Beaver Creek-Purgatory Creek Watershed Study

Prepared by The Northwest Alabama Council of Local Governments

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Introduction

Water is a fundamental resource for any community. Each person requires clean water for a healthy lifestyle, for drinking, daily household use, recreation, and for preserving vital natural habitats. Because of its centrality in life and household activities, water is also a vital resource for economic development. Water quality is important because these uses and processes each demand different quality standards. Water suitable for some activities, such as agriculture or irrigation may be unsuitable for drinking. Balancing the uses of water across a range of community needs and for environmental preservation requires an understanding of the conditions and uses of water within a watershed.

A watershed is an area in which all water resources flow to a specific point along a river, lake, or stream. The watershed is a fundamental ecological unit and provides a logical framework for managing natural and environmental resources. Because of the interrelated systems and effects within a watershed, watershed management requires effective multi-disciplinary approaches, adequate stakeholder involvement, assessments of current and potential problems, measurable water quality goals, and specific actions to attain these goals.

The Beaver Creek-Purgatory Creek Watershed is home to a variety of land uses including forestry and urban development in the City of Guin. It is a also habitat for many different plant and animal species. Water quality evaluation of this area is important because the economic future of the area depends to some degree on the recreational and aesthetic value of the Beaver Creek-Purgatory Creek Watershed. As noted in the EPA's publication Water Quality in the Mobile River Basin, the major threats to water quality in the sub-basin area is from urban and agricultural runoff and increased urban development and population growth.

Officials in the vicinity of the Beaver Creek-Purgatory Creek Watershed, including Marion County, the cities of Hamilton and Guin, Alabama, have expressed concerns over the quality of water resources in the area due to the potential for new development in the area. In July 2009, the Northwest Alabama Council of Local Governments submitted a proposal to the Alabama Department of Environmental Management Water Division to conduct a Watershed Study of the Beaver Creek-Purgatory Creek Watershed. In August 2009, the proposal was accepted and the study was approved. The study was funded through Section 604(b) of the Clean Water Act. The study is intended to provide an initial assessment of existing conditions in the Beaver Creek-Purgatory Creek Watershed and provide a foundation for creating a watershed framework and future partnerships.

Natural Characteristics

Project Location

The Beaver Creek-Purgatory Creek Watershed is located in northwest Alabama in the vicinity of the City of Guin in southern Marion County, Alabama. The watershed drains the City of Guin and portions of Marion County. The watershed is a sub-basin of the Buttahatchee River Watershed, which drains portions of West Alabama and East Mississippi. On a larger scale, the watershed is part of the Tombigbee River Basin, which is part of the larger Mobile River Basin. The streams that make up the watershed originate in the higher elevations north and south of Guin, Alabama. Reedy Creek and Hughes Branch converge just southeast of Guin, south of Highway 278, to form Purgatory Creek. Purgatory Creek flows parallel to Highway 278 through Guin and is the most visible and prominent water feature in the town. Beaver Creek drains a larger and more sparsely populated area north of Guin. It converges with Purgatory Creek west of Guin, continuing its flow to the Buttahatchee River and, eventually, the Tombigbee and Mobile Rivers before finally reaching the Gulf of Mexico. The Beaver Creek-Purgatory Creek watershed is a vital local water resource due to its drainage and habitat characteristics.

Geology

The geologic formations in the watershed are of sedimentary origin and range in age from Cretaceous to Mississippian. The parent material consists of limestone, sandstone, and shale. Geologic units include the Tuscaloosa formation with undifferentiated gravel, sane and clay. The physiography of the area falls within the Gulf Coastal Plain and is found to be characteristically rolling to flat with slopes of 0 to 6 percent.

Soils

The 1976 Soil Survey of Marion County, published by the Soil Conservation Service, provides a detailed assessment of the soils, their properties, and how those properties may potentially affect development and therefore impacts to the local area watershed. A key characteristic for water quality management is the suitability of soils for use as fields for the treatment of sewage waste through the use of on-site septic tanks. Unsatisfactory performance of septic absorption fields, including slow absorption of fluids, surfacing or overflow of effluent, and hillside seepage can affect public health and safety through the contamination of surface and groundwater supplies.

The soils in the area are commonly composed of Savannah-Urban Land Complex with nearly level and gently sloping and moderately well drained areas with slopes of 0 to 6 percent. In addition to the Savannah soils, Iuka-Manatachie-Stough association and the Smithdale-Luverne-Flomaton association soil types are present. Slopes range from 0 to 2 percent. The Smithdale-Luverne-Flomaton association is well drained to excessively drained, gravelly soils on steep hillsides. Since these soils are shallow and well drained, groundwater has negligible effect on the collectors lying within this association. Slopes range from

15 to 35 percent. Most of the areas of the Savannah-Urban Land complex are artificially drained with sewer systems, gutters, drainage tiles, and to a lesser extent, surface ditches. The Savannah soil has a seasonal high perched water table at a depth of 18 to 36 inches late in winter and spring. The Savannah soil is low in natural fertility and in organic matter content. Permeability is moderate in the upper part of the subsoil and moderately slow in the fragipan. Available water capacity is moderate.

Climate

The climate in the area is moderate and varies from hot summers with a long duration with sporadic precipitation to mild winters with abrupt periods of extreme cold. Consistent and sufficient precipitation is available throughout the area. The average summer temperature is 76 degrees Fahrenheit (F°) and average daily maximum temperature is 89 F°. In winter the average temperature is 27.8 F°. Typically, initial freezing temperatures are encountered each year during the latter part of November and continue on a sporadic basis until mid-March. Average annual rainfall is approximately 60.7 inches per year with 45 percent typically falling between April and September. The average number of frost free days exceeds 200 annually. Annual snowfall is negligible for the area.

Vegetation and Wildlife

Alabama is home to a great many diverse biological species, including over 120 potential endangered and threatened species. Although no inventory has been conducted, the watershed area is a potential home for many of these. Vegetation within the watershed area is mixed. The majority of vegetation is evergreen and deciduous forest consisting of loblolly pine, sweet gum, and oak. There is also considerable cleared ground that has re-grown as shrub and scrub, as well scattered pastureland and fields. Wetland vegetation is present in local streams. The area is home to a variety of open and woodland wildlife including a variety of bird species, raccoons, foxes, squirrels, and deer.

Current and Future Issues of the Watershed

Water Quality: An overview

Water quality is affected by a variety of factors, including runoff, sedimentation, point source pollutant discharges, sanitary sewer overflows, and a host of other potential pollutants. Pollution destroys the habitat necessary to sustain life- plant, animal, and human life. Adequate clean water supply is necessary to all biological functions and is vital to the health and success of a community. Our ability to judge water quality has evolved with technology from the use of sight, smell, and taste to the use of testing equipment to detect changes in the chemistry of water sources and to detect pollutants of different types.

General perception of water quality in the Beaver Creek-Purgatory Creek Watershed is very good. Low population density, large areas of vegetation, few point source polluters, and little commercial agriculture, which limits animal waste and

fertilizer usage, all contribute to a healthy watershed. There are problems, however, and unbeknownst to many, Purgatory Creek has been listed on the State's 303(d) list due to PH levels. As part of this assessment, water chemistry testing was performed at five sites in Marion County. The results are found in Appendix B.

Water Quality Law

The primary federal laws governing water quality in the United States are Federal Water Pollution Control Amendments of 1972, which was later strengthened and modified by the Clean Water Act of 1977 and the Water Quality Act of 1987. Collectively, these are known as the Clean Water Act (CWA) and they give the Environmental Protection Agency the authority and regulations needed to regulate discharges and other sources of water pollution. Under the CWA, the EPA can regulate sources of pollution, both point source and non-point source, and finance public wastewater projects to protect water quality. The primary means of regulating pollution is known as the National Permit Discharge Elimination System (NPDES), which requires point source discharges to acquire permits and abide by discharge limitations that protect water quality. Non-point source pollution is regulated by EPA's Stormwater I and Stormwater II requirements, which require stormwater discharges and municipal sewer systems to obtain NPDES and places sedimentation and erosion control requirements for new construction.

Under the CWA, States designate streams by their common uses (recreation, swimming, fishing, boating, etc.) and establish guidelines known as Water Quality Standards (WQS). Streams that do not meet WQS are placed on the "303(d) List" and require the development of a Total Maximum Daily Load (TMDL) to establish the maximum pollutant levels for the stream to still meet WQS. TMDL development can be a long and difficult process.

The Alabama Department of Environmental Management (ADEM) has primary responsibility for permitting and enforcing the provisions of the CWA throughout the State of Alabama.

Types of Pollution

In a natural state, water contains a variety of organic and inorganic compounds that are present as a result of natural processes. In a natural hydrologic cycle, rainwater falls to the ground, collects as runoff, and moves toward streams and into groundwater. In its course, it collects soils, metals, and organic materials that travel with it to streams. When people enter the picture, additional sources of contamination are introduced. Population density and urban development brings activities such as agriculture, industry, and site disturbance that can introduce additional pollution to area waters. Almost all naturally occurring water sources requires some degree of treatment to become suited to human activities. Water treated to drinking water standards is subjected to chemical and mechanical processes that introduce foreign matter. It is then used for some process

(drinking water, irrigation, industrial activities, etc.) that introduces additional pollutants. Used water is then discarded, hopefully to an adequate treatment facility, where it is treated to a standard (again through chemical and mechanical means) to be discharged back into the waters of the area. Meanwhile, rainfall in an urbanized area is exposed to a larger and more hazardous number of polluting conditions- pesticides, erosion and sedimentation, and metals and other inorganic compounds from the operation of vehicles and machinery.

Water pollution is generally classified as one of two types: Point source pollution or non-point source pollution. Point source pollution is the introduction of contaminants from a specific location, such as a wastewater discharge. Non-point source pollution is derived from diffuse sources, such as stormwater runoff that carries agricultural byproducts, such as nitrates and phosphorous from fertilizer. Although point source pollution is sometimes easier to recognize and mitigate, both pollution types can be hazardous and are regulated.

Pollutant Type

- Sediment
  Sediment is the loose sand and soil that settles to the bottom of streams and bodies of water. Sediment can come from loose soil or from organic sources. Wind, water, and ice help carry these particles to rivers, lakes and streams. Sediment is the most common pollution type in streams and is caused primarily by human activity where land is disturbed and erosion carries particles to water sources. Sediment can increase flood hazards, alter or destroy wildlife habitat, and increase the cost of treating water supplies.

- Pathogens
  Pathogens are harmful bacteria that can cause disease, illness, and death in humans and can change the wildlife and vegetation habitat of streams. Pathogens such as E coli, and fecal coliforms are common pollutants that may be introduced to streams by animals and human activity. Sanitary sewer overflows and septic tank failures are common causes of pathogenic pollution. Likewise, commercial agriculture can be a source of contamination.

- Nutrients
  Nutrient pollution, particularly from nitrogen and phosphorous, is a consistent cause of water pollution and water quality degradation throughout the nation. Nitrogen and phosphorous contaminants can be introduced through stormwater runoff across fertilized fields, rooftops, and streets as well as from discharge from sewage treatment facilities. Excess nitrogen and phosphorus lead to significant water quality problems including harmful algal blooms, hypoxia or “dead zones”, and declines in wildlife and wildlife habitat. Excesses have also

been linked to higher amounts of chemicals that make people sick.

- Metals
  Heavy metals such as arsenic, cadmium, chromium, lead and selenium may be naturally occurring in rock formations underground and may be a source of contamination and environmental degradation. Human activities such as mining and construction can release metal contaminants. Older orchards may be a source of arsenic, once used as a pesticide. High concentrations of these metals can be hazardous to health.

- Temperature
  Known as thermal pollution, water quality can be damaged by anything that changes the ambient temperature of the water, such as the use of water for coolant in industrial processes and power generation. Stormwater runoff can also be a source of thermal pollution. Higher temperatures decrease oxygen and affect the ecosystem. Rapid changes in temperature can cause fish and other wildlife to be killed, an effect known as "thermal shock".

- Pesticides
  Pesticides includes all chemicals used to kill or control pests, including herbicides, fungicides, and other chemical compounds. Pesticides used in agriculture can damage ecosystems and cause health conditions when they run off of land and into water sources. Contamination can affect biodiversity, predator-prey relationships, and human health when pesticides are consumed directly or in high concentrations in seafood.

Hydrology

Headwaters

The headwaters of Beaver Creek and Purgatory Creek are upland streams of the first order, meaning they have no merging tributaries or forks. There are 23 first order, 7 second order, and two third order streams in the watershed. The third order streams, Beaver Creek and Purgatory Creek, converge and continue to flow westward out of the study area. These headwaters are good indicators of water quality and are exceptionally vulnerable to degradation from development, pollution, and runoff. Most of the land uses adjacent to the headwaters of Beaver Creek and Purgatory Creek are forested timberland.

Population Facts and Issues

Population in the study area has fallen slightly in recent years in large part due to significant economic challenges. According to the 2000 census, the study area was home to approximately 3394 residents and 1448 households. This number is not expected to change significantly in the 2010 Census.

Land Use Facts and Issues

The majority of the land area of the watershed is forested land on moderate to steep slopes. Individual residences make up the most common type of developed land in the watershed. Households in the study area are served by septic tanks and the town of Guin's public sewer service. Public sewer serves approximately 819 household. The remaining 629 are served by private septic systems. Most of these are on large lots and have no difficulty being served by individual septic systems, however, smaller lat developments in the northeastern and southern portion of the Town have been known to fail due to poor soil types. Businesses and industry in the area are concentrated in the vicinity of the Town of Guin. There are 6 permitted discharges in the watershed. The Town of Guin has a 472,000 gallon per day treatment facility and lagoon that discharges into Beaver Creek. The facility currently treats approximately 381,000 gallons per day. A review of the EPA's Permit Compliance System database and the Municipal Wasterwater Pollution Prevention (MWPP) reports indicate that the facilities in the watershed have not had any major violations.

What Local People Think

Interest in planning for watershed management was found to be low in the local area. A watershed study workshop was scheduled for August 23, 2010 and despite outreach to local stakeholders, it was poorly attended. Stronger local leadership is needed in order to continue to promote watershed approaches to resource management in the local area of Beaver Creek and Purgatory Creek.

Recommendations

Development of a Watershed Plan

A watershed plan can be an effective technique to guide land use and development in the watershed in a manner that reduces the impact on the waters of the study area. The watershed is located within the incorporated area of the Town of Guin and unincorporated areas of Marion County. The involvement of stakeholders and local citizens in the development of the plan will be critical in the development of the plan. Interest in the development and implementation of a watershed plan for the area should continue to be expanded through education and outreach activities.

Land Conservation

Land conservation is an effective means of preserving critical wetlands and wildland habitat needed for a healthy watershed. Conserving land in an undeveloped state provides recreational open space and buffer spaces for water resources that prevent pollution and contamination. Conservation techniques include conservation easements, land acquisition, protection of open space and setback requirements through zoning. Local regulatory tools are useful for protecting open space. Land banks are an additional private resource that can be utilized for conservation.

Establish and Maintain Aquatic Buffers

Aquatic buffers are areas that have been conserved specifically for the protection of streams. These areas are useful as greenways and recreational areas, as well as providing a critical natural buffer against surface water pollutants that might otherwise reach streams in runoff.

Better Site Design

Site design is a critical component of any new development. Although the NPDES permitting process regulates point source pollution, contending with the negative effects of stormwater runoff and other non-point source pollutants during and after construction is largely a local regulatory affair. Site design criteria should contain provisions for containing sediment and erosion during construction and easing the volume and velocity of stormwater runoff post-construction. Minimizing land clearance during development is a key technique for better site design.

Conclusion

A watershed is the area of land where all of the water that is under it or drains off of it goes into the same place. John Wesley Powell, scientist geographer, put it best when he said that a watershed is: "That area of land, a bounded hydrologic system, within which all living things are inextricably linked by their common water course and where, as humans settled, simple logic demanded that they become part of a community."

The Beaver Creek-Purgatory Creek Watershed is fundamental environmental resource for southern Marion County. Without a healthy watershed to support human activity in the area, no growth, development, or progress will be achievable. The preceding study has provided an assessment of existing conditions in the watershed and a set of recommendations for preserving and protecting water quality in the study area. The vitality and their critical place of these resources cannot be understated in the future prosperity of the region. Measures should be taken to preserve, protect, and promote the environmental integrity of the watershed.

Appendix A: PCS Search

Name	3M Co-Guin	Big Wheel Recycling	City of Guin-Beaver Creek Lagoon	Falcon Oil Company	Gateway Advantage Homes	Wood Perfect
Address	6675 US Highway 42	US 43, Guin	County Rd 16	10th Ave and Railroad	6440 US Hwy 43	365 11th Avenue
Latitude, Longitude	+3357569, -08753550		+3358011, -08756059	+3357508, -08754185	+3358090, -08753490	+3357534, -08755132
Receiving Waters	Purgatory Creek	UT Grizzard Branch	Beaver Creek	Purgatory Creek	UT Purgatory Creek/Reedy Branch Purg	Purgatory Creek
Outfall Type	Stormwater			Stormwater	Stormwater	Stormwater
Activity Status	Active	Active	Active	Active	Active	Active
Permit Expired	31-May-2009	28-Feb-2011	28-Feb-2014	31-Jan-2007	30-Jun-2012	30-Jun-2012
Monitored Parameters	BOD, 5-DAY (20 DEG. C); Flow (In conduit or through treatment plant); Carbon, TOT Organic TOC; Oil and Grease; Nitrate plus Nitrate total 1 Det. (as N)	BOD, 5-DAY (20 DEG. C); PH; Flow (In conduit or through treatment plant); Total Suspended Solids; Nitrogen Ammonia Total (As N); Organics, Total Toxic (TTO); Oil and Grease;	Oxygen, Dissolved (DO); Solids, Suspended Percent Removal; Solids, Total Suspended; Nitrogen, Ammonia Total (as N); Nitrogen Kjeldahl Total (as N); Nitrate plus Nitrate total 1	No PCS Limits Information Found	pH; Rainfall; Oil and Grease; Total Suspended Solids	pH, Rainfall, Total Suspended Solids, Oil and Grease

		Total Phenols; P-Cresol; Benzioc Acids-Total; Cobalt, Total (As CO)	Det. (as N); Phosphorous Total; Flow (In conduit or through treatment plant); Chlorine Total Residual; Coliform, Fecal General; BOD Carbonaceous 05 Day (20C); BOD Carb 5-Day (20C) Percent Removal; Suspended Solids; pH			
Violations	31-DEC-2004; Non-receipt of Discharge Monitoring Report	31-Mar-2009; 31-Dec-2008; 30-Sept-2008; 30-June-2008; 31-March-2008; 31-Dec-2007; 30-Sept-2007; 30-June-2007; 31-March-2007; 31-Dec-2006; 30-Sept-2006; 30-June-2006: Non-receipt of Discharge	31-Mar-2009; Non-receipt of DMS Report	No PCS Violations Information Found	None	None

		Monitoring Report				