ABSTRACT

ASSESSMENT OF BACTERIAL CONTAMINATION IN THE SINCLAIR-DYES INLET WATERSHED: THE INITIAL PHASE OF A WATERSHED-BASED TMDL IMPLEMENTATION PROGRAM

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Human development and land-use activities in coastal watersheds have the potential to significantly alter the aquatic ecosystems of estuaries and near shore areas. In addition, land-cover alterations and land-use activities in upland watersheds can also contribute nonpoint-source pollution. The sources of bacterial contamination in developed watersheds are ubiquitous and widespread sources include humans, domestic animals, and wild animals. Beneficial uses of estuarine, near shore, and coastal marine water resources are diverse and generally very highly valued. These beneficial uses include passive recreation, swimming, boating, fishing, and shellfish harvesting. As human population and development within the near shore area and in adjacent watersheds has increased, there has generally been an increase in the number and extent of "beach closures" for fishing, contact recreation, and shellfish harvest. Currently, bacteria contamination ranks among the top three causes of "non-attainment" for marine receiving waters. Sinclair and Dyes Inlets, as well as several contributing drainages are currently on the 303(d) list for bacterial contamination and several other pollutants. In addition, near shore habitat for salmonids and other native species is degraded. A watershed-based total maximum daily load (TMDL) implementation program is underway to address all of these problems from an ecosystem perspective. This paper will focus on bacterial contamination.

Recent studies indicate that levels of bacterial contamination in near shore areas is strongly correlated with human population, the level of watershed development, and the quantity of impervious surfaces within a drainage area. In most cases, impervious areas such as roads, driveways, sidewalks, and lawns act as source areas, collecting and concentrating pollutants during dry weather. Rainstorms tend to wash these pollutants, including fecal material, into the storm water drainage system and from there on into the natural drainage network and ultimately into receiving waters. An integrated, comprehensive monitoring program was developed to target all known and potential sources of bacterial contamination throughout the watershed. Streams and storm water outfalls were sampled during base flow conditions and storm events. Near shore and marine areas were also monitored. The results of this monitoring effort as well as subsequent bacterial source tracking and pollution correction efforts will be discussed in detail.

Based on the findings of this study, storm water runoff is a significant source of bacterial contamination in urbanizing watersheds. In addition, improperly installed or poorly maintained on-site sewage (septic) systems are also a significant source of near shore bacterial contamination. From a bacterial pollution perspective, it can also be concluded that it is exceptionally difficult to maintain all the beneficial uses of receiving waters as development progresses within a watershed. Even at low levels of development (rural to low-density

suburban) bacterial contamination of storm water runoff is widespread and at a high enough concentration to significantly degrade water quality. In addition, the potential list of bacterial sources in urbanized watersheds is large and diverse, although human-related (domestic pets, livestock, sewage overflows, and failed septic systems) sources appear to dominate. Another vexing conclusion that can be drawn from current research is that watershed best management practices (BMPs) need to be highly effective and widespread if bacterial contamination is to be controlled. Watershed-based bacterial pollution source control is still in the formative stages of evolution, but prevention is still the key. The overall value of source control as a BMP is obvious, however it is not clear as to how to maximize its effectiveness. This should include an aggressive public education program to make people aware of the sources of bacterial contamination as well as the ecological and socio-economic impacts of this pollution. Control of pet and livestock waste should be a very high priority. Routine septic system inspection and maintenance should also be a component of this source control effort.