>
<tr>
<td>204</td>
<td>36-52-12</td>
<td>76-06-54</td>
<td>Western Branch Lynnhaven River</td>
</tr>
<tr>
<td>770</td>
<td>36-54-13</td>
<td>76-01-53</td>
<td>Whitehill lake</td>
</tr>
<tr>
<td>870</td>
<td>36-53-38</td>
<td>76-01-13</td>
<td>Broad bay</td>
</tr>
<tr>
<td>WB1</td>
<td>36-51-28</td>
<td>76-07-50</td>
<td>Lake Pembroke</td>
</tr>
<tr>
<td>WB3</td>
<td>36-50-38</td>
<td>76-07-38</td>
<td>Thalia Creek</td>
</tr>
<tr>
<td>BB1</td>
<td>36-54-17</td>
<td>74-02-12</td>
<td>Broad bay</td>
</tr>
<tr>
<td>BB2</td>
<td>36-54-36</td>
<td>76-02-37</td>
<td>Long Creek</td>
</tr>
<tr>
<td>BB3</td>
<td>36-54-17</td>
<td>76-03-47</td>
<td>Long Creek</td>
</tr>
<tr>
<td>LR1</td>
<td>36-54-38</td>
<td>76-05-49</td>
<td>Crab Creek</td>
</tr>
<tr>
<td>LB1</td>
<td>36-51-45</td>
<td>76-00-31</td>
<td>Linkhorn Bay</td>
</tr>
<tr>
<td>LB2</td>
<td>36-51-09</td>
<td>76-00-17</td>
<td>Linkhorn Bay</td>
</tr>
<tr>
<td>EB1</td>
<td>36-52-33</td>
<td>76-05-36</td>
<td>Eastern Branch Lynnhaven River</td>
</tr>
<tr>
<td>EB4</td>
<td>36-53-18</td>
<td>76-04-04</td>
<td>Lynnhaven Bay</td>
</tr>
<tr>
<td>EB5</td>
<td>36-52-28</td>
<td>76-03-43</td>
<td>Eastern Branch Lynnhaven River</td>
</tr>
<tr>
<td>LC1</td>
<td>36-54-13</td>
<td>76-05-10</td>
<td>Lynnhaven River</td>
</tr>
</tbody>
</table>
For each of these sites the citizens monitored several parameters. These included (Alliance for the Chesapeake Bay, 1998):

- Dissolved Oxygen Average: An essential parameter, which decides if the water can support marine life.
- Salinity: Salt content of water.
- Water temperature: Essential to determine if the water can support oyster reefs, serve as spawning grounds, nurseries and support other marine colonies.

These efforts by the citizens have created greater awareness among the rest of the populace and have help identify crucial factors that need to be monitored to maintain the quality of the water and to design measures to maintain the parameters at safe and appropriate levels. The citizen water quality monitoring is still done periodically and efforts are on to get more people involved.
8. **Comparison to EPA’s WPA framework:** The Watershed Protection Approach as described by the EPA, involves a series of steps, which essentially form its framework. Presented in this section is a step by step comparison and analysis of the Lynnhaven watershed with this approach.

- **Identifying, targeting and prioritization of problems:** The Lynnhaven has been subject to several studies as a part of the larger Chesapeake Bay area and has a pretty well documented list of problems and issues that threaten and affect the health and quality of the watershed. The WPA states that the critical data needs should be met through monitoring the problem causing issues. The Lynnhaven has been well studied for point source and non-point source pollution, stormwater drain outlet points have been monitored in the dry and wet seasons to monitor unauthorized use of stormwater drains. However, one of the critical issues identified as affecting the health of the whole watershed is the fecal coliform pollution, and although the probable cause has been identified, no concrete data has been gathered for this parameter. This is a definite shortcoming in the protection strategy.

- **Stakeholder involvement:** An interview with Mr. Clayton Bernick (Administrator, Environmental Management Center, City of Virginia Beach) revealed that all the people living in the watershed area or dependent on its resources for recreation, commerce etc. are considered to be stakeholders. A formal listing of all the people segregated into different groups or identified as specific individuals with a stake has not been made. A common task force to save the Lynnhaven has just been established and a common course of action needs to be decided upon. However, the
city has conducted a study to identify all the organizations, past, present and future involved in saving the watershed and has documented the work done by them.

- **Integrated Solutions:** The City Planning Department has so far received ideas from individual groups in the watershed, and a few of them have been implemented. However, the lack of a concrete entity and task force has not resulted in complete input of all the solutions that may be effective in saving the watershed.

- **Identify barriers:** This is one of the steps in the WPA, which has been very well studied and documented. The HRPDC has in its study of the multiple-use recreational conflicts, identified the key elements posing as a barrier to conservation and protection efforts in the Lynnhaven Bay like lack of adequate public knowledge, commercial versus ecological importance of the Lynnhaven etc. This is one of the initial and most positive steps taken towards developing an appropriate management plan for the watershed.

- **Documentation of the approach:** All studies done on the watershed with respect to its resources, uses, use-conflicts, sensitive habitats and species are well documented. The process that will be adopted has not yet been clearly defined and thereby is not very well documented.

- **Monitoring, data collection and evaluation:** Water quality, recreational use, resource utilization is being monitored through citizen groups, ACB, VMRC, CBF PRD and PWD. This data is periodically analyzed and its significance with respect to the health of the watershed is evaluated by the respective organizations. These findings are published as reports accessible to all individuals.
**Conclusions:** The above comparison clearly indicates that while work is being done in the Lynnhaven watershed, there is a lack of coordination of efforts. This may be due to the fact that there are too many organizations and individuals involved and there has until recently been no effort to get together all of them to work as a single task force. This problem was realized by the City Planning department and they are now working on an EPA grant to try and coordinate all efforts to save the bay, increase public participation and ultimately develop a watershed management plan for the region.

Any effort to save the Lynnhaven watershed and its resources will require extensive public input, support and participation owing to the fact that it is mostly urbanized and used by the people for a multitude of purposes besides being retained as a natural ecosystem. So far there has not been considerable citizen input. The work of a few individuals cannot help in making a plan successful. It is very essential to set up a framework of what is to be done before any policies are implemented or efforts undertaken. It would probably be a good idea to adopt the WPA as a starting point.

Therefore, the first task would be to make a list of all the stakeholders. Bring them together through workshops and seminars to interact and pool together their ideas and solutions. Form an active task force that will set forth the goals and the means to achieve them. And finally monitor and evaluate the parameters studied, their significance and decide on long term strategies. A detailed discussion on the analysis of the lessons learned through this case study and the policy implications for the future are included in chapter 6 of this paper.
Chapter 4: South Santiam Watershed, Willamette River Basin, Oregon

1. Introduction This section is a case study of the South Santiam watershed. It describes the location, resources of the area, their use and arising conflicts, the institutional framework in place, community involvement and the an evaluation of the management process with the WPA.

a. Geography: The South Santiam Watershed is located in the state of Oregon in the Willamette river basin. It encompasses an area of 1300 square miles and includes the communities of Scio, Lebanon, Waterloo, Cascadia, Lacomb and Sweet Home. The city of Albany although not located within the watershed boundary, is considered a part of the watershed because it draws its water from the South Santiam River, one of the main water sources in the area (South Santiam Watershed Council, 1998).

Figure 3: The South Santiam Watershed

b. **Topography:** the Willamette basin region where the South Santiam watershed lies is characterized by rich farmland. The soils are highly fertile and were primarily agricultural lands in the 1800’s, but slowly the development of settlements along the river basin has led to it being a developed and urbanized area with several cities and towns located within its watershed. The area to the north of the South Santiam watershed has the mountain ranges. The soil type varies from sand and gravel to volcanic (Bastasch.R, 1998). Several wetland habitats exist in the watershed.

c. **Hydrology:** The Santiam River branches into the north and south main rivers. The South Santiam River has several small tributaries, which branch out and cover an extensive area. These support a variety of riparian and wetland habitats. The waters not only support anadromous fish populations but are also a source of drinking water supply to Lebanon, Sweet Home and Albany (SSWC, 1998).

d. **Species richness:** The Willamette valley has been designated as one of the most threatened ecoregions for the State of Oregon. A study done in November 1996 of the Willamette basin, identified 153 natural communities occurring in native wetland and riparian habitats of which 101 were new to the plant community classification of the Oregon Natural Heritage Program (Titus.J.H, et al, 1996). Some of the rare plant species include: *Gnaphalium palustre sloughs, Lysichiton americanum, Desces Valley Prairie, Salix hookeriana, Quercus garryana* etc. Some of the species that are listed threatened and endangered in the state of Oregon are found in the South Santiam watershed. The most important ones are: the American Peregrine Falcon
(Falco peregrinus anatum – endangered), the lahohan cut-throat trout (Oncorynchus clarki enshawi – threatened), bald eagle (Haliacetus leucocephalus – threatened), spotted owl and the steelhead (Department of F&W, Oregon, 1998).
2. **Watershed Uses:** the South Santiam region has a variety of waterbody types, which include rivers, streams, reservoirs, aquifers, wetlands, ponds and lakes. Each of these supports a variety of uses, some of which are distinctive and others not so much. As in the case of the Lynnhaven watershed, the uses are classified into 3 broad categories: recreational, commercial and natural resource use.

a. **Recreational uses:** “State law declares it a matter of public interest to increase outdoor recreation opportunities by developing waterways and water facilities and providing access to public waters with recreational value” (Bastasch.R, 1998).

Fishing for recreation is a very common pursuit for several people in the region. The waters are rich and support a number of fish species. Salmon, trout and steelhead were found in vast numbers in these waters a decade ago and are the most popularly ‘angled’ species. Other recreational activities include power boating, rafting and sailing.

b. **Commercial uses:** In 1990 the USGS conducted a study to list all the uses for the South Santiam watershed. Several of these were primarily for commercial or public uses and the following list summarizes those uses (USGS, 1990):

- **Public supply:** Several thousand gallons of groundwater are withdrawn each day to provide for the drinking water requirements of the people in surrounding towns. In addition surface water is also withdrawn.

- **Domestic withdrawals:** Some households withdraw water for personal requirements on their own.
Thermoelectric Power Use: Groundwater and surface water are constantly drawn upon for geothermal and nuclear power generation. 

Mining: Location of mines in the surrounding areas has resulted in the use of water in this watershed for mining processes. 

Livestock: Ground and surface water are used for maintaining livestock. 

Hydroelectric power: The Green Peter Lake Dam and The Foster Lake Dam are sources for generation of power. 

Fishing: Besides fishing for recreation, trout and steelhead are also caught for commercial trade. 

3. Natural Resource Uses: The wetlands in the area are invaluable in terms of recharging the groundwater supplies essential for the local drinking water supply. The riparian vegetation prevents shoreline erosion near the dams and further downstream. The waterways also provide for nurseries for schools of fishes especially the Salmon, which is anadromous. The riparian vegetation and the wetlands support a number of wildlife habitats. The trees along the waterways are frequently used as nesting grounds by birds. 

d. Development around the watershed area: Increasingly new residential developments in the watershed are putting a strain on the groundwater reserves and encroaching upon the wetland areas. The Willamette basin region is Oregon’s largest and most productive region (Bastasch.R, 1998) and ensures a steady growth of urban development in the region.
3. **Threats to/Reasons for deterioration of the watershed:** To protect a watershed and maintain the quality of the water and its surrounding environment, it is essential to enumerate the factors that adversely affect or contribute to its detriment. The following information was gathered from data sources of the USGS, the National Watershed Network, research by Bastasch.R (1998) and revealed in a letter to the author in February 1999 by Dr. John Bolte of the Oregon State University.

**Threats to the watershed:**

- Inappropriate agricultural practices that include excessive use of fertilizers and pesticides. It has also led to sedimentation of narrow streams in the region.

- Logging of trees along the riparian areas has led to severe erosion and sedimentation. It has also caused damage to the wetlands.

- Urban development and sprawl has resulted in consequent pollution problems with runoff from impervious surfaces.

- There has been an increase in the nitrogen and phosphorous content of the waters in several areas. Over the past few years several new species of exotic and noxious weeds have multiplied in the waters.

- Water temperature, which determines the wildlife species that can be supported by the waters, has also become a major concern over the past few years.

- Excessive fishing in the waters for recreational sport has led to a considerable decline in fish populations over the past several years and the salmon is now on the endangered species list.

- Fecal coliform pollution from leaking septic tanks and feedlot runoff is another major threat to water quality.
4. Watershed Use Conflicts (focus on recreational uses): As previously mentioned, the South Santiam watershed covers a vast area and supports several uses. A multitude of uses invariably results in conflicts between different user groups or uses. While the literature on these conflicts is not as well documented as in the case of the Lynnhaven watershed, local watershed councils and research studies have identified a number of conflicts between recreational uses and conservation efforts, development and wetland and riparian area protection.

- Boating and fishing are very popular in the waterways and are the most common forms of recreation. This has however, over the past few decades caused a drastic reduction in the population of the salmon, trout, and steelhead and has resulted in the salmon now being protected under the ESA.

- With the heavy dependence of the local population on the water resources of the waterways for their drinking water supply and as a safeguard against floodwaters, several dams have been built on all the rivers of the Willamette basin. The most adverse effect of these dams is isolating species of fish and affecting the migratory patterns and runs of native fish species. The Chinnok Salmon is extinct in the rivers to the north of the Willamette basin (Bastasch.R, 1998).

There are two dams on the South Santiam River namely, the Green Peter Lake Dam and The Foster Lake Dam. The dependence on these lakes is less for drinking water and more for recreational pursuits. The two dams together house 9 recreational areas. Foster Lake being extremely popular for fishing, is artificially stocked with trout and
 kokanee. In an effort to reduce the conflicts, above and below the dam fish passages have been provided for native salmon and steelhead run.

- In several areas along the waterbodies, livestock farms are located and the waste from these farms often runs straight into the water causing high fecal coliform counts.
- The existence of water rights also often brings users into conflicts for drawing too much on the groundwater and surface water resources.
- In a letter to the author in February 1999, Dr. John Bolte of the Oregon State University revealed that timber harvest and logging is one of the biggest threats to the watershed. The riparian areas are rich in trees that are regularly harvested by the loggers. However, cutting down trees leads to erosion and sedimentation problems and habitat loss for certain wildlife species.
- Increasing development of residential lots along the waterways has led to urban sprawl and improper septic tank systems. Leakage from septic tanks has affected water quality, the recreation potential and the use of the water. It also raises a big question about the suitability of the water for drinking. Urban development has also promoted the degradation of wetlands by filling in wetlands and on them. Although regulations and permits are designed to control it and protect the ecosystem, it is being significantly adversely affected.
- The Willamette basin is known to have the most fertile land in the whole state. As a result, agriculture is very common in the watershed. Agricultural practices and excessive use of pesticides have created problems of water pollution, sedimentation and destruction of wetland by filling.
5. Institutional and Regulatory Framework

Institutional Framework: In order to understand the processes in progress for protecting the South Santiam watershed it is very essential to understand the significance of a very important factor. In the State of Oregon there is a statewide focus on the protection and conservation of fisheries and wildlife and this is done on an individual watershed level for every watershed. Protecting fish populations is set as the primary target and the means to achieving it is to protect the entire watershed. The South Santiam is one of the focal watersheds where the protection of the Salmon population by preserving the environment in which it exists is achieved by protecting the entire watershed.

Federal framework

a. U.S. Environmental Protection Agency: The U.S.EPA along with the COE administers the CWA. The EPA has started several programs to increase awareness about the need to save watersheds. Its WPA is one of the most significant programs which has been adopted by several states.

b. National Marine Fisheries Service: The NMFS is located within the National Oceanic and Atmospheric Administration (NOAA) in the Department of Commerce and has implemented several laws throughout the country in order to preserve and protect fisheries and wildlife. Several of have been enforced and are currently applicable in the state of Oregon. These include authorizations of two different types (CNIE, 1995):

   (i) Annual

   The Anadromous Fish Conservation Act
   Central, Western, and South Pacific Fisheries Development Act
   Endangered Species Act
Interjurisdictional fisheries Act  
Atlantic Coastal Fisheries Management act  
Magnuson Fishery Conservation and Management Act  
Marine Mammal protection Act  
Marine Protection, Research, and Sanctuaries Act  
NOAA Marine Fisheries Program Authorization Act

(ii) Indefinite or Permanent  
  Driftnet Impact Monitoring, Assessment, and Control Act of 1987  
  Fisherman’s Protective Act of 1967  
  Saltonstall-Kennedy Act

In addition to these, several other acts have been implemented such as the Atlantic Salmon Convention Act and the Wetlands Planning, Protection and Restoration Act that aim to help preserve the diversity of natural ecosystems.

c. **National Resource Conservation Service:** The NRCS is involved in developing programs aimed at conservation of all natural resources throughout the country.

d. **Federal Energy Regulatory Commission:** The FERC is actively involved in the state of Oregon in order to regulate and oversee the multitude of thermal, hydroelectric and nuclear power generation plants which variously draw on ground and surface water resources for their functioning or for the basic process of power generation.

**State Framework:**

a. **Oregon’s Department of Environmental Quality (ODEQ):** Its task is to protect and restore the state’s public waters. The agency oversees a wide variety of programs and regulates water quality standards for each waterbody. DEQ assures compliance with standards through monitoring, education and enforcement programs.
b. **Oregon Department of Agriculture (ODA):** The agency oversees confined animal feeding operation, which aims to prevent the discharge of animal wastes into local waterbodies. It is also responsible for agricultural water quality management plans. When DEQ identifies a limited water quality stream, the ODA is required to initiate practices and measures to control any pollution caused as a result of agricultural practices.

c. **Oregon Department of Forestry (ODF):** The agency establishes best forestland management practices “to insure that the maximum extent practicable non-point source discharges from forest operations do not affect water quality standards” (Bastasch.R, 1998).

d. **Oregon Parks and Recreation Department:** Oversees the state’s scenic waterways program which targets rivers, lakes and lands that “possess outstanding scenic, fish, wildlife, geological, botanic, historic, archaeological and outdoor recreation values” (Keisling.P, 1995).

e. **Oregon Department of Fish and Wildlife:** The ODFW basically deals with all programs and activities aimed at maintaining and protecting fish populations. They oversee fish passage programs, inspect fishways, inventory obstructions, aid land owners in planning fish dams for fish to pass through and prevent them from getting killed by irrigation pumps and machinery.

f. **Division of State lands:** The agency has the responsibility of regulating all materials that may be introduced or removed from state waters. These include natural waterways, streams, wetlands and territorial sea.
g. Oregon Water Resources Department (OWRD): The agency responsible for supply of public drinking water, maintenance of drinking water quality and overseeing domestic water supply issues.

Regulatory Framework: The State Marine Board is responsible for creating and enforcing laws regulating recreation. Recreational activities are primarily in the form of boating and fishing and are regulated by the following methods:

- All recreation vessels need to be titled and registered.
- The board has a series of boating regulations: restriction on operation of boats under influence of alcohol or drugs, improper use of equipment, boating times and places, excessive noise, proper operation of powercraft, etc.
- All recreation guides are required to have valid licenses.
- The state police and the county sheriff department ensure that boating safety regulations are followed.
- The board sponsors boating-education courses and water-safety programs.
- The board awards grants to develop and maintain boating facilities and protect water quality.
6. **Existing Watershed Management Plan:** “What happens in a watershed can have a great impact on the timing and the quality of the water it releases” (Bastasch.R, 1998). Increasing awareness about the importance of water for everyday life, led to a movement in Oregon to protect and manage watersheds. Watershed management and protection in the state generally consists of managing activities such as grazing, mining, logging, road building, recreation and urban development.

Different watersheds across the state have one or more watershed councils that work with government assistance and support. In 1997, watershed councils were given the enormous task of leading the “Oregon Plan”, which aimed to restore habitat for the endangered salmon (Bastasch.R, 1998). The South Santiam watershed area has three main councils: the Crab Tree/ Thomas Creek Council, Friends of Opal Creek and the South Santiam Watershed Council (EPA, 1998). The former two are limited in the area they service, while the latter covers the entire watershed area within its purview.

In a letter to the author in February 1999, Dr. John Bolte stated that the South Santiam Watershed Council (SSWC) has a well developed action plan which is currently serving as the base for the watershed management plan. The plan has identified its goals based upon priority ranking into high, medium and low priority. The high priority issues reflect the primary goals and visions for the watershed, which the plan targeted at completing by the end of 1998/beginning of 1999. Its salient features are:

- Provide future and current users of the watershed and its resources with diversity, productivity and opportunity.
• Increase awareness among the watershed residents and landowners about the impact their activities can have on the watershed.
• Maintain and restore the quality of water for all uses in the watershed.
• Enhance the habitat to support fish and wildlife populations.
• Complete and maintain an assessment record of all the components with respect to the natural system, for the entire watershed.
• Increase citizen involvement in the council’s activities.
• Create an atmosphere for cooperation and coordination of all the stakeholders.
• Implement several field projects aimed at improving the health of the watershed.

The watershed council also has links with the local communities of Lebanon, Sweet Home, Albany and Linn counties. The entire watershed management plan is focused on getting the community involved, getting a response from all the stakeholders and conserving the resources through joint effort. The U.S. Army Corps of Engineers and the Oregon Water Resources Department conducted phase 1 of a public involvement study, done through workshops between December 1996 and April 1997 to focus attention on the Willamette basin. As targeted by the Oregon Plan, the management of the watershed orients itself to providing passage for the salmon and creating an environment in which it can exist. As a part of this goal, the Foster Dam and lake has been designed to maintain native steelhead and salmon run above and below the dam. Fishing is such a essential part of life in Oregon, for recreation as well as commerce that all plans to protect and conserve fish species are done on a watershed level, thereby ensuring conservation and protection of the ecosystem as a whole.
7. **Community Involvement:** The SSWC was formed with the primary intention of bringing together all the people in the watershed, in order to improve local awareness and educate the public about enhancement, restoration and protection of the watershed’s natural resources (SSWC, 1998). Its members include individuals from the government, business and private entities. The SWCC was sponsored by the Linn Soil and Water Conservation District and was formed in 1995. The first public forum was held in September 1995 at Lebanon, followed by similar meetings in Sweet Home and Millersburg. To make community involvement as one of its key projects, the SWCC holds executive committee meeting on the third Wednesday of each month, that are open to the public (SWCC, 1998).

Community involvement is therefore directed through the SWCC. Currently several projects are underway at the South Santiam watershed. The Council frequently conducts groundwater classes and the water quality monitoring project, which are educational in nature and intended to make people aware of the importance, maintenance and quality of groundwater and surface water sources. The council performs regular assessment of the natural resources and their condition in the watershed.

The South Santiam watershed is listed by the Oregon DEQ as being water quality limited because of high fecal coliform counts in the water and temperature standards. Fecal coliform pollution is caused by failing septic tanks, runoff from feedlots, other animal wastes and poorly treated sewage. During summers, the streams of the South Santiam have a very high water temperature, which is not optimal for the salmon and trout species
to survive in. The council has started an ongoing project wherein local high school students and citizen groups will monitor biological, physical and chemical water quality parameters in the watershed. The project aims to achieve several goals (SWCC, 1998):

- Increase understanding in the common citizens of watershed functions and the effect of land use practices on water quality and habitat (SWCC, 1998).
- Train teachers, students and citizens in water quality monitoring techniques.
- Involve watershed managers, landowners and users in watershed assessment program.
- Measure baseline conditions and trends and identify problem areas in the South Santiam River and its tributaries.
- Provide water quality information to the public and to local, state and federal agencies.

As mentioned earlier, the U.S. Army Corps of Engineers and the OWRD conducted phase 1 of a public involvement study to focus attention on the Willamette basin between December 1995 and April 1996 (OWRD, 1997). The study used questionnaires, press releases, fact sheets about the study and water issues, background information and workshops to interact with and obtain information from the public and at the same time increase their awareness and get them involved in watershed protection issues. The results of the study were released in the form of a report with the actual responses of the participants on issues ranging from recreation, fish and wildlife management, agricultural practices to construction of dams and reservoir levels. The comments were used as a feedback by all the organization involved in trying to save the different region of the basin, including the South Santiam.
8. *Comparison to EPA’s WPA framework:* this section evaluates the current efforts to protect the South Santiam watershed with reference to the framework of the WPA as prescribed by the EPA. The WPA advocates a series of steps, which are integrated together to address the issues faced by watersheds and finding the effective steps towards addressing them.

- **Identifying, targeting and prioritization of problems:** The support to the local watershed councils from the Governor’s Watershed Enhancement Board (GWEB), has been a key factor in uniting efforts for watershed conservation in Oregon. The SWCC has a very well defined action plan aimed at protecting the South Santiam watershed. They have identified all the problems, their possible sources, and have set priority goals with target dates when they hope to achieve those goals.

- **Stakeholder involvement:** The SWCC has identified all the stakeholders who have an interest in the watershed, ranging from landowners, to concerned citizens and locals dependant on the salmon for their living or recreation. This is a very significant step in the WPA, because all the interest groups need to be represented. Under the directives of the council, several workshops have been held and the stakeholders form the task force.

- **Integrated solutions:** Active representation from the stakeholders has enabled the pooling of ideas and solutions that can be applied to the various problems of the watershed. The SWCC is still in the first phase of achieving its high priority goals, one of which is to establish stakeholder groups to perform different functions.

- **Identify barriers:** This has been done reasonably successfully in the South Santiam watershed, since they have clearly identified the different stakeholders. However,
some of the problems faced by the watershed (for instance, declining fish populations, effects of dams) are to be addressed at a larger scale or require a statewide approach. This is where the Oregon Plan comes into effect and enables protection of watersheds by primarily targeting protection of the steelhead and salmon populations.

- **Documenting the approach:** The proposed action plans, stakeholders, responses to workshops and community involvement are very well documented by the SWCC for future references or guidelines.

- **Monitoring, data collection and evaluation:** Since the plan is still in its initial stages, proposals for data collection and assessment of watershed quality parameters and resource assessment and the roles to be played by the different stakeholders have also been decided. The DEQ has collected all water quality data so far and has identified the limitations in water quality. Actual involvement by the stakeholders in the watershed and monitoring efforts are likely to begin in the near future.

**Conclusions:** The above comparison of the local watershed management to the WPA clearly indicates that the SSWC is playing a critical role in the protection of the watershed and the steps in the WPA approach are being followed. As seen in many cases across the country, inputs and participation of the public and all the stakeholders involved is very essential to ensure the success of a resource protection effort. The SWCC has taken the first few steps in the right direction. Judging by the fact that the watershed is valuable not only for its recreation potential, but also for a variety of commercial, industrial and domestic uses, protecting the watershed is imperative to the health and well being of its residents too.
Chapter 5: Comparison of Watersheds: The study of the two watersheds has shown a number of interesting observations regarding their similarities and differences.

This section tries to list these similarities and differences with respect to three main components: watershed features, resource utilization and the existing management strategies.

1. Watershed Features: The following table is a comparison of the two watersheds with respect to their location, geography, hydrology, service boundaries and species richness.

Table 1: Watershed features

<table>
<thead>
<tr>
<th>Feature</th>
<th>Lynnhaven Watershed</th>
<th>South Santiam Watershed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location</td>
<td>Coastal Virginia (East Coast), City of Virginia Beach</td>
<td>Northwest Oregon (West Coast)</td>
</tr>
<tr>
<td>Total Area</td>
<td>64 square miles</td>
<td>1300 square miles</td>
</tr>
<tr>
<td>Predominant setting</td>
<td>Urban</td>
<td>Rapidly urbanizing</td>
</tr>
<tr>
<td>Water source</td>
<td>Lynnhaven River and Chesapeake Bay</td>
<td>Santiam River</td>
</tr>
<tr>
<td>Part of a larger watershed</td>
<td>Yes, Chesapeake Bay</td>
<td>Yes, Willamette Basin</td>
</tr>
<tr>
<td>Branches/tributaries</td>
<td>Eastern &amp; western branches of Lynnhaven River, Linkhorn Bay and Broad Bay</td>
<td>North &amp; South Santiam rivers and several small streams</td>
</tr>
<tr>
<td>Regions serviced</td>
<td>City of Virginia Beach</td>
<td>Sweet Home, Albany, Lebanon &amp; Linn county</td>
</tr>
<tr>
<td>Dams/Reservoirs</td>
<td>Mount Trashmore Lake</td>
<td>Green Peter Dam and Lake and Foster Dam and Lake</td>
</tr>
<tr>
<td>Watershed habitats</td>
<td>Wetlands, riparian, estuarine, coastal and inland waters</td>
<td>Wetlands, riparian, freshwater and Reservoirs.</td>
</tr>
<tr>
<td>Endangered/threatened sp.</td>
<td>Several. Most important: the bald eagle</td>
<td>Several. Most important: salmon and steelhead</td>
</tr>
</tbody>
</table>

While the area covered by the watersheds is quite different, it is evident that they both support a variety of habitats and species. Both are parts of a larger watershed area and are used by a large population for various purposes.
2. **Resource utilization:** this section compares the two watersheds with respect to the forms of resource use and use conflicts.

Table 2: Resource Use comparison

<table>
<thead>
<tr>
<th>Feature</th>
<th>Lynnhaven Watershed</th>
<th>South Santiam Watershed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recreational Uses</td>
<td>Boating, fishing, powercrafts, scubadiving, swimming, crabbing, kayaking/canoeing and nature photography</td>
<td>Boating, fishing, powercrafts, nature photography and swimming (only in some areas)</td>
</tr>
<tr>
<td>Commercial Uses</td>
<td>Shellfish, crab and oyster harvesting, marinas, boat launching facilities</td>
<td>Salmon and trout fishing, power generation- thermoelectric, nuclear &amp; hydro-electric, mining, livestock, domestic and public water supply</td>
</tr>
<tr>
<td>Natural Resource Uses</td>
<td>Breeding and foraging grounds, spawning and nursery grounds, nesting for birds, wintering grounds for birds, wetland erosion control</td>
<td>Breeding and foraging grounds, nursery and spawning grounds, nesting for birds, riparian erosion control and groundwater recharge</td>
</tr>
<tr>
<td>Threats to watershed</td>
<td>Urban sprawl, pet waste-fecal coliform pollution, recreational activities like powercrafts and fishing sewage and leaking septic tanks</td>
<td>Agricultural practices, logging, recreational and commercial fishing, urban sprawl and leaking septic tanks-fecal coliform pollution</td>
</tr>
</tbody>
</table>

The above table shows many similarities in the uses of the respective watersheds. However, it is clear that the commercial uses of the South Santiam watershed are far more than those of the Lynnhaven watershed. On the other hand, recreational activities are more in the Lynnhaven. Some of the major threats faced by both the watersheds are leaking septic tanks, urban sprawl. Recreational uses are similar and may be a key factor in deciding on the techniques to protect the watersheds.
3. **Management/ Conservation strategies:** the following table is a comparison between the two watersheds with respect to key goals, organizations involved in saving the watershed, community involvement and action plans.

Table 3: Management/ Conservation strategies

<table>
<thead>
<tr>
<th>Feature</th>
<th>Lynnhaven Watershed</th>
<th>South Santiam Watershed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Key organizations</td>
<td>City Environmental Management Center, City Planning Department, ACB, CBF, Parks and Recreation, Public Works Department, EPA, DEQ, HRPDC, VMRC</td>
<td>National Marine Fisheries Service, EPA, NRCS, Oregon State Departments of: environmental quality, fish and wildlife, parks and recreation, agriculture, forestry, lands, water resources</td>
</tr>
<tr>
<td>Local organizations</td>
<td>No definite structure</td>
<td>South Santiam Watershed Council</td>
</tr>
<tr>
<td>Goals</td>
<td>Improving water quality, controlling non-point source pollution, increasing public awareness and participation, coordinating work done by different organizations and resolving recreational use conflicts</td>
<td>Protect and enhance salmon and trout populations, improve water quality, represent all stakeholders, stress on public participation, maintain assessment records for watershed conditions</td>
</tr>
<tr>
<td>Guidelines from any other plan</td>
<td>From HRPDC study on multiple recreational use conflicts</td>
<td>The Oregon State Plan</td>
</tr>
<tr>
<td>Similar to WPA's framework?</td>
<td>Not yet. A lot of work and coordination is required</td>
<td>Yes. The approach to managing the watershed is along the lines of the WPA</td>
</tr>
</tbody>
</table>

From the above table it is evident that besides the government, there are several private non-profit organizations working for the Lynnhaven watershed. Most of these organizations are working on the Chesapeake Bay watershed and the Lynnhaven is added to their work as a small component of a larger picture. The Lynnhaven has been given significant importance because of its location, prominence and the fact that it provides access to the Bay through an inlet channel. On the other hand, most of the organizations supporting the South Santiam are state departments.
An important point that may explain the lack of success in the efforts to protect the Lynnhaven may well be the fact that there is no local organization in the watershed. There is a lack of a local organized group or structure that can provide guidance and lead the efforts to protect the watershed. The programs implemented so far are disjointed and results of a study done by an organization/agency are not known to another involved in the same area. For instance, the Alliance for the Chesapeake Bay has a Citizen Water Quality Monitoring Program. But the data collected, its analysis and the output is not known to many of the other agencies. As a result another agency might end up repeating the same work in the future while designing a program.

By contrast, the South Santiam has a single local organization, the SSWC, which heads all conservation efforts in the watershed and is strongly supported by all state agencies. As a result, efforts in the South Santiam are remarkably well organized and all programs and inputs are fielded through the SSWC.

The presence of a statewide approach in Oregon has enabled better structuring of all the efforts and focusing the goals of preservation. The conservation strategies in the South Santiam are based on a strong state foundation: The Oregon State Plan. Thus far, the only document providing significant insight and guidelines in the conservation efforts of the Lynnhaven is a study done by the HRPDC. The city is very much on its own in terms of designing conservation and management strategies and programs.
Chapter 6: Conclusions and policy implications for effective management of watersheds in the United States:

This section presents a critical summary of the management process followed in each of the watersheds and the outcome, what worked and why, what failed and why, and the lessons learned from the case studies. Finally a few points are presented on some of the management options that can be adopted by all watersheds.

The Lynnhaven Watershed: The number of users of a waterway are always on the increase owing to the fact that this is the place where people work, live and play in. With the likely increase in the users of the Lynnhaven system, the use conflicts too will increase. The number of accidents will increase affecting the goal of providing safe recreation, increased human activity will also work to the detriment of the natural resources of the region unless something is soon done.

The Lynnhaven Bay area has been well studied owing to the fact that it is an important part of the Hampton Roads waterways and the Chesapeake Bay watershed. The waterways of the Lynnhaven form the heart of the City of Virginia Beach. As mentioned in the section comparing the management process of the Lynnhaven to the WPA, the sources of pollution, critical issues threatening the watershed and the barriers to conservation and protection efforts have been well identified. The City of Virginia Beach is economically well positioned and projects to conserve the Lynnhaven have ready access to research grants. Despite good funding and inputs from studies done by
various organizations, efforts to improve the Lynnhaven have not achieved much in the past few years. The possible reasons for this are many:

- Most of the homes located along the shoreline of the waterbodies are owned by rich people using these homes as their summer retreat. Therefore, they do not take much interest in active citizen participation aimed at saving the bay and are more concerned about their privacy and comfort. The city’s efforts to promote recreational activities like canoeing and kayaking over powercrafts has met with stiff resistance from local homeowners who feel their privacy is being compromised by having canoes and kayaks rowing in their backyard. Therefore any efforts to save the bay, does not have the full representation of all the stakeholders.

- The Lynnhaven is also affected by “over-involvement” of too many organizations with too little coordination. This can be seen in the existing watershed management plan wherein several agencies have conducted various studies, but the outcomes have not been coordinated to develop a practical solution. While different departments and agencies are conducting studies and planning programs to protect the bay, few of the agencies are aware of what the others are doing. This leads to replication of work and a waste of time and money.

- A large part of the revenue for the City of Virginia Beach is obtained through tourism and recreational activities. It is very essential to determine what the main priority is; would the city consider a reduction in revenues from tourism in order to protect the fragile ecosystem?

- Most important of all is the role played by the state. The City of Virginia Beach is very much on its own in its conservation efforts. There is a lack of strong state
support for all initiatives and programs unlike the South Santiam. Although the entire watershed lies within the single jurisdiction of the city, the city has no clear guidance as to how the efforts to protect the Lynnhaven should be channeled. While the city can always gather inputs from the numerous studies done by the various government and non-government organizations in the Bay, it lacks support from an overall state framework that would set the guidelines of programs to implement, regulations to enforce, issues of public concern and public involvement.

The above issues need to be addressed and the priority issues clearly defined before any watershed protection is successful.

**The South Santiam watershed:** A marked difference between the Lynnhaven and the South Santiam watersheds is the extent of commercial use of the resources. Although not as densely populated as the Lynnhaven area, the South Santiam watershed has a greater pressure on it because of the use of water for a variety of industrial activities. Similarly, increase in human activities for recreational fishing and urban development will continue to deplete the salmon population and degrade the South Santiam watershed. However, efforts to save the South Santiam have met with far greater success than the efforts to save the Lynnhaven in the past few years. The reasons for this success are:

- The efforts to protect the watershed are remarkably well organized. The South Santiam Watershed Council (SSWC) is actively involved in every project and has made many attempts to integrate the efforts.
• All the stakeholders in the watershed are well represented. This ensures that any program designed to conserve the resources will receive inputs from all parties affected.

• The priority issues have been clearly delineated and the conservation and protection of the salmon has been stated as a major goal. This automatically focuses attention to recreational boating and fishing activities and means to regulate them.

• Unlike in Lynnhaven, the activities of all the participating organizations and agencies are well coordinated by the SSWC and this ensures that all programs are implemented smoothly avoiding any repetition and waste of time and money.

• The WPA as advocated by the EPA has so far been followed. It is however too early to make any comment about the success or failure of the approach because the efforts are still in their early stages.

• The success of the SSWC can be attributed to the fact that it has a strong state support from all the state agencies and departments. Added to that is the existence of The Oregon State Plan, which provides a focus to the conservation efforts in the South Santiam watershed.

It remains to be seen how well programs are designed and implemented to achieve the stated goals and if the watershed can be effectively managed and protected for the future. Irrespective of which watershed it is, there are some strategies which need to be followed and this is what the WPA attempts to do. In my opinion some of the management and conservation strategies/policies that can be adopted by all watersheds are listed below:
• It is essential to define the boundaries of the watershed and gather all information, data, maps and tables relating to its resources, waterways, people, etc.

• Analysis of the data should yield opportunities and constraints for development and conservation. Based upon the results of analysis, goals and priority issues should be identified. A ‘statement of purpose’ should support every goal or program.

• Identification and determination of the participants would be essential to any successful implementation plan. Additional programs to promote active interest in watershed activities can be initiated. Plans should be designed to educate more people and generate understanding about the stakes involved.

• All programs need to be financed and therefore, budget issues should be resolved before starting any project to prevent conflict once the program is operational.

• Impact analysis can be used to predict the current and future environmental, social and economic implications of activities in the watershed.

• As suggested in the WPA, integrated solutions can be applied to different goals. The strategies have to be evaluated for their feasibility and applicability to a region.

• Alternatives for every approach need to be decided in the preliminary stages.

• To manage recreational conflict issues, strict enforcement of boating and recreational safety regulations should be done. Providing alternative sites for docking vessels, restricting sensitive areas from any vessel intrusion and having strict permitting standards with no exceptions are ways to achieve this goal.

• Plans and programs that enhance and protect natural resources and recognize the value of protecting shallow and riparian habitats and attempts to minimize the impact
from human activities. This has been done in several areas through establishment of no wake zones and fishing and boating restrictions.

- All the strategies adopted need to be backed by legal framework of policies or legislation. When a policy regarding resource protection is well defined, the task of implementing it is made simpler by virtue of the fact that there will be no one to question the word of authority.

- Finally the most important factor to aid the success of watershed protection and management is education. Understanding the significance of a resource and the need to protect it is half the battle won.
Chapter 7: References

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EDUCATION

Masters in Urban and Regional Planning Aug '97 – May ‘99
Virginia polytechnic Institute and State University,
Blacksburg, VA 24060
GPA: 3.8/4

Master of Science in Ecology Jul '94 - Jun '96
Salim Ali School of Ecology and Environmental Sciences,
Pondicherry University, India
GPA: 8.72/10 (University Gold Medallist)

Bachelor of Science in Chemistry, Botany And Zoology Jun '91 - Apr ‘94
M.E.S College of Arts, Commerce and Science,
Bangalore University, India
Result: 84.5% (Rank holder in the University)

WORK EXPERIENCE

Planning Aide, City of Virginia Beach (summer internship) May ‘98 - Jul ‘98
• Worked for the City Environmental Management Center on the Lynnhaven Watershed
  Management Plan. Work involved researching and documenting the watershed management
  approach and the work accomplished by all organizations involved in protection and
  conservation of the Chesapeake Bay.
• Published a report to serve as background for future management plans and strategies for the
  Lynnhaven Bay.

Graduate Assistant, Department of Urban Affairs and Planning Aug ‘97 – Present

Trainee, Clinical Chemistry Research Laboratory, Bangalore, India Jun '97 - Jun '97
• Studied basics of Clinical Analysis for common Health disorders, prepared patient reports for
  follow-ups.
• Administrative work involving stocktaking and data filing.

Research Student, JIPMER (Jawaharlal Institute of Post Graduate Medical Education and
Research) Pondicherry, India Jun ’95 - Jul ’96
• Analyzed and catalogued birth defect records for a 7-year study period at the Medical
  Records Data Center. Study aimed to establish that birth defects were on a constant increase
  in the region over time and may have been influenced by parental occupation related
  exposure to possible mutagens.
• Conducted a field study to show the increased occurrences of birth defects in a polluted
  industrial area.
PROBLEMS
• Housing and infrastructure evaluation study of the Hurt Park Neighborhood, Roanoke City, Virginia in collaboration with the Roanoke Neighborhood Partnership.
• Needs assessment study for the development of a Resource Management Plan for Buffalo Mountain, Virginia

RELATED SUBJECTS
Urban Planning Studio  Land Use and Environment  Environmental Planning Studio
Land Use Planning  Principles of EIA  Natural Resources Planning & Policy
Land Use Law  Environmental Toxicology  Advanced Quantitative Techniques
Conservation Biology  Health and Environment  Real Estate principles
Management of Ecosystems  Health and Environment  Environmental Ethics and Policy
Microeconomics for Planning professionals  Environmental Mutagenesis

COMPUTER SKILLS
Platforms/Operating Systems: PC, Macintosh, MS-DOS, Windows95, Windows 3.1
Software: MS Word, MS Excel, MS Power point, ABC flowchart, SPSS, MS Access, Project Manager

HONORS AND ACTIVITIES
• Awarded the University Gold Medal for topping the M.S. degree program at Pondicherry University.
• Selected as Outstanding Graduate Student of India in 1996 by the Prime Minister’s office.