COASTAL GEORGIA OSDS: GEO-LOCATION, INSPECTION & MAINTENANCE

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Abstract. Most of Georgia's coastal counties have limited municipal sewage treatment systems and rely heavily on individual on-site septic disposal systems (OSDS) to handle human sewage production. OSDS have a great potential to become dysfunctional after a short period of time, if a homeowner maintenance schedule is not implemented. The threat of dysfunctional systems makes it imperative to inspect and maintain OSDS to prevent nonpoint source pollution, particularly in the areas of tidal wetlands, a highly productive biological nursery and ecosystem that is the predominant coastal boundary system.

The UGA Marine Extension Service (MAREX), the Coastal Health District and Local Health Departments, the Southern Georgia Regional Commission (SGARC) and EPD's Coastal Nonpoint Source Program (NPSP) have partnered to implement a Clean Water Act section 319 (h) grant funded project which has geo-located all relevant existing OSDS and water wells within the proximity of marshlands or other waters of the state in Bryan, Effingham, Liberty and Long counties. The project produced GIS maps by plotting verified OSDS and well positions and provided access to additional GIS layers for further analysis. All data was placed in SGARC's transferable geo-referenced WelSTROM database, which is web accessible. The project also assisted Camden and McIntosh counties in transferring historical OSDS data into the WelSTROM GIS database. The database provides a standardized method of recording all current and future OSDS installations for all Coastal NPSP Area local health departments.

INTRODUCTION

Local public health offices often lack the resources to conduct proper surveys of the soil types and other characteristics to determine if the area can safely support OSDS, thus improper systems are sometimes installed. In particularly, rural or remote portions of counties within close proximity of state waters have become a concern because improperly regulated dysfunctional OSDS are a potential threat to the public's health. MAREX served as the principal investigator for this section 319 (h) grant funded project that partnered with the Coastal Health District and Local Health Departments, the SGARC and EPD's NPSP to conduct , a comprehensive environmental regulatory program for local government officials and homeowners that defines the relationship between individual OSDS and surface water quality. This program stresses the protection from and prevention of septic contamination, calling for the periodic system inspection and maintenance by homeowners.

The project initially identified and located all relevant existing OSDS and water wells and visually inspected each individual system for signs of failure. The local health departments took immediate enforcement actions to ensure that all identified failing systems were repaired or replaced according to Georgia statute. Immediate remedial actions are needed to resolve problems with failing systems which are essential to improve the quality and prevent impairment of coastal waters.

IMPACT OF DYSFUNCTIONAL OSDS

For effective treatment, it is essential that on-site sewage systems include, among other, provisions for an adequate vertical separation. Vertical separation primarily affects degradation of organic nutrients (i.e. BOD5) and removal of bacteria and viruses. It also plays a role in converting nitrogen to soluble nitrate ($NO3-$) ions which can then readily migrate into the groundwater unless denitrifying conditions are present. Vertical separation is the depth of permeable, unsaturated soil (soil types 2-6, as per WAC248-96-094) that exists between the bottom of a subsurface soil absorption system and some restrictive or limiting layer or feature such as a water table, bedrock, hardpan, unacceptable fine textured soils, or excessively permeable material (Hall, 1990).

Bacterial contamination caused by dysfunctional OSDS is a real threat to coastal Georgia water quality. Fecal coliforms, *Eschericia coli* or enterococci bacteria are indicators of human and animal fecal pollution associated with the presence of potentially dangerous pathogenic strains of bacteria and viruses. Increased nutrient loading from faulty OSDS, specifically from nitrogenous compounds, represent another threat to water quality that can lead to reduced dissolved oxygen levels and algal blooms in the water column.

Harmful algal blooms (HABs) are periodically found in the waters of almost every US coastal state. Notable toxic algae include those responsible for "red tides" caused by blooms of dinoflagellates including the species *Gymnodinium breve* and the flesh eating organism, *Pfiesteria piscicida* that has plagued coastal North Carolina and Maryland (Luttenberg et al., 2000). These "red tides" kill fish and other marine species. Blooms of toxic algae also devastate tourism and the seafood industry.

GIS TECHNOLOGY & PUBLIC HEALTH

Information technology has become critical to public health practice and management. First, geography is a near-universal link for sorting and integrating records from multiple information systems into a more coherent whole. Second, modern GIS systems provide a format that allows the quick response needed for public health decision making. Third, GIS facilitates policy development (*Yasnoff & Sondik, 1999*).

GIS can spatially represent site characteristics and hydrological responses with mapped features. A GIS system can help describe the suitability of a site to locate a septic-system and assess the potential for nitrate pollution of groundwater from that location (*Stark, Nuckols & Rada, 1999*).

A GIS-based study was conducted in McIntosh County, Georgia to locate and inspect OSDS. One thousand and fifty six septic tanks adjacent to the coastal waters or salt marsh in McIntosh County were mapped. Of these, 53 (5%) were visually dysfunctional. One hundred septic tanks were found within one foot and an additional 11 were between 1 and 25 feet of a body of water, the minimum distance away from a body of water required by state regulations for the proper placement of septic tanks. The combination of the shallow coastal water table and prevalent sandy soil (esp. Bohicket-Caper-Water soil type) indicated that most (63%) of the tanks were found in areas of high pollution susceptibility. Likewise, 75% of the septic tanks in McIntosh County occur in the 100 year floodplain. Eighteen percent of the septic tanks occur within water recharge areas *(Walker, Cotton & Payne, 2002).*

PURPOSE & LIMITATION OF STUDY

The purpose of the study is to determine area factors of potential OSDS pollution susceptibility by geo-locating, inspecting and inventorying septic tanks located within 90'of state water bodies or marshlands in Bryan, Effingham, Liberty and Long counties. The information gathered for this project includes only the land parcels with OSDS within 90' of State water bodies or marshlands found in the target counties. This study evaluated the geo-location and inspection of OSDS in Bryan, Effingham, Liberty and Long counties within the given boundary. The data collection timetable was one year.

METHODOLOGY

MAREX partnered with the SGARC, Coastal Health District and the Bryan, Effingham, Liberty and Long County Health Departments to train one employee (inspector) whose duties would be to locate and provide GPS data on OSDS and well positions and provide other OSDS data related activities as required by the project. Each inspector received a Trimble Juno SB Global Positioning System (GPS) unit and appropriate training on both the use of the GPS unit and the use of the WelSTROM database. Each county health inspector conducted a survey to geo-locate and inspect all relevant OSDS and well locations within 90' of marshlands or other state waters in Bryan, Effingham, Liberty and Long counties. The 90' boundary was deemed optimal through GIS layer analysis.

The inspector recorded the GPS coordinates of the home structure in situations when access to the property was denied by such barriers as homeowner refusal, locked gates, animals, or dense tree canopy by noting the property and using a GIS mapping tool to gain the GPS coordinate. All located OSDS were evaluated and noted if the device was visually dysfunctional or not.

Figure 1: Project Tracking Website, Liberty County

During each county survey, the collected GPS positions were transferred from the Trimble Juno SB GPS unit to a county health department computer equipped with the Trimble GPS software interface. The GPS data coordinates were then downloaded into a GIS folder. Periodically, this GIS folder was emailed to the MAREX GIS Specialist. The Specialist checked the data coordinates for discrepancies. Once the data was cleared for accuracy, the Specialist uploaded the coordinates into the Project Tracking Website and forwarded the coordinates to the SGARC's GIS Director for input into the WelSTROM GIS database. Even after project funding expires, each county will maintain access to the WelSTROM septic and well database/map website and a map database website containing specific datasets referencing public health planning.

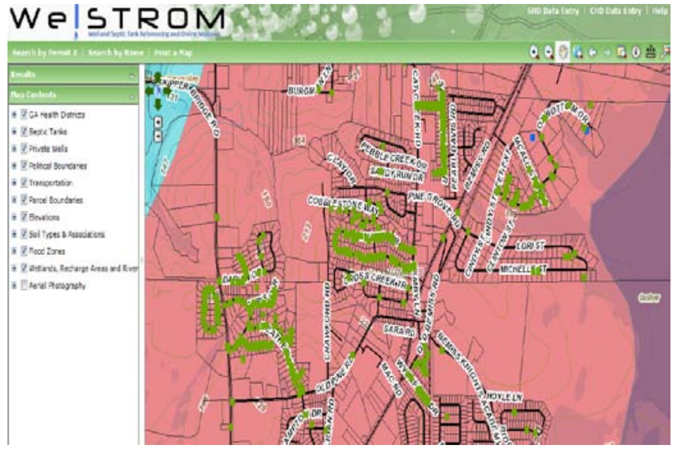

Figure 2: WelSTROM GIS Database for Septic & Well Systems

RESULTS

During this project, a total 2,345 OSDS were geo-located and inspected in Bryan, Effingham, Liberty and Long counties. A complete breakdown of results by county follows in figures 3-6. Of the four counties, only Bryan and Effingham reported OSDS failures inside the project boundary, with 18 total failures reported during the grant period. A total of 334 well heads were geo-located. A number of these wells are "community wells" and service as many as 50 homes.

GIS analysis used the following GIS layers: Floodplain Data (Federal Emergency Management Agency), National Wetlands Inventory Data (U.S. Fish & Wildlife Service), State Soil Geographic Data (United States Department of Agriculture-Natural Resource Conservation Service), Pollution Susceptibility (Georgia Geologic Survey), Geology (Georgia Department of Natural Resource), Ground Water Recharge Zones (Georgia Department of Natural Resource), Licensed Shellfish Bed (Georgia Department of Natural Resources). This study determined the significance of OSDS impact by calculating the percentage of GIS layer characteristics that are deemed as unfavorable conditions which could lead to potential OSDS pollution for each county.

Bryan County

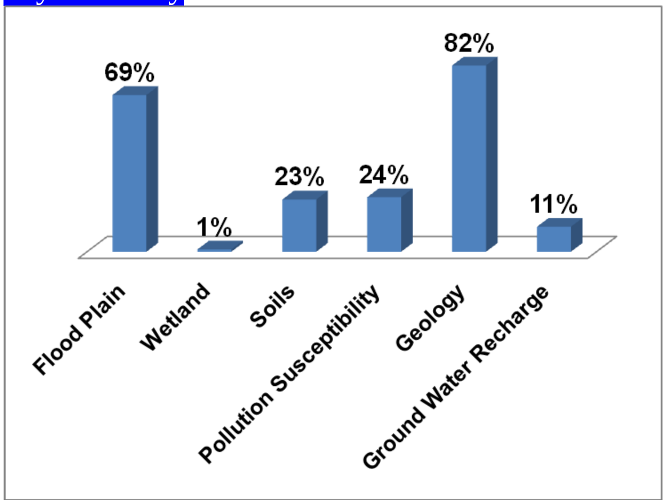

Figure 3: Bryan County GIS Layer Significance of Impact

The majority, 403 (69%) of OSDS surveyed in Bryan County, were within the 100 year flood plain. Only 5 (1%) of the OSDS surveyed were located in an area classified by the U.S. Fish and Wildlife Service as a Wetland. The U.S. Fish & Wildlife classifies 17 subsets of wetland types. For this study, all OSDS and well coordinates captured were designated as either being in a wetland area or an upland area.

The majority of OSDS were located in the Bohicket, 133 (23%), soil type. Bohicket soils are found on broad level tidal flats bordering the Atlantic Ocean; less than 3 feet above mean sea level and extending 5 to 15 miles inland along some of the larger rivers. Bohicket soils have very poor draining properties, exhibiting both very slow runoff and very slow permeability characteristics (http://ortho.ftw.nrcs.usda.gov/osd/dat).

Of the OSDS surveyed, 139 (24%) were located in a high pollution susceptibility zone. Pollution susceptibility levels refer to the time needed to complete groundwater runoff in relation to soil types found in this area. A high, low or average susceptibility refers to the travel time or speed required for groundwater runoff to completely pass through a landscape.

The majority, 478 (82%) of the OSDS surveyed, were located in the Qhm: Holocene Shoreline Complex. The Holocene and Pamlico Shoreline Geologic Complex indicate that these systems are located in marshland and lagoon bedrock areas.

Only 65 (11%) of the OSDS were located in groundwater recharge areas. Groundwater recharge is a hydrologic process in which rain water percolates through the soil column as it transforms from surface water to groundwater.

Effingham County

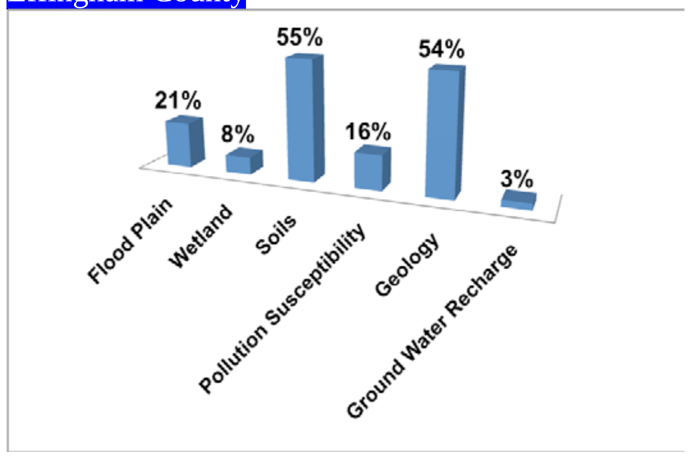

Figure 4: Effingham County GIS Layer Significance of Impact

Of the OSDS surveyed, 60 (21%), were found within the 100 year flood plain. Only 22 (8%) of the OSDS surveyed were located in an area classified by the U.S. Fish and Wildlife Service as a Wetland.

The majority of OSDS were located in the Pottsburg soil type, 157 (55%). The Pottsburg soil type is classified as Coastal Plain/upland and consists primarily of marine sediments. Drainage is poor with some areas subject to flooding. Permeability is moderate (http://ortho.ftw.nrcs.usda.gov/osd/dat).

Only 46 (16%) of OSDS surveyed were located in a high pollution susceptibility area. The majority of OSDS were located in the Qpnm: Penholoway Shoreline Complex,114 (40%), as well as the Qpni: Penholoway Shoreline Complex, 38 (14%),substrate. The Penholoway Shoreline Complex is defined by clay loam sediments located at 50-70 feet above sea level. Only 8 (3%) of OSDS surveyed were located in groundwater recharge areas.

Liberty County

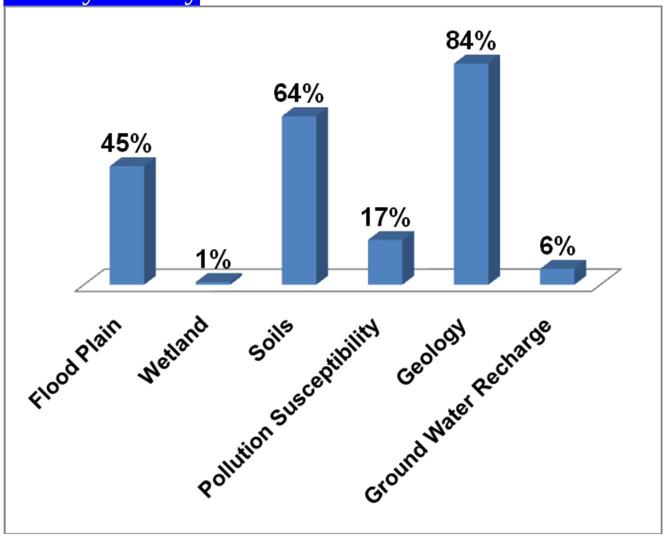

Figure 5: Liberty County GIS Layer Significance of Impact

Of the OSDS surveyed, 613 (45%) were located in the 100 year flood plain. Only 8 (1%) of OSDS were located in a wetland area.

The majority of the OSDS surveyed were located in Bohicket, 570 (42%), and Brookman, 303 (22%), soil types. Brookman soils are found on broad, shallow depressions of the Pamlico terraces and flood plains in the lower Coastal Plain. The water table is located at a depth of 0 to 1.0 foot late in the winter and early spring and occasionally in the summer and fall at those depths (http://ortho.ftw.nrcs.usda.gov/osd/dat).

Only 239 (17%) of OSDS surveyed were located in a high pollution susceptibility zone.

The majority of OSDS were located in the Qpmm: Pamlico Shoreline Complex, 611 (45%), and Ohm: Holocene Shoreline Complex, 528 (39%), substrate. The Holocene and Pamlico Shoreline Complex refer to systems located in marshland and lagoon bedrock areas. Of OSDS surveyed, 84 (6%) were located in groundwater recharge areas.

Long County

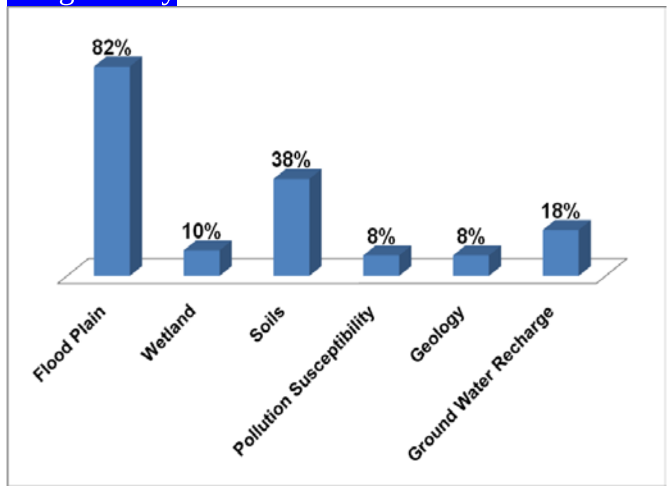

Figure 6: Long County GIS Layer Significance of Impact

The majority of OSDS, 91 (82%) were located in the 100 year flood plain. Only 11 (10%) of OSDS were located in a wetland area.

The majority of OSDS were located in Pelham soil type, 42 (38%). Pelham soil drains poorly and exhibits slow runoff capacity and moderate permeability. Pelham areas often form ponds during brief periods of flooding (http://ortho.ftw.nrcs.usda.gov/osd/dat).

The majority of OSDS, 9 (8%) surveyed were located in a high pollution susceptibility zone.

The surveyed OSDS were located in the Qpni: Penholoway Shoreline Complex substrate, 9 (8%).

Of OSDS surveyed, 20 (18%) surveyed were located in a groundwater recharge zone.

DISCUSSION

This project specifically addressed Georgia's requirement to develop a federally-approved, comprehensive Coastal Nonpoint Source Management Program. The work focused on the federal conditions that apply to individual septic systems and the protection of aquatic resources. Phase I of this initiative was successful and accomplished the following objectives: (1) the inspection and GIS in-

ventory of onsite septic disposal systems (2,345) and wells (334) in relevant, high priority areas adjacent to state waters; (2) creating the first GIS inventory system of septic systems and wells in the 11 county EPD's NPS region; (3) establishing the technical process that improved collection and verification of OSDS position locations followed by data entry into the Department of Community Health's mandatory Statewide Garrison Database; (4) development of mapping capacity (WelSTROM) to improve local and state management of septic systems and wells; and
(5) providing public outreach and education efforts to convey the importance of mandatory homeowner maintenance of installed OSDS.

The geo-location and inspection of OSDS and wells for all of the coastal counties provides vital information for resource managers. The compiled information coupled with the enactment of the developed model ordinances provide urban and rural county municipal officials or planners with powerful new tools that will help them protect and preserve coastal natural resources, as well as public health.

This pilot project process has been transferred to Camden, Chatham, Glynn & McIntosh counties (Phase II) beginning in July 2010. All Phase I project maps are available at: http://www.marex.uga.edu/advisory/cssmip.html.

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