# Report for 2003NY24B: GIS Based Spatial Modeling and Analyses of Urban Stormwater Size and Stormwater Management Practice (SMP) Feasibility in the Lower Buffalo River Watershed.

There are no reported publications resulting from this project.

Report Follows

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## Introduction

This project aims to identify the size (acre-feet) of storm runoff in each of Storm Water Catchments (SWC) in the Lower Buffalo River watershed. Then, the suggestions of suitable Stormwater Management Practice (SMP) tool or tools will be proposed through the spatial analysis of five screening factors. The suggestions for the choice of five SMP tools for each of the SWCs will be proposed by mapping and analyzing the major parameters of five screening (feasibility) factors, namely Land Use, Physical Feasibility, Watershed/Regional Factors, Storm Management Capability, and Community and Environmental Factors.

## Work Accomplished

Stormwater catchments of the lower Buffalo River watershed were delineated using USGS DEM with 10 meter resolution and the ArcHydro extension in ArcGIS. A total of 86 catchments were delineated for the entire Buffalo River Drainage Basin. Among them, 26 fall into the area of the lower Buffalo River watershed (Figure 1.). The delineated catchments are topologically connected in terms of river drainage network.

Land use map apply the modified American Planning Association (APA) land use scheme with structure and function dimensions is accomplished. The map was compiled using New York State 2002 true color aerial photographs with wither 1 foot or two feet spatial resolution. A total of 8,640 land use polygons were generated for the entire Buffalo River drainage basin (Figure 2).

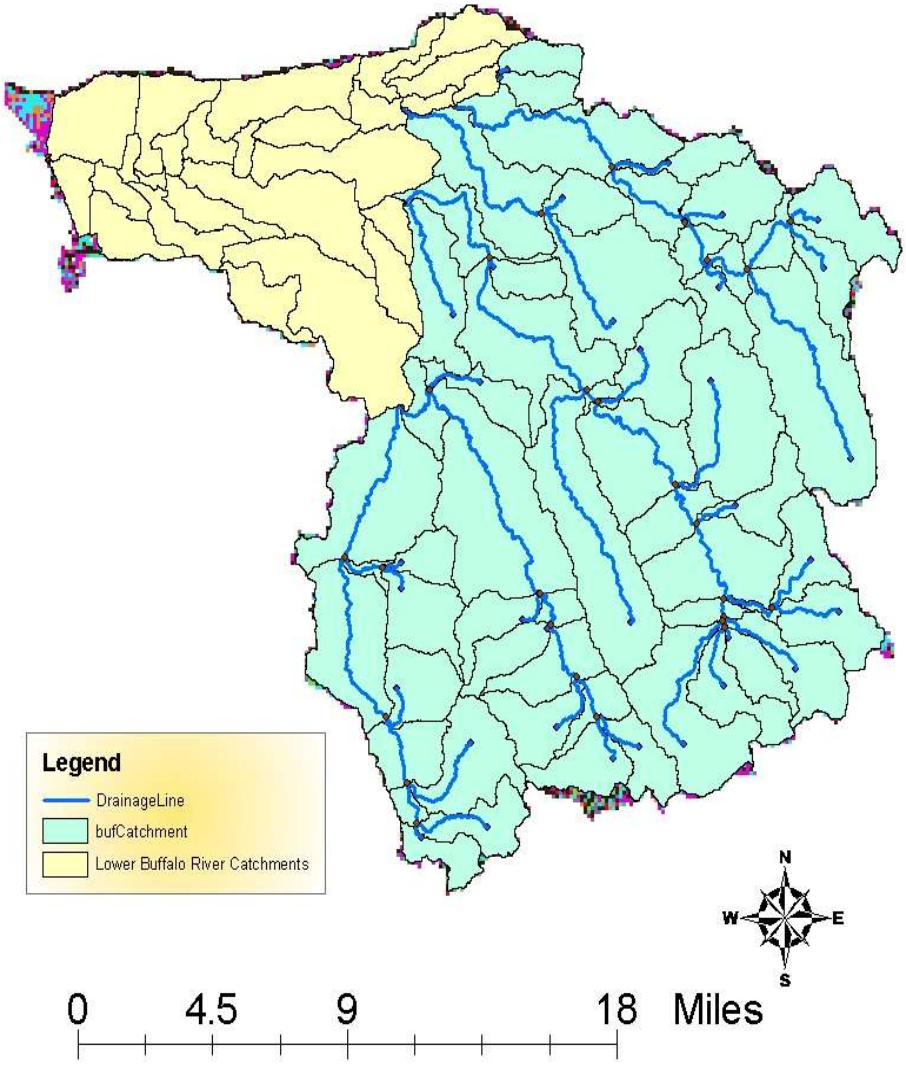


Figure 1. Catchments delineation in the lower Buffalo River watershed in Comparison with Entire Drainage Basin

Slope and flow direction map layers in the raster format were generated from the USGS DEM with 10 meter resolution. Currently, it is being converted into vector format and it is in the process of merging polygons with slope degree ranges. The objective is to combine them into 60 to 70 slope range categories (Figure 3). Since the distribution of the slopes is mainly cluster in the lower degree angles, the categories of the ranges will be arranged by statistical classification method in ArcGIS.

Soil distribution map was compiled for the entire Buffalo River Drainage Basin. However, detailed soil classifications (SSURAGO) are only available in the lower and middle watershed areas that fall into the Erie County. Therefore, the detail soil map in the Erie County was merged with less detail soil classification map (STATSGO) in other counties in the upper watershed (Figure 4.)

. Field sampling and measurement sites were selected from the drainage points of the catchments. Eight sampling sites were selected through field investigations of 20 confluences and drainage outlet sites. Differential GPS survey of these sites was conducted. The sediment discharge and major pollutant loadings of TSS, TP, TN, Cu, Pb, Zn, and F. Coli will be interpolated using these eight sample points. (Figure 5).

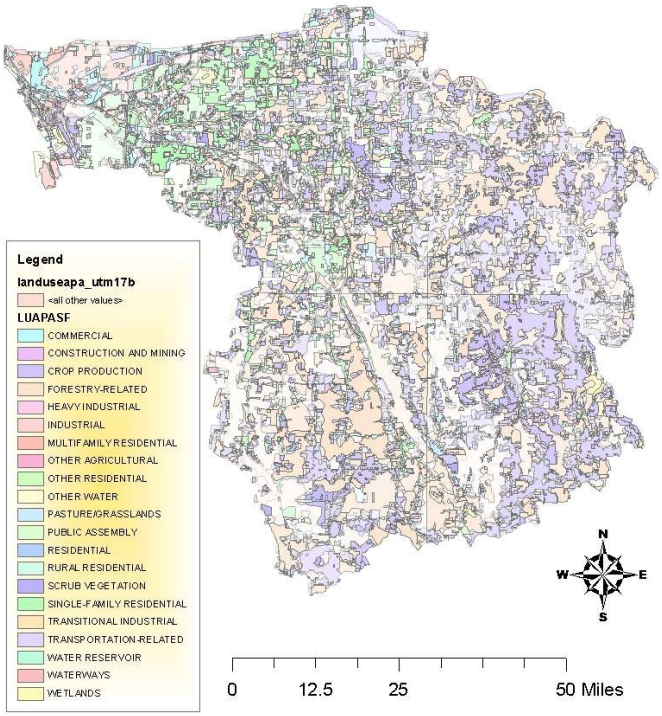


Figure 2. Land Use Classification Using APA Land Based Classification System

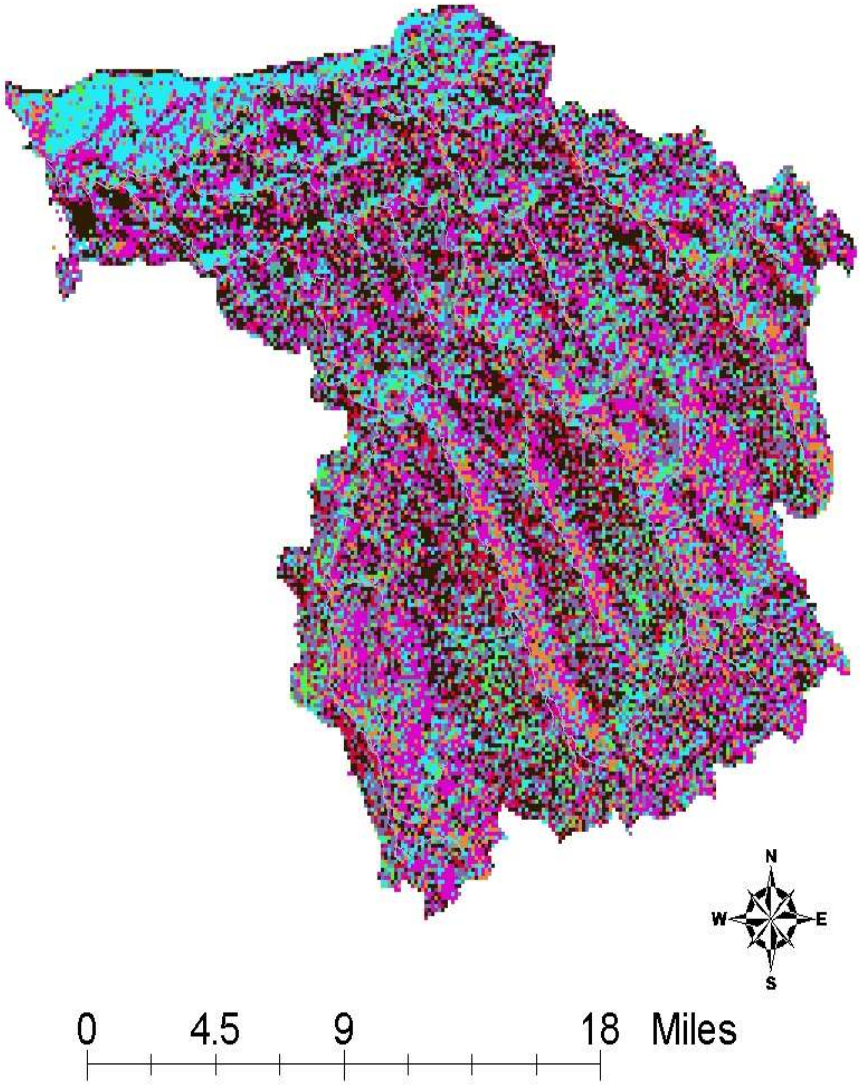


Figure 3. Flow Direction and Slope in the Buffalo River Watershed in Vector Format

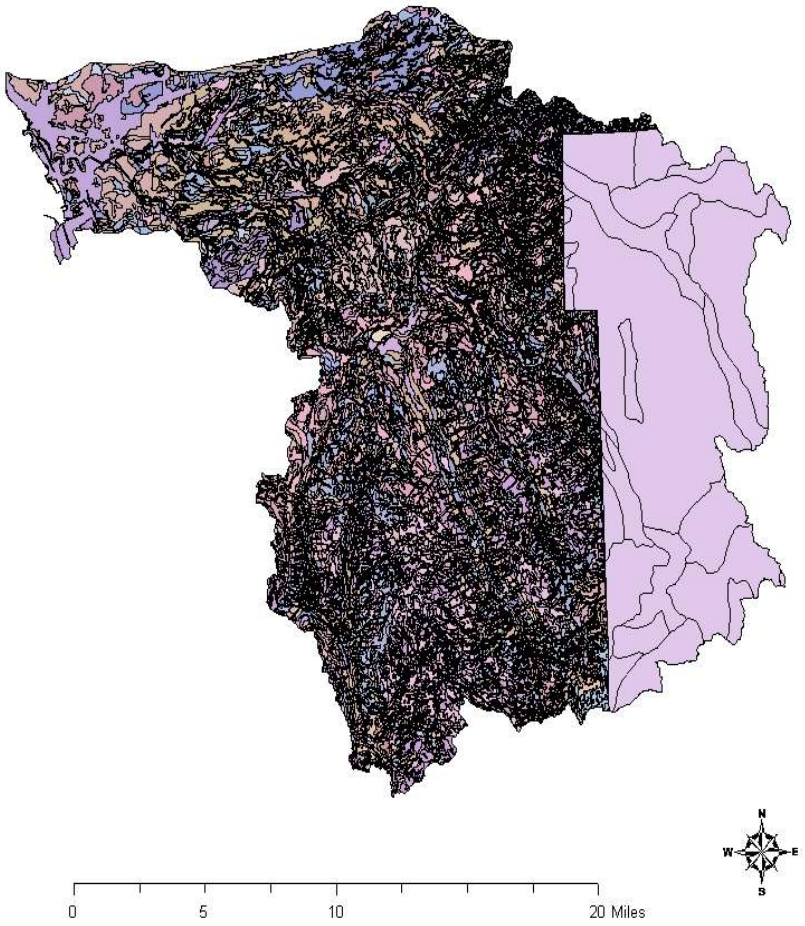


Figure 4. Soil Map in the Buffalo River Watershed (compiled with different levels of classifications, classified using SSURAGO).

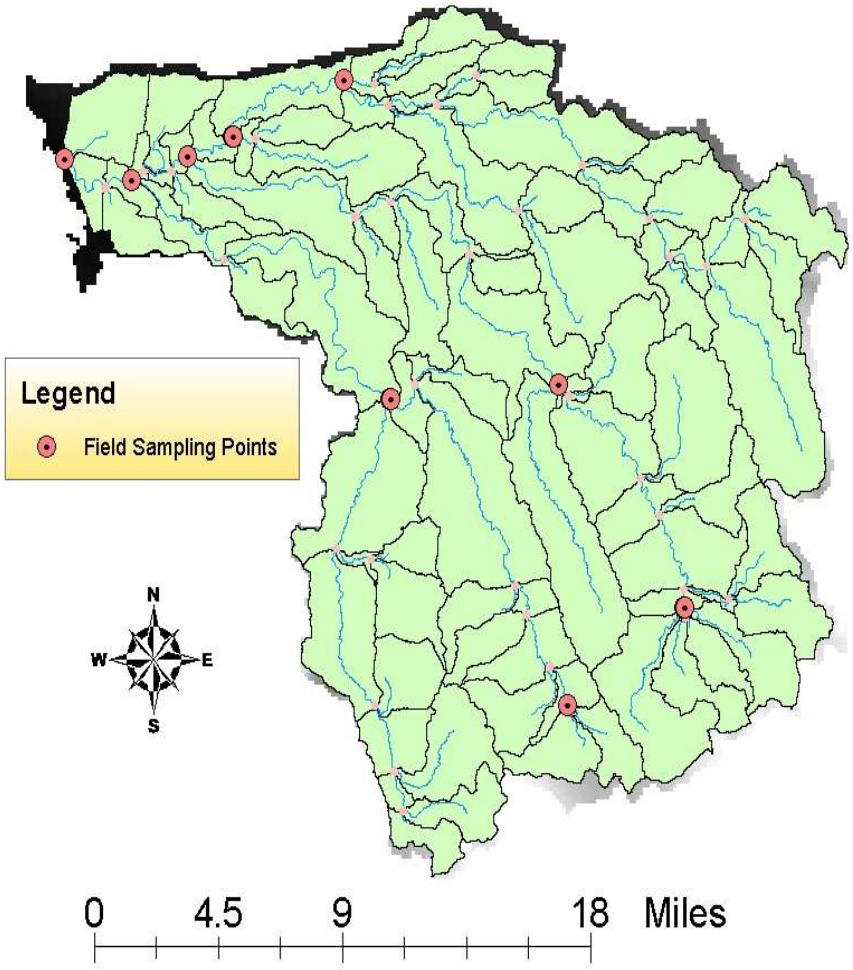


Figure 5. Field Sampling Sites (Nine sites are shown on this map. One of the two upper reach or head water sites will be sampled in each of the field samplings.)

**Work in Progress**

Field sampling and analyses are currently conducted for two rainfall storm events and one dry weather environment. The purpose of these field samplings is to incorporate field data into the GIS based mapping and spatial analysis. Mapping of slope and vegetation covers are in the progress. The average household income and population of age under 18 or younger in the lower Buffalo River watershed still need to be accomplished in GIS to fulfill the requirement of community and environmental factors.

After the field samplings were accomplished, percent contaminate loading maps will be compiled. Modification of field sampling was made from the catchments to the confluences or drainage points of the stormwater catchments because the difficulties encountered for entering private properties and obtain permissions. Basic topology of river network and connectivity of catchments in the lower Buffalo River watershed will be used to interpolate and map the percent contaminate loadings based on field data.

The map layers will be overlayed and the WQv (water quality volume) will be calculated using the 90% rainfall. Loading of each of seven contaminates will be calculated according the NY DEC "simple method" model. The SMP selection factors will be evaluated visually from digital maps for the location selections of the Stormwater Management Practice tool selections for each of the catchments.

**Preliminary Discussions**

One full time graduate student and one part time graduate student are working on this project. Since both my research and their research interests are on Geographic Information Systems (GIS) and computer mapping, the theoretical approach of this project is focused on the inter-map layer connectivity and topological interpolations. ArcHydro extension of ArcGIS was applied in this approach. Mapping part of the project encountered some difficulties. For instance, the USGS DEM (digital elevation model) with 10 meter resolution can generate slope, flow direction, etc in raster GIS data format. However, the conversion from raster to vector data structure produced four million small polygons that take very long computing time to be merged in certain slope degree groups.

Owing to the limited funding form the grant, the field sampling is not extensive. Eight sites were selected for collecting water samples based on the confluence locations and field accessibility. More field sampling sites would yield more reliable and accurate estimation. In general, this project was mainly designed for Stormwater influence factor mapping and interpolation, other than extensive sampling. Estimations will be made for the spatial distributions of contaminate loadings from the comparison of the field sample of loadings in the lower, middle, and upper reaches of the Buffalo River watershed. The mapping and modeling work using topology in this project was presented in the New York State GIS Conference in Albany.