

Use of Aerial Photography to Evaluate Domestic Wastewater Treatment Options

David A. Mays, Teferi Tsegaye and Eddie Davis* Alabama A&M University and USDA/NRSC*

ABSTRACT

Scientists from Alabama A&M University investigated the status of domestic wastewater treatment in the black land prairie (Black Belt) region of Central Alabama. The soils of that area are montmorillonitic clays overlaying limestone or chalk which shrink, swell, and crack and have poor internal drainage. Water accumulates on or near the surface in wet weather and septic tank systems often fail. A survey found that there are more than 70 approved centralized wastewater treatment facilities in the 11 county area. However, the residents of most villages and small towns do not have access to centralized waste treatment. We propose that a relatively low cost treatment option could use individual septic tanks for primary treatment with the effluent being collected for further treatment in a sand filter, lagoon or wetland or used for irrigating non-food crops. Using Dallas County, Alabama for a pilot project, we used a county-wide aerial ortho-photograph along with ARC-GIS 9.1 computer technology to identify 11 rural housing concentrations where centralized effluent concentration appears to be feasible. We believe that a public utility with the ability to issue bonds or raise money by some other means could install such a wastewater treatment system and retire the debt with a monthly fee for service from each homeowner. The aerial photos can be obtained from the USDA FAS aerial photography field office, 2222 West 2300 South, Salt Lake City, UT 84119-2020.



Marion Junction Soils: Houston Clay, Aktibbeha Clay, Sumter Clay, Vaiden Clay

INTRODUCTION AND BACKGROUND

The blackland prairie region of Alabama (Black Belt) covers parts of 11 counties and stretches across the south central portion of the state from Russell County in the east to Sumter and Choctaw Counties in the West. The blackland soils extend on westward into parts of eastern Mississippi. Many of the Black Belt soils are montmorillonitic clays overlaying limestone or chalk. These soils typically shrink, swell and crack and have poor internal drainage. Because of this, water often accumulates on or near the surface in wet weather. There are also poorly drained sandy soils in this region where water tables are high.

This expanse of poorly drained soils in the Black Belt creates serious domestic wastewater disposal problems for many households and commercial properties. The Alabama Department of Public Health lists 76 approved public wastewater treatment facilities in the 11 county area. They serve the larger municipalities, rural schools, and some mobile home parks and subdivisions. The permitted systems include mechanical treatment systems in the larger cities as well as lagoons and spray fields which often serve more rural needs. This leaves most smaller communities as well as all rural areas to depend on septic tank treatment of their domestic waste.

While septic tanks can be effective for treating wastewater, they depend on discharge to a field line grid for final disposal of the water. In a properly sited and operating system, the water percolates downward and is further cleaned as it moves through the soil. However, in a poorly drained soil or one with a high water table, the septic tank effluent often accumulates on the soil surface and plumbing fixtures in the house fail to operate properly. Septic tank failures caused by poor soil drainage can sometimes be alleviated by installing small constructed wetlands or mound treatment systems for final disposition of the effluent water. However, either of these solutions has an installation cost of \$10,000 to \$12,000 per household, and an investment of this magnitude is not possible for many low income families. Thus, there is a need for low cost, centralized systems for treatment and disposal of septic tank effluent for many small communities in the Black Belt Counties.

PROPOSED SOLUTIONS

We propose that communities with a few dozen to a few hundred homes in close proximity to each other could have wastewater disposal by using existing septic tanks connected to a collection grid which would move the effluent to a central location for further treatment and final disposal. Final treatment could be accomplished by using a sand filter, a lagoon, a constructed wetland or by using the effluent for irrigation of non-food crops. The irrigation option would require a storage lagoon to accumulate effluent for use during the growing season. Because the septic tanks would be the first link in the treatment system, the central treatment facility would not have to treat any solid waste and there would be no sludge to dispose of.

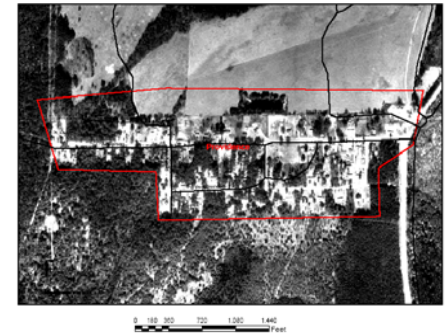


Beloit Community Soils: Berndale fine sandy loam and Savannah fine sandy loam. Note the mobile home park and the small wastewater lagoon to the left of the village

SELECTION OF POSSIBLE COLLECTION ZONES

We selected Dallas County, Alabama in the central Black Belt for a pilot project to delineate grouped housing areas where centralized effluent collection might be feasible. We used a county wide aerial ortho-photograph and ARC GIS 9.1 computer technology to identify 11 rural housing concentrations where centralized effluent collection seems feasible. Three examples of the villages which were selected are shown in the photos. In each case we used the computer to draw a boundary around the concentrated housing area. Note that the individual homesteads can be seen on the photo. These 3 villages have all been deemed to have severe wastewater disposal problems by the Alabama Department of Public Health.

The photos can also be used to identify possible sites for treatment lagoons, constructed wetlands or fields which could be irrigated with effluent. Aerial photos like those used in this study are available from the USDA FAS aerial photography field office, 222 West 2300 South, Salt Lake City, UT 84119-2020.



Providence Community Soils: Bigbee sand and Wickham fine sandy loam.

FINANCING OPTIONS

Since many of the Black Belt communities are relatively poor, creative financing will be important in implementing any improved wastewater treatment projects. We propose that public entities with borrowing or bond issuing authority provide up front financing for these projects and then retire the debt with a monthly fee from each household for wastewater treatment. This could be done by incorporated towns or villages or by water and power authorities. Most people who live in cities pay sewer fees to retire installation debt without protest and it should be feasible for small towns also. For this proposal to work, all persons living in the service area should be required to be connected to the system and should pay the monthly fee.

END RESULT

Implementation of an effluent collection and treatment/disposal system would result in improved public health. Elimination of failing septic systems and puddles of effluent in the neighborhood would result in more aesthetically pleasing surroundings. This in turn, should result in enhanced property values.

For additional information please contact:
David A. Mays
Department of Natural Resources & Environmental Sciences
Alabama A&M University
docmays@comcast.net