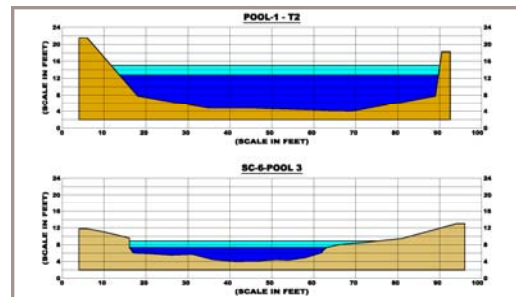


WATERSHED MANAGEMENT

GBM^c & Associates has significant experience in the area of watershed management. Detailed watershed analysis and characterization studies have been completed to identify causes/sources of stream corridor disturbance and potential measures to restore natural conditions and protect water quality. Experience includes; point source and non-point source pollutant loading assessments, flow studies, geomorphology surveys, stream and riparian habitat assessments, landuse/landcover assessments, rapid bioassessments, and water quality modeling. Assessment findings have led to development of watershed management plans and protection strategies including; best management practices (BMP's), storm water treatment features and aquatic habitat restoration.

Experience and Capabilities

- Completed multiple **watershed scale studies** to determine the source(s) of water quality degradation and the potential means to reverse the decline in quality. Studies have been completed on various size watersheds from small (<15 mi²) to large (10,000 mi²).
- Have completed detailed **watershed management** plans for urban and rural watersheds which included assessment and development of management options. Each process has involved stakeholders and associated economic considerations.
- Conducted dozens of stream and riparian **habitat assessments** including quantitative **geomorphic measurements**, and qualitative cover determinations. Habitat data has been used to assess stream stability, potential for maintenance of biological integrity, and for determination of potential non-point source pollution impacts.
- GBM^c scientists are experienced in stream characterization and restoration procedures as developed by Rosgen (1996). They are proficient in the use of geomorphic assessments/surveys for application in **natural channel design**.
- Utilized detailed **geographical information system (GIS)** data, including landuse/landcover data, aerial photography, satellite imagery, infrared aerial photography, and topographic maps, to characterize and assess potential sources of pollution entering a stream corridor.



- Completed dozens of **aquatic biota assessments** to determine the maintenance of biological integrity. Assessments of macroinvertebrate and fish communities have been used to determine the extent of impacts originating from point and non-point source pollution in a stream system.

WATERSHED MANAGEMENT (cont.)

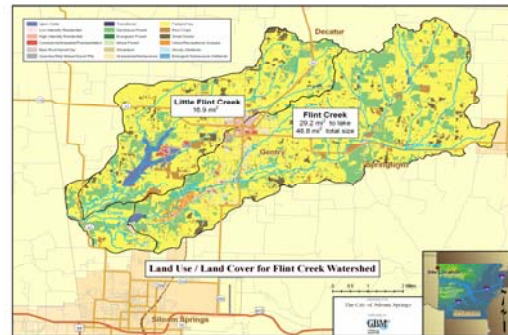
- GBMc engineering staff is experienced in the development of **BMP's** and storm water treatment practices to control non-point source pollution and to mitigate storm flow hydrographs in critical watersheds. In addition, **low-impact development (LID)** techniques are a part of the storm water pollution prevention toolbox utilized by GBMc in watershed management.
- Developed detailed habitat restoration plans for diverse habitat types including wetlands, uplands, riparian areas, and lakes. Restoration studies and implementation have included soils assessments, surveying and engineering of surface elevations, use of geotechnical materials, oversight of construction, and vegetative planting plans.



- Developed and conducted several flow studies to support watershed management including: low-flow analysis, peak flow analysis, HEC-RAS flood modeling, storm water run-off assessments, time of travel studies and losing/gaining stream studies.
- Conducted dozens of water quality investigations, which included analysis of historical data, intensive field studies, and continuous in-stream monitoring of various chemical/physical parameters.



- Utilized sophisticated computer based water quality and flow models to predict the fate and transport of pollutants in stream, river, and lake systems. Models utilized in analyses have included QUAL2E, WASP, TR-55, BATHTUB, and SWAT.
- GBMc personnel keep abreast of regulatory development in Region 6 and 7 states and are actively involved in the public comment process and third party rule-making in states such as Arkansas, Louisiana, Missouri and Oklahoma. Our personnel actively participate in state and regional development of water quality standards.



GBM^f Contacts

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