

# Chapter 9

## Water Quality Stressors and Sources of Impairment in the Pasquotank River Basin

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### 9.1 Stressor Identification

Human activities can negatively impact surface water quality, even when the activity is far removed from the waterbody. The many types of pollution generated by human activities may seem insignificant when viewed separately, but when taken as a whole can result in significant stress to the aquatic ecosystem. Water quality stressors are identified when impacts have been noted to biological (fish and benthic) communities or water quality standards have been violated. Stressors apply to one or more use support categories and may be identified for Impaired, as well as Supporting waters with noted impacts.

Identifying stressors is challenging because direct measurements of the stressor may be difficult or prohibitively expensive. DWQ staff use field observations from sample sites, special studies and data from ambient monitoring stations, as well as information from other agencies and the public to identify stressors and potential sources. The Division of Environmental Health Shellfish Sanitation Section collects data and information regarding potential sources of water quality stressors to shellfish growing areas. It is important to identify stressors and potential sources of stressors so that water quality programs can target limited resources to address the stressor.

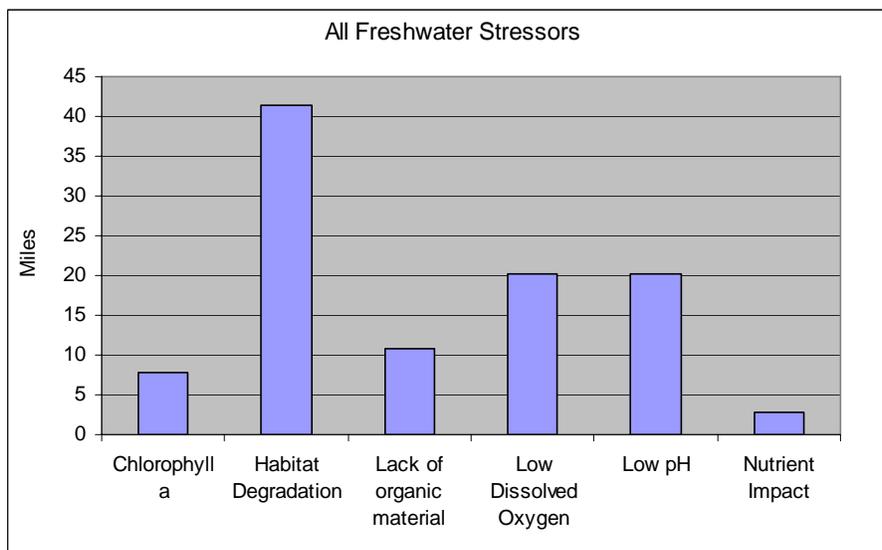
Stressors to recreational use include pathogenic indicators such as fecal coliform bacteria, *escheria coli* (*E. coli*), and *enterococci*. In the fish consumption category, mercury and dioxin are the noted stressors. Other substances may also result in the issuance of a fish consumption advisory or advice by the NC Department of Health and Human Services (NCDHHS).

Most stressors to the biological community are a complex grouping of many different stressors that individually may not degrade water quality or aquatic habitat, but together can severely impact aquatic life. Sources of stressors are most often associated with land use in a watershed, as well as the quality and quantity of any treated wastewater that may be entering a stream. During naturally severe conditions such as droughts or floods, any individual stressor, or group of stressors, may have more severe impacts to aquatic life than during normal climatic conditions. The most common source of stressors is from altered hydrology

#### 9.1.1 Overview of Stressors Identified in the Pasquotank River Basin

The stressors noted below are summarized for all waters and for all use support categories. Figure 11 identifies stressors noted for Impaired streams and streams with noted impacts for freshwater bodies. The stressors noted in the figure may not be the sole reason for the impairment or noted impacts. Fecal Coliform is the sole parameter that results in impairment in the shellfish harvesting category. DWQ relies heavily on Division of Environmental Health growing area classifications and Shellfish Sanitary Surveys for identification of sources of fecal coliform. For specific discussion of stressors to the impaired or noted waters, refer to the subbasin chapters. Stressor definitions and potential impacts are discussed in the remainder of this chapter.

Figure 11 Freshwater Stressors



### 9.1.2 Dioxin- Stressor

In the fish consumption category dioxin is a stressor resulting in the Impairment of waters in Albemarle Sound to the mouths of the Chowan and Roanoke Rivers. Dioxins are the byproducts of industrial processes and are formed during the chlorine bleaching process at pulp and paper mills. The current dioxin advisory was issued by the Department of Health and Human Services in 2001. The advisory is for the consumption of catfish and carp in the Albemarle Sound from Bull Bay to Harvey Point; West to the mouth of the Roanoke River and to the mouth of the Chowan River to the U.S. Highway 17 Bridge (Perquimans, Chowan, Bertie, Washington, and Tyrrell Counties). Women of childbearing age and children should not eat any catfish or carp from this area until further notice. All other persons should eat no more than one meal per month of catfish and carp from this area. For more information on this advisory please visit the DHHS website <http://www.epi.state.nc.us/epi/fish/>.

### 9.1.3 Copper- Stressor

Ambient water quality samples in the Pasquotank River basin found Copper as the most common problem parameter identified. Copper is naturally occurring in the ocean and estuaries; however, concentrations of copper typically range from 0.3 to 3.8  $\mu\text{g/L}$  in estuaries and 0.1 and 2.5  $\mu\text{g/L}$  in coastal waters in the United States. For all twelve of the ambient stations, at least 10 percent of the samples were above 3.8  $\mu\text{g/l}$ . For eight of the twelve ambient stations, samples were above 3.8  $\mu\text{g/l}$  at least 25 percent of the time. Higher than normal copper concentrations found in the basin may indicate anthropogenic sources of copper such as copper antifouling boat paints. These paints are designed to leach copper into the water to reduce barnacle and algal growth on boat bottoms. Boaters should use alternative nontoxic antifouling paints to protect their boats.

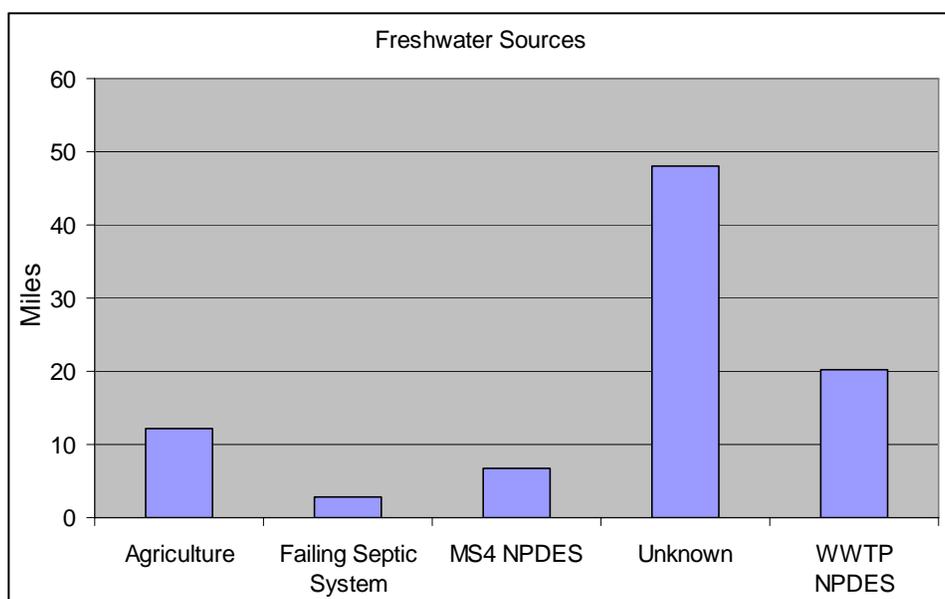
## 9.2 Source Identification

DWQ identifies the source of a stressor, point or nonpoint, as specifically as possible depending on the amount of information available in a watershed. Most often the source is based on the

predominant land use in a watershed. Stressors sources identified in the Pasquotank River basin during this assessment period include urban or impervious surface runoff, construction sites, road building, marinas and agriculture. Point source discharges are also considered a water quality stressor source. In addition to these sources, many impacts originate from unknown sources.

Stormwater runoff from a variety of land use practices is identified as the primary source of impairment to shellfish harvesting waters in the Pasquotank River basin. Runoff from rain events carries the fecal coliform bacteria stressor that results in impairment of the shellfish harvesting use support category. Established development, new construction, animal waste (e.g., domestic pets, agricultural animals, and wildlife), and human waste from sewer overflows and failing septic systems are all contributing factors to compounding problems in stormwater runoff. Figure 12 below shows stressor sources identified in the Pasquotank River basin.

Figure 12 Stressors Sources



### ***Reverse Osmosis Water Treatment- Source***

As development continues to expand along the NC coastline new drinking water treatment facilities have opened over the last several years to meet demands of population growth. There are 16 permitted water treatment plants in the Pasquotank River basin. With these new facilities, State and federal natural resource agencies are concerned with discharge of filter backwash and reverse osmosis reject water into estuarine and coastal receiving waters. Reverse Osmosis (RO) Water Treatment uses semipermeable membranes for water purification by forcing water through a membrane against the concentration gradient. This process allows water molecules to pass through the semipermeable membrane and excludes ions (e.g.,  $\text{Na}^+$ ,  $\text{Ca}^{2+}$ ,  $\text{Cl}^-$ ) or larger molecules (e.g., bacteria, organic contaminants). Discharge from RO plants has the potential to create an ion-imbalance problem, depending on the salinity and mixing conditions of the receiving waters. Discharge can be highly ionic which can further stress estuarine and coastal environments.

Since 2000, DWQ permitting policy for monitoring whole effluent toxicity (WET) (i.e., tests to determine toxicity of discharges to sensitive aquatic species) of RO facilities has evolved. Permitting strategies were developed by an interagency workgroup to evaluate the impact RO discharge may have on the state's coastal waterways. As expected, data collected in coastal basins indicate that the briny (i.e., salty) discharge is less toxic to saltwater organisms than freshwater organisms. The interagency workgroup produced one major recommendation: the initial planning stage of RO facilities should incorporate the location of discharge outfalls such that the effluents produce minimal water quality impacts. WET data collected in the Pasquotank River basin strongly support this recommendation. (DWQ ESS, April 2006).

An ecological assessment of the proposed Currituck County and Pasquotank County Reverse Osmosis Water Treatment Plant discharge sites was conducted by Eastern Carolina University's Institute for Coastal and Marine Resources. In effort to identify potential effects on receiving waters from RO facility discharges this study used environmental conditions at the Camden County Reverse Osmosis WTP as a baseline. The following information is a summary of environmental condition data for the Camden WTP area collected from July 2005 to June 2006 as reported by Rulifson et al., 2006.

The Camden WTP discharges to the Pasquotank River across from Elizabeth City and the US Coast Guard facility. The facility draws water from two 600-foot wells from the Castle Hayne aquifer, and two 100-foot wells from the Yorktown aquifer. Discharge from the Camden RO-WTP was relatively constant at ~207,000 GPD, with the effluent plume shifting with prevailing winds and current conditions.

- The salinity of the in-plant discharge from the Camden Reverse Osmosis WTP ranged from 10.2-15.2 ppt and the groundwater feed to the plant varied from 8.1-8.3 ppt and 0.9-1.0 ppt for the Castle Hayne and Yorktown, respectively.
- Ion concentrations were much more variable at the bottom sites around the diffuser than at surface sites, and generally showed decreasing concentrations away from the diffuser in all directions. Surface waters were not noticeably affected and showed less variable chemistry than bottom waters.
- Ratios of major ions (except  $\text{HCO}_3^-$ ) to chloride were similar to surface water and groundwater samples. For,  $\text{HCO}_3^-$  in  $\text{Cl}^-$  the groundwater feed into the RO-WTP and the in-plant discharge were significantly higher than that of local water from the Pasquotank River and Albemarle Sound.
- Agronite is the only mineral to potentially reach saturation and precipitate out in the receiving waters, but will likely dissolve quickly as waters mix.
- Ammonium concentrations within 15 meters of the diffuser were significantly higher suggesting the possibility of increased photosynthetic activity and perhaps algal blooms. No algal blooms were observed during the study period, however, the naturally dark color of the river water results in visibilities of less than 0.5 meters suggesting that minimal light penetration may limit photosynthesis. (Rulifson et al., 2006).

More information regarding aquatic life, recreation, fish consumption and shellfish harvesting stressors and sources can be found in Chapter 3 of the *Supplemental Guide to North Carolina's Basinwide Planning: Support Document for Basinwide Water Quality Plans* <http://h2o.enr.state.nc.us/basinwide/SupplementalGuide.htm>.