The Upper Cahaba Watershed Greenprint

A project of the Upper Cahaba Watershed Consortium

Prepared for the Upper Cahaba Watershed Consortium

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Abstract

The 550-square mile Upper Cahaba Watershed, in addition to being a primary source of drinking water for metropolitan Birmingham, Alabama, is nationally recognized for its biodiversity and recreational value. The purpose of Upper Cahaba Watershed Greenprint is to help inform decisions about land use, conservation, and land development in the watershed. The Greenprint is one part of the ongoing effort to protect and improve the Cahaba River.

Information about the watershed was organized and analyzed using Geographic Information Systems. The Greenprint for the Upper Cahaba watershed illustrates land-based characteristics that relate to water quality. The criteria include: topography, karst/limestone, runoff potential, watershed position, wetlands/waterbodies, and forests/tree cover. The Greenprint is meant to be used as a planning tool in conjunction with other watershed protection tools. The Greenprint is designed to be flexible and can be updated: (1) for changing priorities and (2) to incorporate new or updated information.

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Executive Summary

The Greenprint for the Upper Cahaba watershed illustrates land-based characteristics that relate to water quality in the Upper Cahaba River. These characteristics were identified in consultation with the Upper Cahaba Technical and Advisory Committees, and are:

- Topography
- Karst/Limestone
- Runoff Potential
- Watershed Position
- Wetlands and Waterbodies
- Forests/Tree Cover

GIS data related to these six criteria were gathered and analyzed, and the results of the analysis are illustrated on Figure 3.7, which illustrates the relative sensitivity of lands in the watershed based on the six criteria. Phase I of the Upper Cahaba Watershed Study concluded that all lands within the watershed have the potential to contribute to the protection or degradation of water quality in the Upper Cahaba, and that further development in the watershed, if not managed correctly, will contribute to the further degradation of water quality in the river. As illustrated on Figure 3.7, however, based on the six watershed planning criteria, the relative vulnerability of the lands varies greatly. Areas in red possess most or all of the vulnerability criteria, areas in green possess few or none of the vulnerability criteria, and areas in yellow generally have a moderate level of sensitivity.

- Water use classification
- 303(d)-listed streams
- Position relative to drinking water intake
- Size of intact forest
- Presence of threatened or endangered
- Potential to connect to existing open spaces
- Existing development pressure (likelihood to develop in the near term)

Most of these criteria, under current conditions, did not differentiate significantly among various areas in the watershed.

Section 6 describes how to use the Greenprint to help inform decisions about land use, conservation, and land development in the watershed. As described in that section, the Greenprint should be used in conjunction with other watershed protection tools.

The Greenprint was developed using the best currently available GIS data. The Greenprint should be updated on an ongoing basis as more complete or more up-to-date information becomes available.

1 Introduction

This Greenprint has been prepared as part of Phase II of the Upper Cahaba Watershed Greenprint. The purpose of the Greenprint is to identify priorities and strategies for protecting watershed lands for the purpose of water quality protection and enhancement. The Greenprint plan builds upon the data developed in Phase I of the Upper Cahaba Greenprint and is one part of the ongoing effort to protect and improve the Cahaba. Other Phase II activities include preparing model ordinances for local governments to consider. These ordinances relate to floodplain management, riparian buffers, conservation subdivisions, and stormwater management. Phase II also includes further refinement of the watershed model developed in Phase I.

The greenprint planning process is intended to create technical tools to understand how land characteristics affect water quality. Information from the Greenprint is intended to assist local governments and other organizations in their decision-making and to identify and prioritize open space for acquisition or by other means of protection. The Greenprint also includes an overview of the costs and benefits associated with various land protection techniques. Based upon the best available information available at the time of its development, the Greenprint is designed to be flexible and can be updated: (1) for changing priorities and (2) to incorporate new or updated information.

2 *Greenprint Planning Process*

Several steps comprised the Greenprint planning process. Figure 2.1 illustrates the process that resulted in the maps included at the end of the report. The steps illustrated on the figure are described below.

GIS Data Collection – The first step involved assessing the available data sources, what data could easily be accessed, and which data sources would be most valuable to characterize the watershed and help prioritize lands within the watershed for preservation strategies. The goal was to use data that were up to date, covered the majority or the entire watershed, and did not require combining multiple data sets to get one comprehensive database. A majority of the GIS data were provided by the Stormwater Management Authority.

Land-Based Criteria – Using GIS, lands were classified for topography, karst areas, runoff potential (incorporates impervious areas), watershed position, wetlands and waterbodies, and forest (based on tree canopy). These are characteristics of the land that were used to help decisionmakers understand the importance of lands for water quality protection. Lands that contribute disproportionately to water quality protection, or which, if developed, contribute more to water quality degradation were rated most in need of protection. For each land-based criterion, three categories of vulnerability to increasing water quality degradation were established; categories A, B, and C. The definition of each category follows:

Category A: Land characteristic that would result in a higher level of impact to water quality resulting from development, all other things being equal. These lands are some of the highest priority lands for potential protection strategies.

Category B: Land characteristic that would result in a lower level of impact to water quality resulting from development compared to Category A, all other things being equal.

Category C: Land characteristic that would result in a lower level of impact to water quality resulting from development compared to Category B, all other things being equal.

Using generally available GIS data, the criteria were applied to the 550-square-mile Upper Cahaba watershed and the results were analyzed. This analysis is described in more detail in Section 3.2. In this step, the GIS database was organized by the 14-digit Hydrologic Unit Codes (HUCs) to create 109 subwatersheds, which were used as the basis for setting priorities for development and protection.

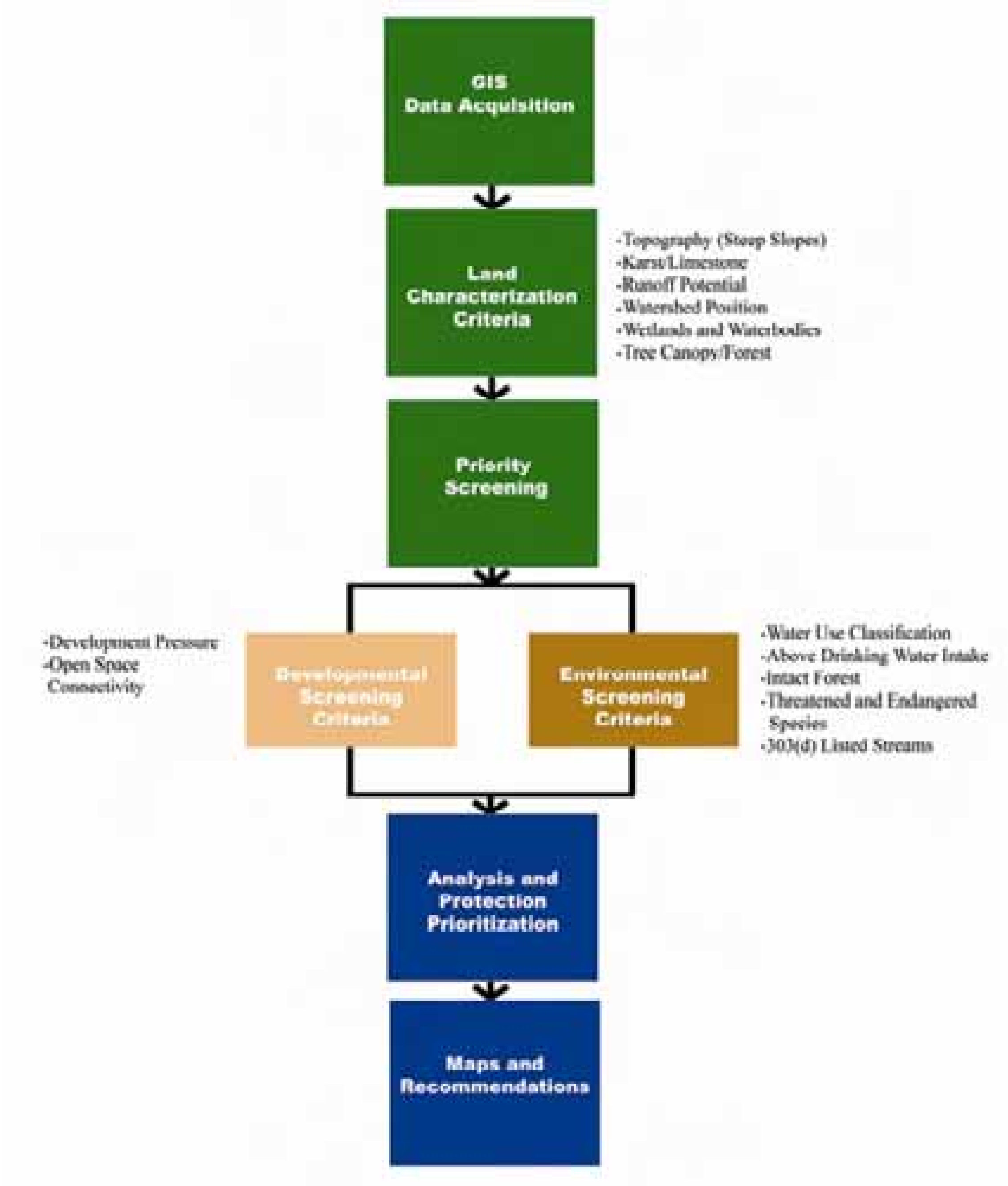

Figure 2.1 Upper Cahaba Greenprint Planning Process

Environmental and Developmental Priority Screening – In this step, other important land- and water-based attributes were included in the analysis to help identify, from a water quality and aquatic health perspective, what will be important in determining priorities for land protection. This step addressed the concern of some Technical Committee members that some criteria should not be used in a more quantitative classification system for water quality protection, but also allowed the inclusion of environmental and other development considerations to be included in the analysis. Note that, like the six criteria included in the earlier step, these criteria can be flexible and should be updated by local governments and interest groups to include new analyses and data as they become available. This approach allows a range of attributes to be considered qualitatively by local governments, land and water protection organizations, and others as they make decisions about what lands to acquire, develop, or protect.

The product of this step is a database that provides information about which subwatersheds possess specific attributes. This tool will allow the flexible evaluation of the watersheds, both during and after the Greenprint is established.

Combined Land Criteria/Priority Screening Analysis – In this step, the criteria maps and priority screening database were analyzed to lead to recommendations for strategies in specific subwatersheds.

Mapping, Strategies, and Recommendations – Using the final database and the professional judgment of the consultant team, and with input from the Technical and Advisory Committees, the planning team developed recommendations for priorities for development and water quality protection.

It is important to note that, using this approach, Greenprint planners developed recommendations, but that by developing an attributed database, others can later re-evaluate lands with different overall priorities or priorities specific to certain subwatersheds.

3 Land Characterization Criteria

Planners identified land attributes that were important for water quality protection and for which GIS-based data were available for most of or the entire watershed. Detailed discussions with the Technical Committee, Advisory Committee, and local planning agencies resulted in the inclusion of six separate criteria. Table 3.1 summarizes the criteria; they are described in more detail in the following sections. Other criteria that were considered but not included for various reasons are described in Section 3.7.

For this step, lands were classified on the basis of topography, karst/limestone, runoff potential, watershed position, presence of wetlands and/or waterbodies, and tree canopy/forest cover (Table 3.1). These land characteristics were used to determine the relative importance of lands for water quality protection. Lands that contribute disproportionately to water quality protection, or which, if developed, contribute more to water quality degradation from development were rated most in need of protection. Category A lands were determined to be most vulnerable to development, Category B lands less vulnerable than Category A lands, and Category C lands less vulnerable than Category B lands.

3.1 Topography

Topography is an important criterion related to water quality because steeper slopes produce higher stormwater runoff at higher velocities, which increases erosion potential and pollutant loading into streams. For this criterion, category A represents most vulnerable lands, which have slopes greater than 15 percent. Category B lands have slopes of 5 to 15 percent, while category C lands have slopes less than 5 percent. The source of the data for this criterion is the Stormwater Management Authority and the U.S. Geological Survey; multiple 10-meter digital elevation models (DEMs) were combined to cover the Upper Cahaba watershed.

As illustrated by Figure 3.1, Category A lands, shown in red, are located throughout the watershed, with concentrations in the northern most area of the watershed (east of Deerfoot Parkway) and along the southeast rim of the watershed. The flattest and least vulnerable areas, shown in green, are also located sporadically throughout the watershed, with concentrations in long stretches in the areas of U.S. Highway 411 in the southeast and a band in the northwest that includes various roadways (County Highway 52, Lakeshore Parkway, Center Point Parkway, etc.). The topography of the Upper Cahaba watershed is characterized by ridges and valleys running southwest to northeast.

3.2 Karst/Limestone

Karst landscapes are more sensitive to water quality degradation due to their direct connection with groundwater by recharge through vertical openings in limestone formations or by percolation through cracks and pores in the limestone rock. In Alabama, some limestone is exposed at the surface, especially in stream valleys where streams have cut to the bedrock; however, depth to limestone bedrock can be more than 100 feet below the surface. Available information for this criterion was limited to geology at the surface of the earth. The source of the karst/limestone data is the Geological Survey of Alabama.

Category A represents lands most vulnerable for water quality degradation from development, defined for this criterion as limestone areas. Category B lands are partially limestone, and category C lands, the least vulnerable, have no limestone composition.

As illustrated by Figure 3.2, there are few Category A lands; they are located generally in a band (shown in red on the map) along Center Point Parkway. The area of no surface limestone, shown in green, is generally centered on the mainstem of the Cahaba.

3.3 Runoff Potential

Hydrologic soil groups are classified based on the infiltration potential of that soil. The more impervious a soil group, or alternatively the less infiltration potential, the more runoff will occur. Runoff from developing sites with low infiltration potential, and consequently high potential for water quality degradation, is greater than from sites with high infiltration potential. The Natural Resources Conservation Service has categorized soils into one of four groups, as illustrated in Table 3.1 (United States Department of Agriculture - USDA, Natural Resources Conservation Service - NRCS, 1986).

Category A – This group consists of sand, loamy sand, or sand loam soil series. These soils have the highest infiltration potential and the lowest runoff potential. There are no soils classified as Category A soils in the Upper Cahaba watershed.

Category B – This group consists silt loam or loam soil series. These soils have a moderate infiltration potential. These soils are the most well-drained soils in the Upper Cahaba watershed.

Category C – This group consists of sandy clay loam soil series. These soils have a low infiltration potential and tend to impede downward movement of water.

Category D – This group consists of clay loam, silty clay loam, sandy clay, silty clay, or clay. These soils have the highest runoff potential and the lowest infiltration potential.

The source of the digital soil data (NRCS, Soil Survey Geologic Data – SSURGO) is the Stormwater Management Authority.

An impervious surface is one that does not allow water to percolate (permeate) through. Sandy soils are pervious; asphalt is impervious. On an impervious surface, stormwater runoff flows downhill until it reaches a waterbody, such as a stream or river, or pervious area where the water can percolate into the ground. This runoff can pick up potentially toxic substances and can carry these materials to rivers and streams. Typical impervious surfaces include roads, parking lots, driveways, sidewalks, rooftops, patios, pools, and severely compacted soils (usually from development activities like grading, excavation, and landscaping). The first three items are the largest contributors to impervious surface area in almost any community.

Typically, most pollutants are washed off impervious areas from runoff during the first 1-1.25 inches of rainfall, which is often referred to as the "first flush". As impervious surface area increases, the stormwater coming from these areas increases in velocity, quantity, temperature, and pollutant load. Any one of these attributes contributes to the degradation of the natural hydrology and water quality of stream and river systems. Studies show that stream systems begin to show signs of degradation when impervious areas reach 10% of the watershed area and deteriorate further as the percentage increases. Once a subwatershed reaches 25% impervious area, most streams cannot support a healthy aquatic system and are difficult to restore (Zielinski, 2002). The source of the digital data on impervious surfaces is the Stormwater Management Authority.

As illustrated by Figure 3.3, Category A, the lands which, if developed, could result in water quality deterioration, represents pervious areas with hydrologic soil group B. Category B lands, shown in yellow, represent pervious areas with Soil Groups C or D. Category C lands, illustrated in green, represent impervious areas. As shown on the figure, the majority of the watershed is in the most vulnerable category. Bands of yellow, which indicate the medium-sensitivity category, are mostly at the outside edges of the watershed. Very little green, which represents the most highly developed areas, is visible at this scale. The green is centered on major highways where commercial development has occurred. Note that the source of the impervious surface data is satellite imagery; scattered impervious surfaces such as those found in developed residential areas may not always be visible in this imagery, particularly if it is masked by wooded areas.

Currently digital hydrologic soil group data and pervious-impervious data are incomplete in the southern portion of the Greenprint area. Where pervious-impervious data is lacking, the area is shown as "No Data" on the map. When this information becomes available, it should be added to the GIS database.

3.4 Watershed Position

Headwaters are more vulnerable to water quality impacts compared to downstream areas in a watershed due to the cumulative nature of discharge from a drainage network. Multiple developments concentrated in the headwaters will have a negative, cumulative effect on the watershed, whereas the same number of developments further downstream will have a diluted effect on the watershed. Therefore, protecting headwater streams is a more effective strategy for protecting water quality.

An initial analysis of watershed position revealed that the 109 14-digit HUC subwatersheds were not detailed enough to capture the complexity of the parallel ridge and valley drainage patterns in the Upper Cahaba watershed. Therefore, a more detailed analysis using the ArcGIS ArcHydro modeling tools was completed to create smaller subwatershed units of analysis. The GIS analysis used a 10-meter digital elevation model and the National Hydrography Dataset for streams to create over 1,700 subwatersheds as small as 25 acres in size. These smaller subwatersheds were then assigned to Categories A, B, or C based on their location in the watershed.

On Figure 3.4, Category A, shown in red, represents a first-order stream subwatershed, considered to be the most vulnerable to development in terms of affecting water quality. Category B lands, shown in yellow, are the second-order stream subwatersheds, and category C represents all other land areas. Areas in all three categories are distributed throughout the watershed, but clearly show the parallel ridge and valley topography of the Upper Cahaba watershed that runs southwest to northeast.

Independent of other criteria, water quality protection in first- and second-order streams is very important because degraded water quality in those streams results in degraded water quality in all downstream areas. The cumulative impacts of degraded water quality in numerous first- and second- order streams can be significant in downstream areas. Adequate stream protection buffers (to be required through ordinances) and other protection measures in these areas is extremely important.

3.5 Wetlands and Waterbodies

A primary wetland function is to improve water quality by filtering potentially harmful pollutants before they reach streams and rivers. Development in these areas is generally governed by federal law because developing these areas has many potentially harmful effects, including the potential to degrade water quality. (Other surface waters were added to this criterion to allow for consistent consideration of surface waters).

Wetland data is a combination of Stormwater Management Authority (SWMA) wetlands database, which is a predictive model based on infrared photography to determine vegetation density and soil types and (National Wetlands Inventory (NWI) mapping. The source of the surface water data is the 1:24,000 National Hydrography Dataset (NHD) from the USGS; streams are represented as 10-meter cell widths, since actual widths are not available.

See Figure 3.5 for the map illustrating wetlands and waterbodies, including streams. Category A, shown in red, represents lands within a wetland or other water body. Category B lands are within 25 feet of a wetland, and Category C, shown in green, represents all other land not within 25 feet of a wetland or in a waterbody.

Note that most wetlands are relatively small in size compared to the 550-square-mile watershed and are difficult to see at this scale. Figure 3.5 should not be used as the final determination of wetlands on individual parcels, since this can only be accomplished through individual site visitation by a wetlands professional.

3.6 Tree Canopy/Forest

Forested lands are very important in protecting water quality, as forested lands can filter potentially harmful pollutants as they run off the land into waterbodies. As forests are cleared, water runs more quickly into streams and rivers, and the potential for filtering is lost. For this reason, the protection of as much undisturbed forest as possible is one of the most important things that can be done to maintain the health of the watershed. Forests on steep slopes, streamside areas, and pervious soils are the most significant forests, and these will generally be indicated on the composite map as most vulnerable (red), since they combine three criteria (forest, runoff potential, and slope).

The source of the data for tree canopy is the Stormwater Management Authority. Figure 3.6 illustrates the Tree Canopy/Forest criterion. Category A lands, shown in red, are the most forested and the most vulnerable. Category C, shown in green, is representative of no tree canopy. There is no category B for tree canopy.

Digital tree canopy data were not available for the southern portion of the watershed; this area is shown as “No Data” on Figure 3.6. As more information becomes available for this area, it should be added to the GIS database.

3.7 Other Criteria Considered (Not Included)

Floodplains

Development in floodplains can increase velocities, volume and erosion downstream in the event of a flood, compromising water quality. Consequently, floodplain areas are more vulnerable to development in terms of water quality. For this Greenprint, however, digital floodplain maps were not available. As they become available, they should be added to the GIS database and should be considered when determining the composite vulnerability map (Figure 3.7).

Soil Erodibility

Soils are classified based on their erodibility. The more erodible a soil, the more likely runoff will wash sediments into streams, given the same rainfall and impervious cover. Planners originally considered using soil erodibility as a stand-alone criterion; Greenprints participants were concerned that there was too much overlap between erodibility and runoff potential. In addition, the majority of the watershed was considered highly erodible. Therefore, impervious surface and soil characteristics were combined into one criterion, called Runoff Potential (see Section 3.3), while the Soil Erodibility criterion was dropped.

Riparian Areas

Riparian areas are zones adjacent to streams, typically classified by distance from a stream. These zones trap pollutants from runoff, stabilize streambanks from erosion, and provide ecological value in the stream. Keeping development away from streams helps protect them from affecting water quality. Greenprint participants decided that the appropriate place to address riparian areas is through the model ordinances, which are being developed as part of Phase II of the Upper Cahaba Watershed Greenprint.

Natural Community Type

Land use is highly correlated to impervious area. Urban areas are highly impervious and contribute to water quality degradation. Conversely, undisturbed areas (including open space, forested areas, meadows, etc.) have low impervious areas and are good areas, if preserved, to protect water quality.

Planners had originally considered three categories: forested and grassland as Category A, or most important to water quality protection; agricultural lands as Category B; and impervious surface as Category C. Greenprint participants preferred to consider forested and non-forested lands only (see Section 3.6); meadows and agricultural lands are therefore not considered as important to water quality. Impervious surfaces were considered in the Runoff Potential category, as described above.

Table 3.1 Criteria for Land Characterization

Map/Criteria	Threshold			Data Source
	Category A	Category B	Category C	
Topography	Slope greater than 15% Grid cell value=1	Slope 5% to 15% Grid cell value=2	Slope less than 5% Grid cell value=3	10-meter digital elevation model (DEM)-SWMA and USGS; data source name: dem10m
Karst/Limestone	Limestone Grid cell value=1	Partially limestone Grid cell value=2	No limestone Grid cell value=3	The data is the beta version of the Digital Geologic Map of Alabama, 1:250,000-Scale, developed by the GIS/Remote Sensing Program at the Geological Survey of Alabama. These digital files represent data that were presented in Geological Survey of Alabama Special Map 220, "Geologic Map of Alabama," by M.W. Szabo, W.E. Osborne, C.W. Copeland, Jr., and T.L. Neathery, published in 1988. These data were compiled into GIS format by D.R. Taylor, under the direction of B.H. Tew.data source name: geology.shp
Runoff Potential	In hydrologic soil group B and Pervious Areas Grid cell value=1	In hydrologic soil group C and D and Pervious Areas Grid cell value=2	In hydrologic soil group D Grid cell value=3	National Resource Conservation Service-SSURGO 1:24,000 data; SWMA; data source name: HydrologicGrp.shp Impervious/Pervious analysis - SWMA; data source name: impv2003
Watershed Position	First order stream subwatershed Grid cell value=1	Second order stream subwatershed Grid cell value=2	All other land Grid cell value=3	10-meter digital elevation model (DEM)-SWMA and USGS; data source name: dem10m; Streams: NHD_flowline
Wetlands and Waterbodies	Within a wetland or waterbody Grid cell value=1	Within 25 feet of a wetland Grid cell value=2	All other land not within 25 feet of a wetland or in a waterbody Grid cell value=3	SWMA; data source names: Vegdi2003 and Hydric Grids NWI Wetlands: SWMA – Wetlands Streams: NHD_flowline
Forests	Tree Canopy Grid cell value=1		No Tree Canopy Grid cell value=3	SWMA-tree canopy
Composite Land Vulnerability				Composite of 6 above criteria; grid cell values are between 6 and 18
Mean Value by Subwatershed				Composite showing the mean of subwatershed mean values; grid cell values between 1 and 3

3.8 Composite Land Vulnerability

All lands in the watershed have some vulnerability to development, as illustrated in the watershed modeling exercise in Phase I of the Upper Cahaba Watershed Greenprint. The purpose of the Greenprints is to help decisionmakers understand which lands have the greatest vulnerability in terms of water quality protection.

Composite Land Vulnerability (Figure 3.7) is a combination of the six land characterization criteria discussed above: 1) Topography, 2) Karst/ Limestone, 3) Runoff Potential, 4) Watershed Position, 5) Wetlands and Waterbodies, and 6) Tree Canopy/Forest. Each land characterization criteria dataset was converted to a 10-meter grid format for ease of analysis of the 550-square mile watershed. The GIS assigned each pixel receiving a Category A rating 1 point; each pixel receiving a Category B rating 2 points; and each pixel receiving a Category C rating 3 points, and summed all the scores for each pixel. A score of 6 would mean that a pixel received all Category A ratings, or most vulnerable ratings, for each of the six criteria. A score of 18 would mean that a pixel received all Category C ratings, or least vulnerable ratings, for each of the six criteria. For the Composite Land Vulnerability map (Figure 3.7), the GIS calculated a total score for each 10-meter pixel, assigning a color between red for a score of 6 and green for a score of 18. The GIS is able to produce a color gradient representing all the possible scores. Pixel colors closer to red have the lower, or most vulnerable, scores; and pixel colors closer to green have the higher, least vulnerable scores. Of course most pixels fall somewhere in between. Looking at the map, however, the analyst is able to identify generally the most vulnerable, or redder areas, compared to the least vulnerable, or greener areas. A review of the map reveals that the most vulnerable areas are generally in the extreme northwest areas of the watershed, as well as southeast areas, and some areas in the Rocky Brook and Bee Mountain and Little Shades Mountain areas west of the river.

Due to incomplete data in parts of the Greenprint area, where any land characterization criterion is lacking, the area is shown as "No Data". This map represents best current available data but should be updated as new information becomes available.

3.9 Mean Value by Subwatershed

Mean Value by Subwatershed, illustrated in Figure 3.8, is the average score for each of the 109 14-digit HUC subwatershed's six land characterization criteria. The mean score was calculated to account for areas shown as "No Data" (see Composite Land Vulnerability map, Figure 3.7) due to one or more missing land characterization criteria data in parts of the Greenprint area. Mean Value by Subwatershed also highlights average criteria scores in each subwatershed, which will help planners set priorities for development and various protection measures. The GIS assigned each pixel receiving a Category A rating 1 point; each pixel receiving a Category B rating 2 points; and each pixel receiving a Category C rating 3 points. For this map, the GIS calculated a mean score for each pixel, and then generalized an average score for each 14-digit HUC subwatershed and assigned a color between red for a score of 1 and green for a score of 3. The GIS is able to produce a color gradient representing all the possible scores. An average score of 1, colored red, would mean that the subwatershed had received mostly Category A ratings, or most vulnerable, ratings for each of the six criteria. An average score of 3, colored green, would mean that the subwatershed received mostly Category C ratings, or least vulnerable, ratings for each of the six criteria.

Subwatersheds closer to the color red have the lower, or most vulnerable, mean scores; and subwatersheds closer to the color green have the higher, least vulnerable mean scores. All subwatersheds in the Upper Cahaba basin fall somewhere between pure red and pure green. Looking at Figure 3.8, the analyst is able to identify generally the most vulnerable, or redder, areas, compared to the least vulnerable, or greener, areas. A review of the map reveals that the most vulnerable subwatersheds, or subwatersheds with the lowest scores, are in the extreme northwest areas of the watershed. In addition, one subwatershed among the lowest scores is located in the Peavine Branch/Peavine Creek area in the southeast portion of the watershed; several other subwatersheds with relatively low scores are in this general area as well. Another subwatershed with a relatively low score is located in the southwest portion of the watershed. In general, the mean values of the scores based on these six criteria, as shown on Figure 3.8, indicate that the most vulnerable areas are at the outer edges of the watershed, and the least vulnerable areas are generally closer to the Cahaba mainstem. This is due to generally steeper slopes in the outer areas and the position of higher-order streams, as well as the predominance of karst in the outer areas. This does not mean that development directly adjacent to streambanks should be encouraged. The value of riparian buffers is well documented, and local jurisdictions are encouraged to adopt the model stream ordinance buffer.

4 *Other Planning Considerations: Priority Screening*

Greenprint participants agreed upon the six land-based criteria described in Section 3 as the major planning criteria for the Upper Cahaba watershed, based on current understanding of the way that land-based characteristics affect water quality, as well as the availability of current digital data. Participants also agreed that other criteria, described in this section, may be considered by local governments and others when considering where to encourage development and where to protect lands. Equally important, conservation organizations may wish to consider these criteria when considering what lands to acquire (conservation easements or fee-simple).

The priority screening criteria presented here should be evaluated qualitatively; that is, they have not been added together or into the criteria "scores" described in Section 3, but can be considered when policy makers and other interested parties are making decisions about which lands to protect. Available data on each of these criteria are included in the database provided to the Consortium, and a matrix indicating the location of various criteria by subwatershed is included in Appendix B.

These screening criteria should not be considered additively (i.e., the subwatersheds with most of the criteria present considered to be the most significant) because some of the criteria may overlap and would result in "double counting" of similar attributes.

4.1 Environmental Screening Criteria

Environmental criteria not included in the earlier phase of land characterization were included in the priority screening phase. These criteria included further refinements of land-based criteria, such as forest patch size, as well as criteria based on current water quality assessments. These latter criteria used other important non-land attributes in the analysis to help identify, from a water quality and aquatic health perspective, what may be important in determining priorities for land protection. For example, areas draining to tributaries that are not meeting water quality standards should receive a higher priority for protection, to help prevent further water quality degradation. This step allows the inclusion of environmental characteristics relevant to water quality to be considered. The GIS database was organized by the 109 14-digit HUC subwatersheds, which were used as the basis for analysis. For each 14-digit HUC subwatershed, whether each subwatershed contained each of the five water quality attributes was determined using GIS, and the environmental characteristics are included in the database.

Water Use Classification

Figure 4.1 shows the waterbodies (rivers and lakes) in the Upper Cahaba whose water use classification is designated as Outstanding Alabama Water (OAW) or Public Water Supply (PWS). Outstanding Alabama Water best usage of waters is defined as: activities consistent with the natural characteristics of the waters. Conditions related to best usage: High quality waters that constitute an outstanding Alabama resource, such as waters of state parks and wildlife refuges and waters of exceptional recreational or ecological significance. Public Water Supply best usage of waters is defined as: source of water supply for drinking or food-processing purposes. Conditions related to best usage: the waters, if subjected to treatment approved by the Alabama Department of Environmental Management (ADEM), and which meet the requirements of ADEM, will be considered safe for drinking or food-processing purposes.

The priority screening matrix in Appendix B shows that all subwatersheds within the Upper Cahaba are located above or drain into one of these designated waterbodies.

Above Drinking Water Intake

Figure 4.2 shows the location of the drinking water intake for the Birmingham Water Works Board. (Specific locations of drinking water intake locations for the cities of Alabaster, Helena, and Pelham were not yet available.) The priority screening matrix in Appendix B lists the subwatersheds within the Upper Cahaba located upstream of this drinking water intake. Development in areas above drinking water intakes have the potential for greater water quality impacts, as water runoff from those areas flow into the drinking water intake.

Intact Forest

The integrity of the water in the Cahaba River mirrors the integrity of the ten-thousand-year-old native oak-hickory-pine forest that surrounds it. As that forest has been removed over the last twenty years, water quality has shown a measurable decline; while there are other factors contributing to the decline; loss of forest and increase in impervious surface are two major contributing factors.

In the earlier land characterization phase, whether or not an area was forested was considered (Figure 3.6). For this phase, Greenprint participants agreed that a further refinement of the forest criterion was warranted. Generally, larger forests are more sustainable over time and will therefore provide more protection to the river. In addition, the perimeter-to-area ratio of forests is important; a forest with a small perimeter is generally more sustainable than a forest of the same overall size with a larger perimeter. To protect the water in the Upper Cahaba, the current size and shape of larger forests with relatively smaller perimeters would ideally be protected.

Some Greenprint participants requested that the analysis include an evaluation of perimeter-to-area ratios of all forests; the specific data available could not determine actual shape and edge conditions of forest patches. Instead, Greenprint participants decided that mapping all contiguous forests 15 acres or larger would be useful information for policymakers.

Figure 4.3 shows subwatersheds in the Upper Cahaba that contain all or part of a forested area greater than 15 acres in size, evergreen or deciduous, that is considered not fragmented (based on forest patch size only). The priority screening matrix in Appendix B lists these subwatersheds within the Upper Cahaba with intact forest patches greater than 15 acres; all of the subwatersheds for which there is data contain forests of that size. (Land cover data for the southernmost subwatersheds is not currently available; this area is shown as “No Data” on the map.)

<u>Threatened and Endangered Species</u>

Threatened and endangered species are generally represented as element occurrences on maps (exact locations are generally not published to protect the species in question). An element occurrence (or EO) is an area of land and/or water in which a species or natural community is, or was (at the time of data collection), present. An EO should have practical conservation value for the species in question as evidenced by potential continued (or historical) presence and/or regular recurrence at a given location. The Alabama Natural Heritage

Program database is the best source of locational information on rare species in the state. However, the lack of occurrences documented in an area may represent data gaps rather than a lack of rare species.

Recent work by Mirarchi, et. al. on imperiled Alabama wildlife was consulted, but the information is not yet available in a single GIS database for mapping threatened and endangered species by stream reach in the Upper Cahaba watershed.

The presence of sensitive aquatic species is an indicator of special importance for a stream reach. Sensitive terrestrial species are not directly related to water quality; however, policymakers may wish to consider these sensitive habitats when setting priorities for development and conservation.

Figure 4.4 shows subwatersheds in the Upper Cahaba that contain federal or state listed threatened and endangered species element occurrences. The priority screening matrix in Appendix B lists the subwatersheds with an element occurrence; they are in about half of the subwatersheds, located throughout the overall watershed.

303(d) Listed Streams

Alabama's Draft 2002 Section 303(d) List includes segments of rivers, streams, lakes, reservoirs, and estuaries that either do not support or partially support their currently designated use or uses. The Draft 2002 Section 303(d) List has been developed using the Final 2000 303(d) List as the starting point. Data in EPA's STOrage and RETrieval (STORET) database, information from Section 319 nonpoint assessments, special watershed studies, other federal and state agencies, industries, and watershed initiatives were evaluated as the Draft 2002 Section 303(d) List was compiled.

Figure 4.5 shows 303(d) listed stream reaches in the Upper Cahaba watershed. The environmental priority screening matrix in the Appendix shows that all subwatersheds within the Upper Cahaba are located above or drain into one of these 303(d) listed stream reaches. At this time, this criterion therefore does not help differentiate or set priorities for subwatersheds, but as stream health improves in the future, the database should be kept up-to-date so that decision-makers can use this criterion to help set priorities.

4.2 Developmental Screening Criteria

While environmental criteria are important in determining priorities for land protection, other criteria may influence how decision-makers set priorities for protection and development. The Technical Committee decided that for this Greenprint, the developmental screening criteria that should be considered were development pressure—how likely is an area to be developed in the short term?—and open space connectivity – where are the opportunities to provide open space corridors, or connect existing public open spaces?

Development Pressure

General likelihood of development can be a consideration in determining the timing of protection measures. Non-profits and other organizations intending to acquire lands for conservation purposes may place a lower priority on lands that are not likely to be developed in the near future, even if they possess significant features related to water quality. Since land acquisition resources will be limited, decision-makers may wish to place a higher priority on acquiring significant lands that are in the path of development.

For development vulnerability, the assessment included interviews with local governments on known development activity or development trajectories, 2004 building permit activity from Jefferson County by Public Land Survey sections, local comprehensive plan information on existing and future land use designations, Alabama DOT state transportation plans, and input from Technical and Advisory Committee members.

Figure 4.6 illustrates the general locations of development activity or pressure in the Upper Cahaba watershed due to residential, commercial or infrastructure (road) development plans. The priority screening matrix in Appendix B indicates which subwatersheds within the Upper Cahaba are designated as having high or moderate development pressure.

The following is a summary of development activity in the Upper Cahaba Watershed Greenprint Area and/or the Greater Birmingham Metropolitan Area:

Birmingham and Jefferson County - The majority of Birmingham's redevelopment activity is occurring in the Black Warrior watershed and not in the Upper Cahaba watershed. Areas such as Oxmoor in Jefferson County and the vicinity of Lakeshore Drive, where it will be extended to Interstate 459, are currently facing development pressure. There is also pressure along County Highway 143: 1) an application has been submitted to the City for a multi-family development on Grants Mill, and 2) Lake Purdy is currently experiencing more development activity. In general, new development has followed highway expansion, creating residential areas that are distant from employment centers. Employment along transportation corridors has shifted from manufacturing to service industries.

The majority of the development pressure exists in southwest Jefferson County, where at least 1,000 single-family units have already been approved. The Tannehill State Park area near Interstate 459 is a residential development “hot spot,” as well as the area west of Shades Creek (I-20) in Vestavia. In addition, by providing the first east-west thoroughfare across the southern part of Jefferson County, the McAshan Road extension will facilitate development in this area, including an industrial park to be located on both sides of the corridor.

Hoover - In the City of Hoover there are two major retail nodes along US Highway 280. Evolving into a distinct node separate from the Galleria on US Highway 31 and State Highway 150, which is also experiencing a significant level of new retail growth. US Highway 31 in the oldest part of Hoover is a high priority for redevelopment. Property values are becoming increasingly high as a result of these development efforts. Much development is occurring around the Shades Creek area. One of the last remaining undeveloped sites in Hoover is located at the intersection of State Highway 150 at Interstate 459.

Irondale - Numerous projects are planned and/or proposed for the City of Irondale. Across from the Auto Mall opposite Interstate 459 on Belmont Road, two residential developments have been approved; one featuring 117 garden homes, and the other with 50-plus garden homes and a small park. Much of the property on Grants Mill Road at I-459 has been rezoned for commercial use. Currently, there are plans for a retail center to be built on Grants Mill Road. Another development is located on Janet Lane, off Old Leeds Road close to Mountain Brook. The 36-acre property is currently zoned residential and is planned for subdivision development.

St. Clair County - Redevelopment focus over the next 3-5 years will be in the Little Cahaba area. Emphasis will be placed on residential development and establishing a golf course. Much of the area north of Interstate 20, going towards US Highway 411, is under contract for commercial and single-family development. An interchange between US Highways 411 and 78 is planned. The majority of shopping and other commercial activity can be found here. The area between I-459 and Brompton is a busy one and is a targeted development spot. Development pressure exists along I-20 and I-59 interchanges. Trussville has much commercial development and is the hottest spot in the state for retail development. Areas south of Interstate 20 will be slower to develop because of topographic constraints and lack of sewer infrastructure. Regarding planned development, Jefferson State Community College at Pell City will be located north of I-20 between US Highway 231 and Wolf Creek Road. The plan calls for a heavily wooded, green campus with walking trails.

Trussville – In terms of planned development, 1,950 acres off Deerfoot Parkway are to be developed; 1,600 acres zoned for residential and 350 acres zoned commercial. A small strip shopping center is planned on the south side of US Highway 11 near Interstate 59 and Interstate 459. Also, a big box development is currently planned for 60 acres behind the Super Target on US Highway 11. Several projects have been recently completed: 1) The large shopping center off US Highway 11; 2) a sizeable shopping center off Chalkville Mountain Road across from K-Mart; and 3) two new schools built on US Highway 11. Leading the metropolitan area in residential development, 400-plus new homes have been built in Trussville over the last 2-3 years. Trussville Crossing extension is the primary transportation project. It will be accompanied by approximately 1,600 homes planned along the planned extension route.

Shelby County - Development pressure areas are primarily US Highway 280 and County Highway 41 corridors. Not much pressure exists in the southwest section of the county. In addition, there is not much development pressure in unincorporated Shelby County because of a lack of sewer infrastructure. Most development in the county is occurring within its municipalities.

Open Space Connectivity

Figure 4.7 shows existing or planned open spaces from land use data from the City of Birmingham, Jefferson and Shelby Counties, and the Black Warrior Land Trust. At the request of Technical and Advisory Committee members, golf courses are shown separately, as they are not necessarily fully open for public recreation. Some committee members suggested placing active parks such as ballfields and tennis courts in the same category; digital data that differentiates these kinds of lands is not currently available.

Appendix B illustrates the subwatersheds within the Upper Cahaba that contain existing or planned public open spaces, where opportunities may exist for connecting existing and planned open spaces. Particularly good opportunities for expanding or connecting existing public open spaces appear to be along the mainstem Cahaba south of Deerfoot Parkway, in the Little Shades Creek and Bee Mountain areas, and in the Acton Creek/Shelby Branch areas.

4.3 Summary

The application of the environmental and developmental screening criteria is intended to provide additional guidance to Consortium members and other decision-makers in setting priorities for land development and protection. Based on the matrix in Appendix B, most of the subwatersheds contain most of the environmental criteria, so the criteria at this time do not substantially differentiate among the subwatersheds. (This is also an indication that the entire watershed is sensitive to development, as described in the Phase I report.) The development criteria may provide meaningful information to decision-makers when they set priorities for land acquisition for use as public open space.

This matrix is based on currently available data; as with the land characterization criteria, as more refined and updated data become available, Consortium member governments should continue to update the matrix.

5 Restoration Strategies

The Greenprint provides guidance, strategies, and an inventory of priorities for land acquisition and preservation to be used in the broader context of watershed management in the Upper Cahaba Watershed. However, land preservation is only one of many tools and approaches that are typically combined to create an integrated watershed management and protection approach. Preservation alone cannot reverse impacts from existing development, nor can it protect from future development impacts; restoration is needed as part of a comprehensive watershed management equation.

An effective plan for dealing with watershed restoration and improvement must be programmatic and sustained to be effective. Just as a watershed becomes degraded in small increments over time, the restoration process should be designed to methodically mitigate and reverse the impacts on an incremental and opportunistic basis. Funding is often limited, so restoration activities need to be well planned and designed to address the most significant ongoing impacts and most cost-effective treatments first.

5.1 Types of Stream Restoration

Typically, stream restoration falls into two main categories - engineered vs. natural channel design. Engineered restoration consists of structural solutions to solve the problem, such as armoring banks with riprap to reduce erosion. Natural designs entail using live materials, stones, and logs to achieve a project that mimics a natural stream landscape. Some professionals consider the natural design approach to be a stronger solution if properly designed. The most popular natural channel design approach is by Rosgen (1996). Rosgen has developed four levels of restoration that vary in complexity and depend on the space available and upstream/downstream restrictions surrounding the reach.

Rosgen levels of restoration include:

Priority 1 Restoration - Reconstruct the incised channel with a new channel at a higher elevation that matches the historic channel elevation. Use data from a reference stream of similar size to create an appropriate channel dimension, pattern, and profile. The goal is to create a stream that has meander bends, riffle/run sequences, and a correctly sized channel shape and slope. Priority 1 restoration will reconnect the stream back to the original floodplain – this restoration option should only be considered if space allows the stream to overtop its banks during storm events.

Priority 2 Restoration – Reconstruct the channel at the existing elevation by creating a new floodplain at the existing stream elevation. As space allows, use data from a reference stream of similar size to create an appropriate channel dimension, pattern, and profile. Priority 2 restoration is considered when there is not enough space to create a new channel and connect the stream back to its original floodplain. Also, if flooding of nearby properties is concern, Priority 2 restoration will not increase flooding and may actually decrease flooding.

Priority 3 Restoration – This is a similar approach as level 2, but adds excavation of a floodplain bench on one or both sides of the existing stream elevation. Priority 3 restoration is usually considered over Priority 2 restoration if space is limited along the stream.

Priority 4 Restoration – Provide bank stabilization and bank projection along a stream channel at the existing stream elevation and leave the banks and floodplain where they exist.

Restoration projects, regardless if focused as Rosgen's Priority Levels of Restoration, should be geared towards improving the observed stream conditions. Specific measures, as outlined in Table 5.1, can be combined to tailor a project to the stream conditions. The changing hydrology from urbanization in the watershed needs to be taken into account when designing restoration projects. Many times, it is recommended that an upstream detention facility upgrade or new detention facility design be closely coordinated with a downstream stream restoration project. This clustering of projects will increase project success and reduced overall project costs.

Table 5.1 Descriptions of Commonly Used Restoration Measures

Restoration Measure	Code	Description
Buffers Enhancement	BU	Plant woody vegetation along stream channels to improve riparian corridor up to the stream bank
Grade Control[1]	CG	Install grade control structures (cross-vanes, weirs, step pools, etc.) to stabilize and/or raise the stream bed
Flow Deflection/ Concentration[1]	DG	Install flow deflection structures (j-hooks, wing deflectors, etc.) to re-direct the stream flow in the channel to improve bank erosion in stream bends, protect key property features, and/or improve in-stream habitat.
Debris Removal	DR	Mechanically remove debris in the stream channel that is mostly or completely blocking the channel and causing upstream local flooding problems and/or isolated bank erosion where stream flow is concentrated
Bank Protection[1]	PG	Improve bank stability and reduce erosion by placing hard structures (riprap, root wads, etc.) along the stream banks.
Bank Stabilization/ Bio-engineering[1]	SG	Grading the slope of the bank to reduce the bank steepness and utilizing vegetative plantings to stabilize the banks
Mixed Bank Protection/Bio-engineering	PS	Use a combination of vegetative plantings and hard structures (usually rip-rap at the toe of the slope) to customize the measure to the specific condition

[1] Restoration groups based on *Urban Stream Restoration Practices: An Initial Assessment* (Brown, 2000).

5.2 Programmatic Considerations for Stream Restoration Planning at the Watershed Scale

Stream restoration projects can be planned and designed to suit many watershed improvement goals, such as water quality improvements, sediment loading reduction, and aquatic habitat improvement. Before restoration can be considered, a set of goals at the watershed scale needs to be determined (Figure 5.1). These goals will drive how data is collected, what sort of (if any) models need to be developed, and how restoration projects are designed.

The Greenprint GIS database has been used to prioritize where lands should be considered for preservation. These same data can be used to help prioritize areas to focus on restoration efforts by looking at the urbanized or urbanizing areas first. The water quality model being developed as part of Phase II of the Upper Cahaba Watershed Study can also help focus efforts based on where water quality is being impacted beyond a defined threshold.

Urbanized watersheds typically have higher percent impervious area compared to undeveloped watersheds. Figure 5.2 shows the percent impervious for areas within the Upper Cahaba watershed. Studies show that stream systems begin to show signs of degradation when impervious areas reach 10% of the watershed area and deteriorate further as the percentage increases. Once a sub-watershed reaches 25% impervious area, most streams cannot support healthy aquatic systems and are difficult to restore (Zielinski, 2002). Based on this correlation, the areas in the Upper Cahaba watershed shown in Figure 6.2 that are the darkest red color are the most impervious and should be assessed for restoration opportunities before the other sub-watersheds. This prioritization will help reduce overall costs and focus efforts in the most degraded areas first.

Prioritizing at the subwatershed level helps to determine which areas to focus restoration efforts first based on the goals and drivers for restoring the watershed. In addition, if multiple projects are being developed within a watershed but there are limited funds to construct the projects, then the evaluation method could be developed to rank the projects. Environmental improvement, ease to construct, complexity of permitting, etc. are all considerations that can be incorporated into the benefit matrix. In addition, costs can be incorporated to measure a benefit to cost ratio for each project. The evaluation scores should reflect the overall goal(s) of the project.

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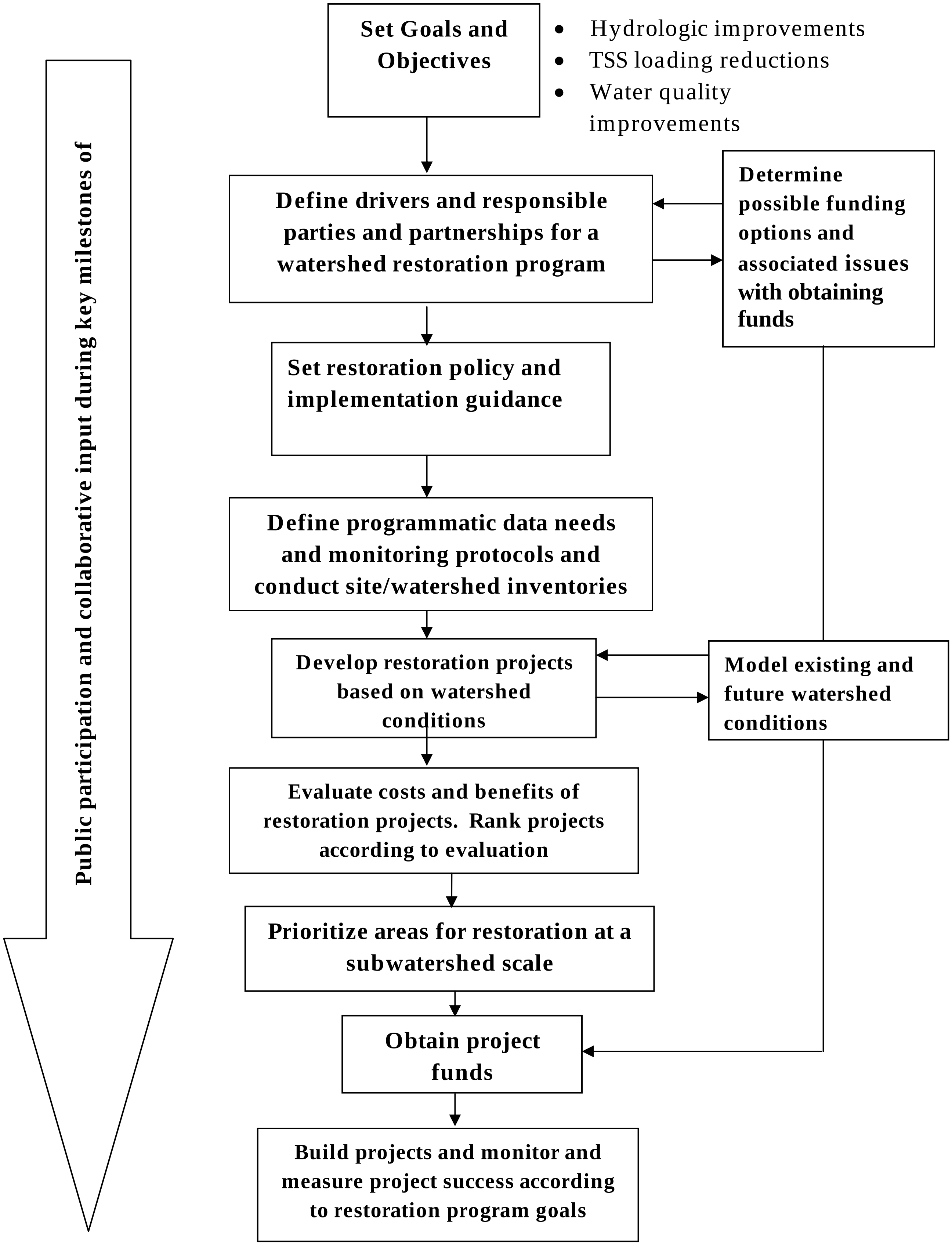
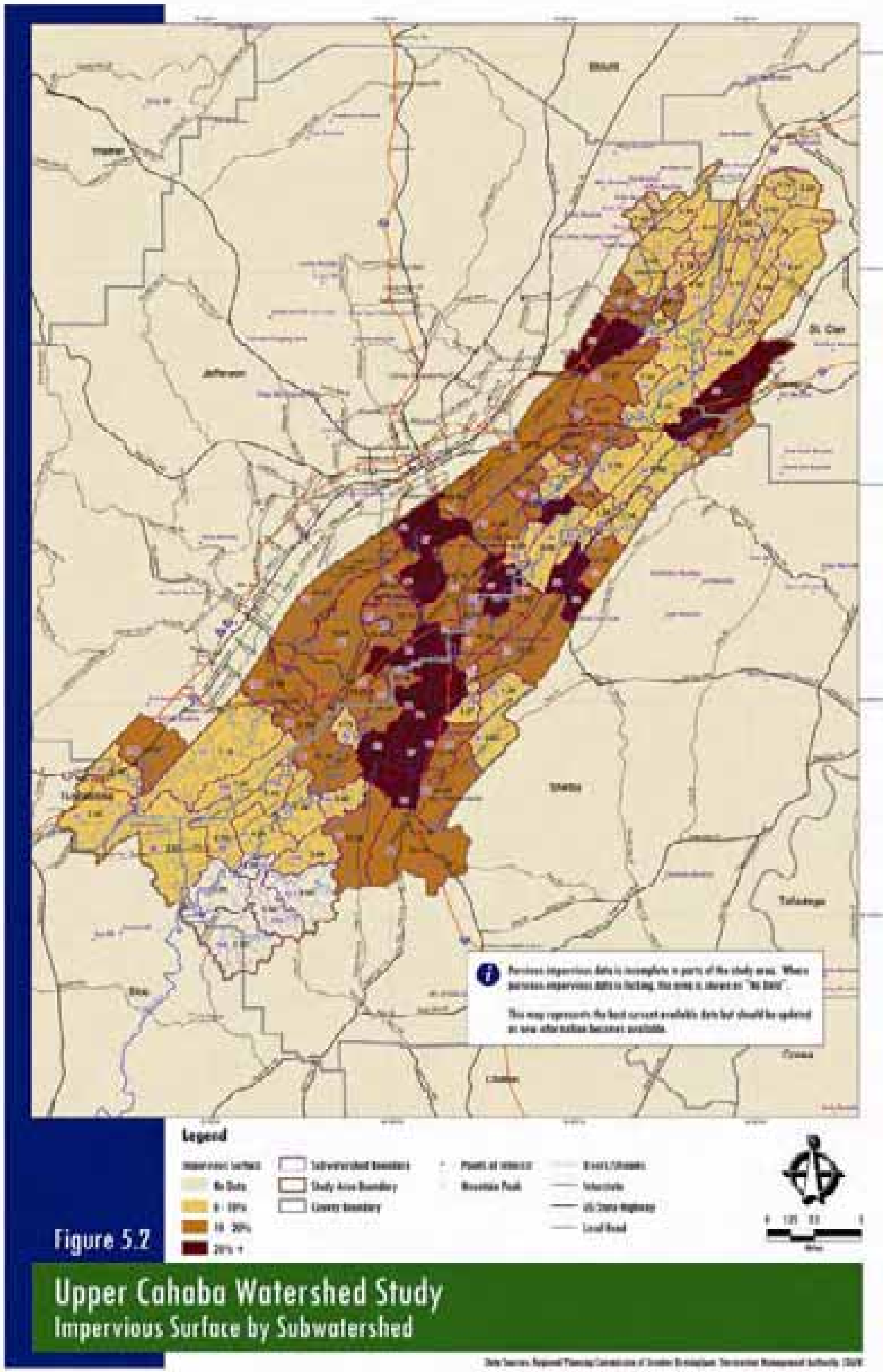
Figure 5.1 Recommended Restoration Planning and Implementation




Legend
Figure 5.2
Upper Cahaba Watershed Study
Impervious Surface by Subwatershed

6 *How to Use the Greenprint*

The Greenprint is a tool to be used by local governments, the private sector, non-governmental organizations, and citizens. Developers, regulators, conservation organizations, and others can use the information included in the Greenprint to guide decisions in balancing growth and water quality protection. The Greenprint is designed to be flexible and it should be updated regularly as new and better data become available.

The Greenprint is essentially a database that illustrates various physical attributes that relate to the relative vulnerability of the land's contribution to water quality in the Upper Cahaba River. These attributes, and the way the data are presented, were developed in conjunction with the Upper Cahaba Watershed Technical and Advisory Committees.

As described in the Upper Cahaba Watershed Study *Phase I Findings and Recommendations* report, all actions in the Upper Cahaba watershed affect the quality of the water in the Upper Cahaba River. As described in that report, all development activities within the watershed, regardless of their Greenprint designation, should be undertaken using best management practices and other measures to help protect water quality. These practices include various protection tools, including riparian, floodplain, stormwater, and sedimentation/erosion control ordinances; "smart growth" measures such as conservation subdivisions; acquisition of sensitive properties; and other tools. For more details on these, see the *Phase I Findings and Recommendations* report.

Following this introduction, this section of the report is organized as follows:

- *Section 6.1* describes how the Greenprint information is organized, and how property owners, local governments and others can use the Greenprint to help with land use, development, and acquisition decisions.

- *Section 6.2* summarizes other tools that can be used in conjunction with the Greenprint to help protect water quality.

6.1 How to Use the Greenprint

As described in Sections 3, the Greenprint map illustrates which lands are more sensitive in terms of water quality. As illustrated on Figure 3.7, areas depicted in red possess more of the characteristics related to water quality than other lands.

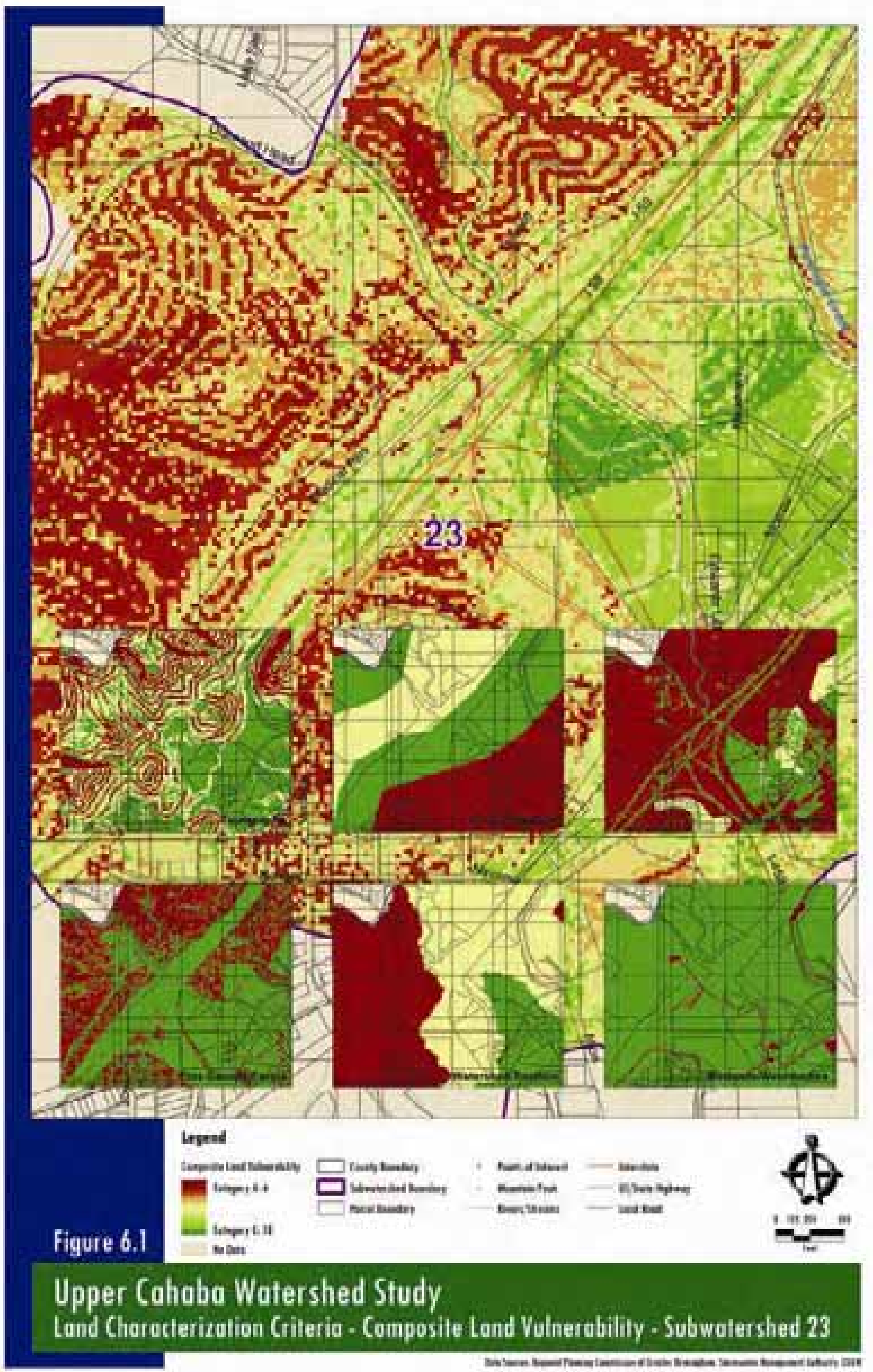
Figures 6.1-6.3 how the maps might be used in planning within the watershed. These examples describe the kind of analysis that a property owner, planner, or conservation advocate can perform using the Greenprint. Users who have access to versions of the Greenprint maps (preferably digitally, in GIS or another accessible format) will be able to "zoom" in on specific parcels, as illustrated in the three figures. These examples show how the Greenprint provides information that can inform decisions about development and conservation.

Example #1

Figure 6.1 illustrates an area in the northwest portion of the watershed, located in subwatershed 23. In this example we are looking at the rectangular parcel just south of the words "Diamond Head" on the large composite map. The composite map shows that most of this parcel is colored red, indicating higher sensitivity. A small portion of the parcel in the northeast corner is in the green/yellow range, indicating lower sensitivity. This would indicate that any development on the parcel should be concentrated in the northeast corner.

Examination of the smaller individual criterion maps reveals that most of the parcel has some very steep topography, and that the northeast corner is the least forested portion of the parcel. The other four criteria do not contribute significantly to differentiation of lands within the parcel.

This analysis indicates that most of the parcel is highly sensitive and, if developed, should be done so very carefully. A conservation subdivision that concentrated development in the northeast corner would be desirable. If other portions of the parcel were developed, it should be with strict erosion/sedimentation control measures, as well as tree protection measures. Alternatively, because most of the parcel is indicated as highly sensitive related to the rest of the watershed, local governments or conservation organizations may want to consider purchasing the land outright or otherwise protecting it through a conservation easement or other measures.


23
Legend
Figure 6.1
Upper Cahaba Watershed Study
Land Characterization Criteria - Composite Land Vulnerability - Subwatershed 23

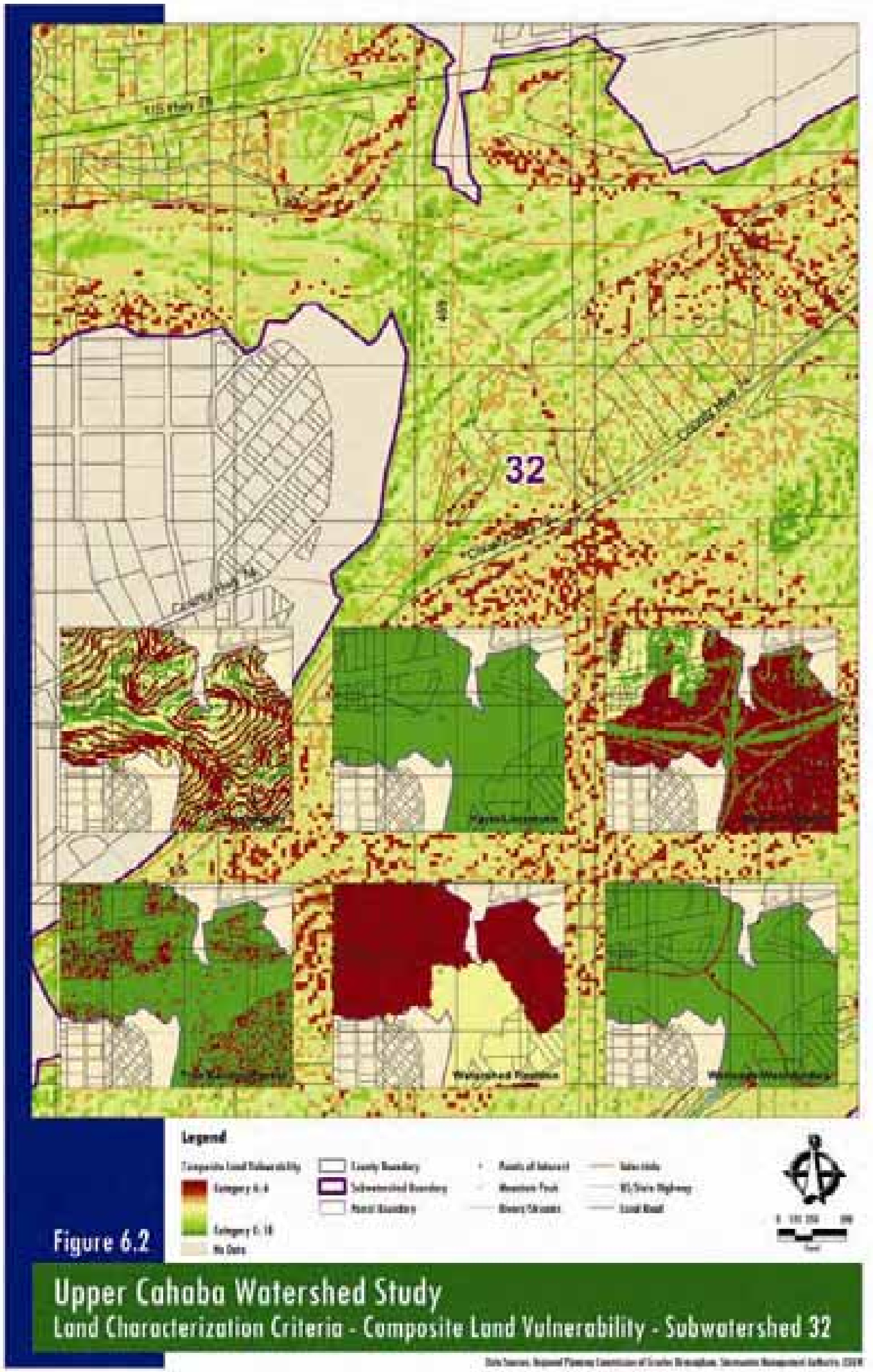
Example #2

The area under consideration in this example is the rectangle east of I-459, shown on the large composite map just to the right of the label "I 459." This area is mostly green and yellow on the composite map, indicating lower sensitivity than some of other areas in the watershed. The map also indicates that there is a stream in the lower left corner of the area, and there is a light red area (i.e. more vulnerable area) associated with the stream.

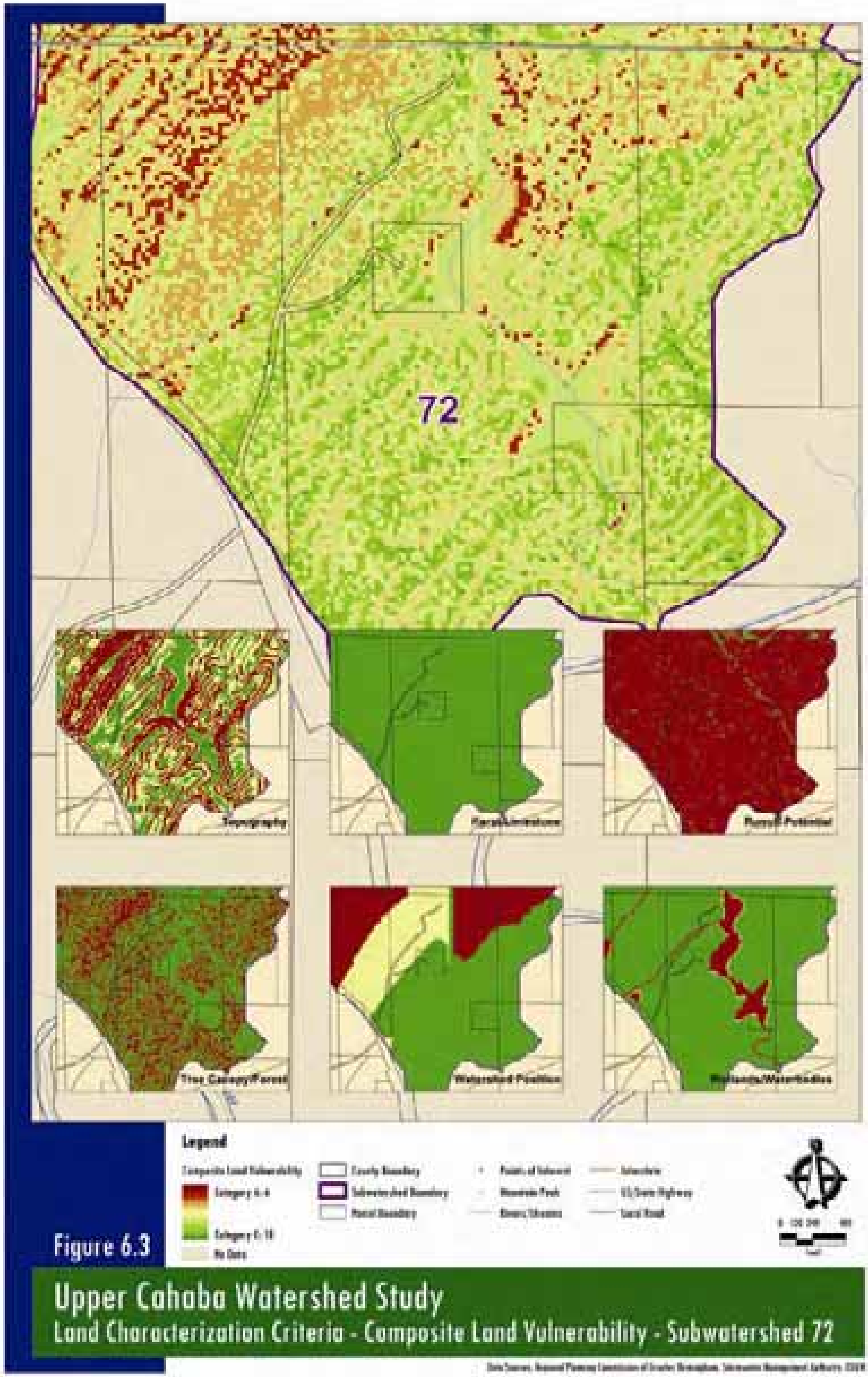
A look at the smaller individual criteria maps reveals that while there are steep slopes in the area, the map is green for the other criteria, indicating relatively low sensitivity. The "runoff potential" map shows impervious surfaces in green and indicates that there is a large road, indicating the area may already be developed. This suggests that it may be a good candidate for redevelopment, and potentially for stream restoration activities described in Section 5 of this report.

Example #3

Figure 6.3 illustrates an area located in subwatershed 72 and indicates a wide range of Greenprint values. In this example, we are considering the rectangular parcel shown in the center of the large map. The parcel includes all ranges of vulnerability, from red (most vulnerable) to green (least vulnerable). Zooming in on the individual criteria maps provides more information. The topography map illustrates generally why the yellow (medium sensitivity) and green (least sensitivity) bands have the pattern that they do. In addition, the tree canopy/ forest map shows that the west half of the parcel is more forested, and the wetlands/waterbodies map shows the presence of water in the eastern third of the parcel. Karst/limestone, runoff potential, and watershed position make little difference to the overall vulnerability map. Given what these maps tell us, and the actual on-ground conditions (surface water in the eastern third of the parcel), a logical conclusion would be that this is parcel would be a good candidate for a conservation subdivision, with the protected areas being the surface water and its buffer, along with the steep slope areas that are designated in yellow. If the owner of this parcel wished to develop it, the conservation subdivision approach would provide for the protection of important resources while also providing for economic use of the property. As with all development in the watershed, the development should be undertaken using best management practices to preserve as much tree cover as possible and prevent erosion.



32
Legend
Figure 6.2
Upper Cahaba Watershed Study
Land Characterization Criteria - Composite Land Vulnerability - Subwatershed 32


72
Legend
Figure 6.3
Upper Cahaba Watershed Study
Land Characterization Criteria - Composite Land Vulnerability - Subwatershed 72

6.2 Other Watershed Planning Tools

Phase I of the Upper Cahaba Watershed Study concluded that development activities anywhere in the watershed have the potential to negatively affect water quality; the Phase I report described protection measures that should be applied basin-wide. These are summarized briefly below. For more details, see the *Phase I Findings and Recommendations* report.

<u>Ordinances</u>

The Consortium is in the process of developing four ordinances to be considered by each of the county and municipal governments in the watershed. These ordinances provide essential tools for balancing development with water quality enhancement and should be in effect in all areas of the watershed.

Stormwater Management – Best management practices associated with construction include proper erosion and sedimentation control measures and stormwater retention and detention. As development continues in the watershed, all new developments should be required to implement measures to severely limit erosion during construction and reduce runoff during and after construction. Strict enforcement of these rules is an essential part of the Consortium’s plan to reduce harmful effects of development on the Upper Cahaba.

Floodplain Protection – Building in floodplains can increase velocity and volume of floodwaters downstream, increasing erosion and harming water quality. Another ordinance under development would define and limit structures that could be built in floodplains. In addition, the Consortium should add floodplains to the Greenprint database as digital floodplain mapping becomes available.

Riparian Buffers – Riparian buffers are an integral part of any watershed protection plan. To be effective stewards of the Upper Cahaba and its tributaries, all local governments should adopt and enforce these buffers, which limit land disturbance and construction within a certain distance of rivers and streams.

Conservation Subdivisions – Conservation subdivisions allow for residential development while protecting significant environmental features, such as floodplains, wetlands, and forests, and reduce impervious surfaces generally associated with residential development. As described in Phase I, local governments should adopt a conservation subdivision district as part of their zoning ordinances, and allow developers to choose that designation in any part of the watershed. In watersheds most vulnerable to development, local governments should require any single-family subdivisions to adhere to conservation subdivision guidelines, protecting sensitive environmental or cultural features and reducing impervious surfaces.

Alternatively, governments could require large lot (minimum two-acre) subdivisions in vulnerable subwatersheds, but only if impervious surfaces are minimized and commercial development is strictly limited. Large-lot zoning can be an effective way to reduce impervious surfaces, but this kind of development can easily lead to sprawl and larger numbers of roads and other infrastructure elements (such as water, sewer, emergency facilities, etc.) to meet the needs of residents.

Based on current data, conservation subdivisions should be required in the red areas on Figure 3.8 – Mean Value by Subwatershed, which generally occur in subwatersheds 1, 6, 7, 8, 11, 17, 15, 23, 31, 41, 51, 55, 63, 75, 79, 81, 86, and 109.

Redevelopment Incentives

As described in Phase I, any "greenfield" development, or development in currently undeveloped areas, has the potential to contribute to the degradation of the Upper Cahaba water quality. Therefore, encouraging redevelopment in already urbanized or suburbanized areas should be encouraged. Redevelopment can also contribute to water quality if best management practices described in the Phase I report and restoration activities described in Section 5 of this report are undertaken at the same time. Local governments can provide incentives for redevelopment through density bonuses, tax abatement, and other incentives available to local governments.

Comprehensive Planning

All comprehensive plans in the watershed should reference the importance of the Cahaba River as a local and regional resource and contain policies and goals addressing the protection of water quality. As described in Phase I, the plans provide the policy foundation for zoning and other development regulations.

Education

Also described in Phase I are several educational efforts that should be taken by the Consortium to raise awareness and understanding of the Cahaba River and its importance to regional quality of life. These efforts include road signs identifying the boundaries of the Cahaba watershed as well as educational programs emphasizing the importance of best management practices at the individual property-owner level.

Development Incentives

Local governments should also consider providing incentives for development in less vulnerable areas, which are shown in green on Figure 3.8 – Mean Value by Subwatershed, and generally correspond to subwatersheds 19, 22, 59, 47, 56, 68, 69 and 70. There are also other "green," or less vulnerable areas, in other watersheds where development should be encouraged. Incentives can include increased density allowances or expedited approval processes.

Transfer of Development Rights (TDRs)

Transfers of Development Rights (TDRs) have gained attention as an innovative land use tool since the 1990s. TDRs allow landowners to sell the right to build on their land to owners of other lands, who can use the purchased development rights to develop more intensely on other (presumably less vulnerable) lands. In return for permanently preserving the land, sellers of the development rights receive compensation from the buyers, tax benefits, and continued rights to reside on and/or farm the property. TDRs can be an attractive option for landowners who want to protect the environment but also wanted to preserve the value of their land.

While TDRs can be a powerful tool to direct development to desirable areas and protect vulnerable lands, obstacles do exist. State enabling legislation would be needed in Alabama to allow for TDRs in the Cahaba watershed. In addition, on a local government or regional basis, governments would need to identify "receiving areas," or areas where development should be encouraged, and "donating areas," vulnerable areas where lands should be protected. Receiving areas should be areas within or outside the watershed that are either redevelopment priority areas, or areas of least vulnerability (green areas on Figure 3.8). Donating areas would be the red areas on Figure 3.8.

Despite these potential difficulties, a TDR program in the Upper Cahaba watershed represents one of the best potential tools to allow for the protection of vulnerable lands while providing adequate compensation for landowners in vulnerable areas who give up their development rights. This potential win-win scenario should be adequate incentive for the Consortium to work toward state enabling legislation and, subsequently, the establishment of a local administrative mechanism.

Fee-Simple Purchase

Under a fee-simple purchase, the buyer assumes full rights of ownership of the entire property. Although acquisition funds are limited, fee-simple purchase is a powerful tool for governments and conservation organizations to permanently protect vulnerable lands. The priority for acquisition should be in the red areas shown on Figure 3.8. These lands generally are found in subwatersheds 1, 6, 7, 8, 11, 17, 15, 23, 31, 41, 51, 55, 63, 75, 79, 81, 86, and 109.

Conservation Easements

A way to stretch land acquisition dollars is to limit acquisition of land to development rights, as opposed to acquiring all rights of a piece of property. Conservation easements, generally purchased by or donated to land conservation organizations or governmental entities, are the most common tool in land protection. Conservation easements are legal agreements that permanently restrict the development and use of land to ensure protection of its conservation values.

Priorities for acquisition of conservation easements are the same as the priorities for fee-simple purchase.

Open Space Corridors

Due in large part to urban development, the segmentation of open spaces leads to the loss of habitat and a lack of biodiversity. Re-connecting these spaces can play a critical role in open space and natural resource protection. Linkages between open spaces provide movement for wildlife habitat and vegetation, rather than leaving the resources in isolation. In addition, linking public open spaces can provide important recreation corridors.

As described in Section 4, Appendix B illustrates the subwatersheds within the Upper Cahaba that contain existing or planned public open spaces, where opportunities may exist for connecting existing with planned open spaces. Particularly good opportunities (see Figure 3.7) for expanding or connecting existing public open spaces appear to be along the mainstem Cahaba south of Deerfoot Parkway (subwatershed 20), in the Little Shades Creek and Bee Mountain areas (subwatersheds 55 and 106), and in the Acton Creek/Shelby Branch areas (subwatersheds 62 and 67). Undeveloped forested areas should also be considered for acquisition as open space.

7 Glossary of Acronyms

ADEM – Alabama Department of Environmental Management

ADOT – Alabama Department of Transportation

ANHP – Alabama Natural Heritage Program

BMP – Best Management Practice

CAWACO RC&D – Cahaba Warrior and Coosa Rivers Resource Conservation and Development Council

CRA – Comparative Risk Assessment

CWP – Clean Water Partnership

DEM – Digital Elevation Model

EO – Element Occurrence

ESRI – Environmental Systems Research Institute

GIS – Geographic Information System

GSA – Geological Survey of Alabama

HUC – Hydrologic Unit Code

NHD – National Hydrography Dataset

NPS – Nonpoint Source

NRCS – Natural Resources Conservation Service

NWI – National Wetlands Inventory

OAW – Outstanding Alabama Water

PWS – Public Water Supply

RPC – Regional Planning Commission of Greater Birmingham

SSURGO – Soil Survey Geologic Database

STORET – STOrage and RETreival database

SWMA – Stormwater Management Authority

TMDL – Total Maximum Daily Loads

TDR – Transfer of Development Rights

UAB – University of Alabama, Birmingham

UCWG – Upper Cahaba Watershed Greenprint

USDA – Unites States Department of Agriculture

US EPA – Unites States Environmental Protection Agency

USFS – United States Forest Service

USGS – United States Geological Survey

Appendix A: Land Characterization Criteria

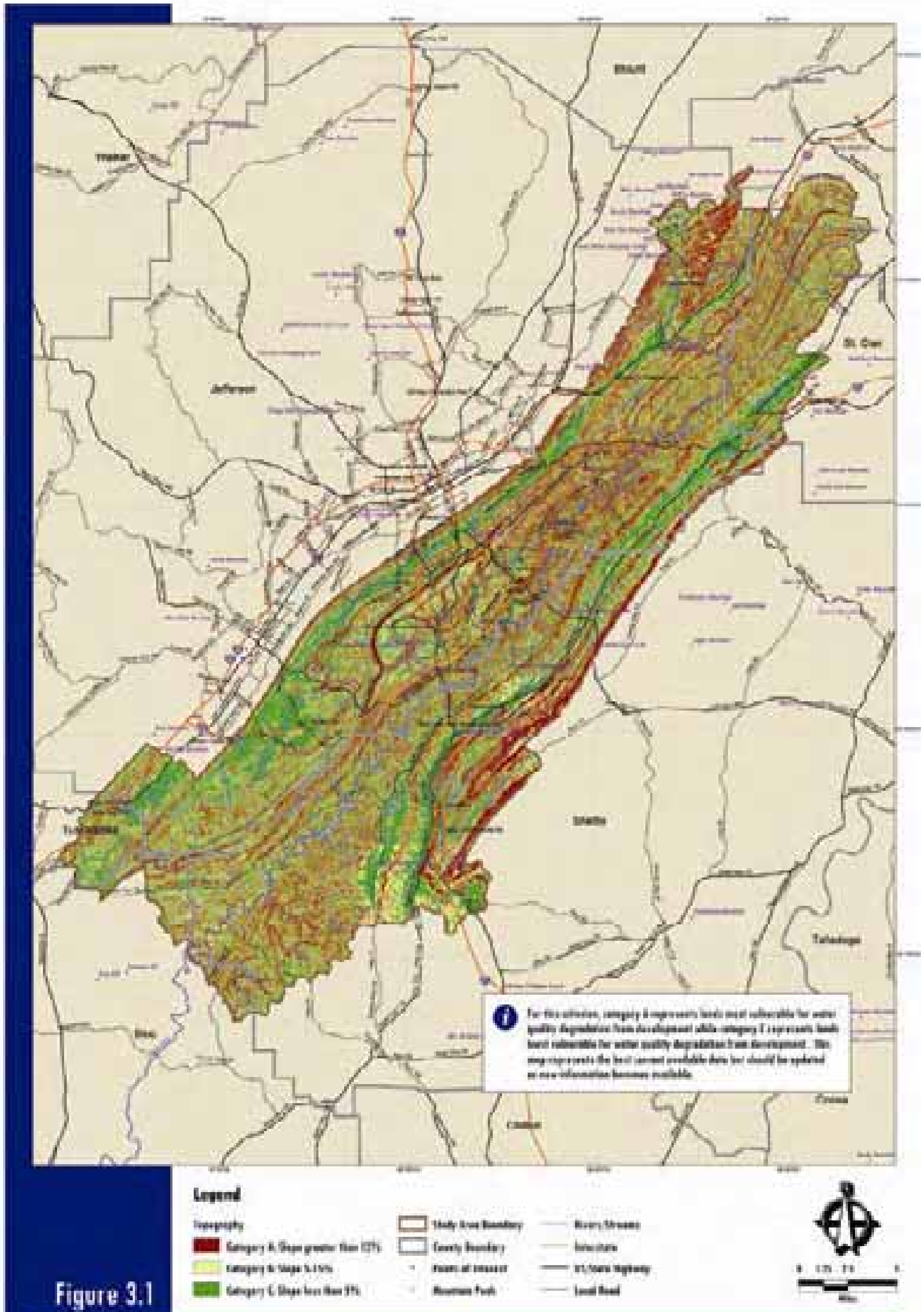


Figure 3.1

Upper Cahaba Watershed Study
Land Characterization Criteria - Topography

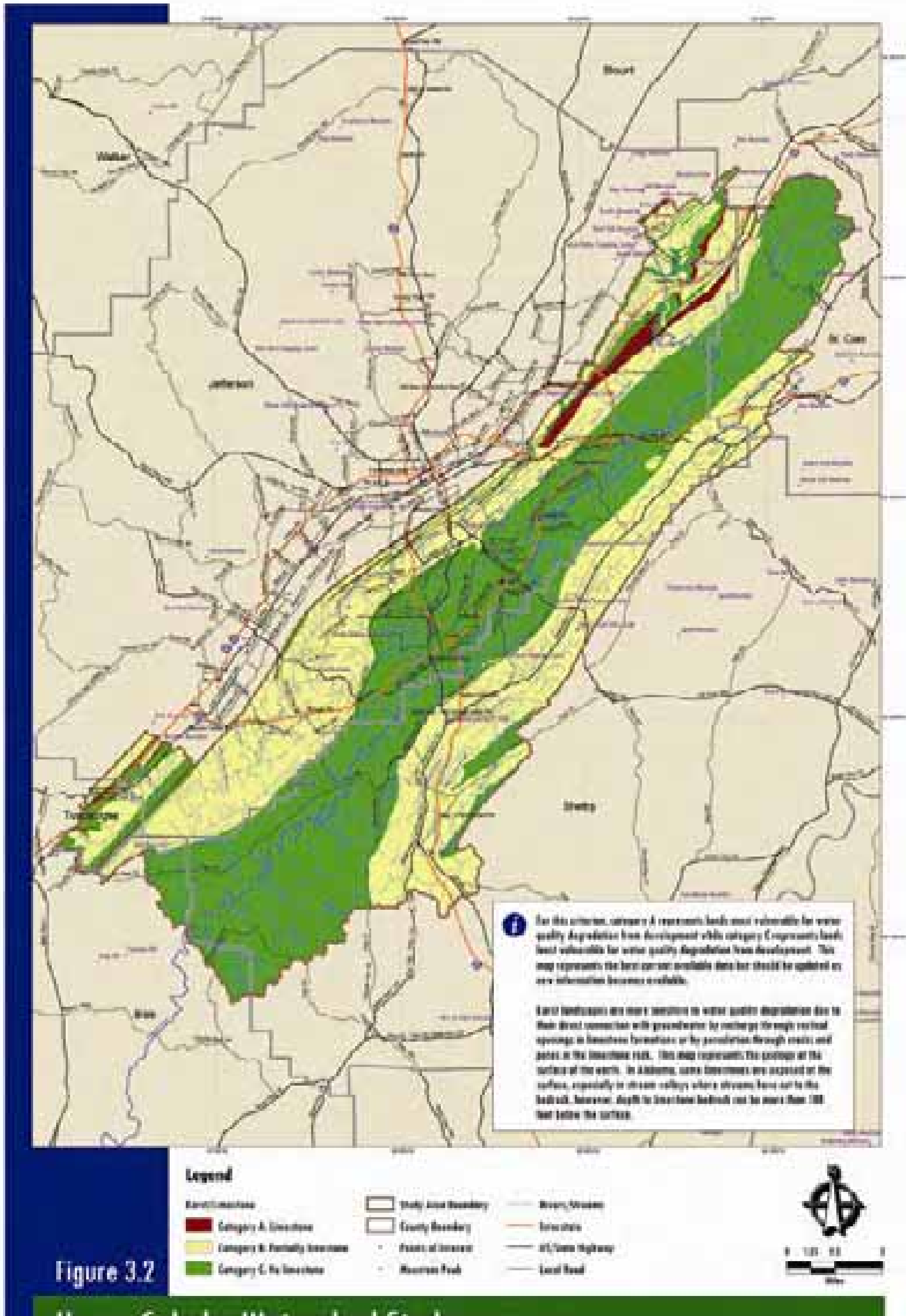


Figure 3.2

Upper Cahaba Watershed Study

Land Characterization Criteria - Karst/Limestone

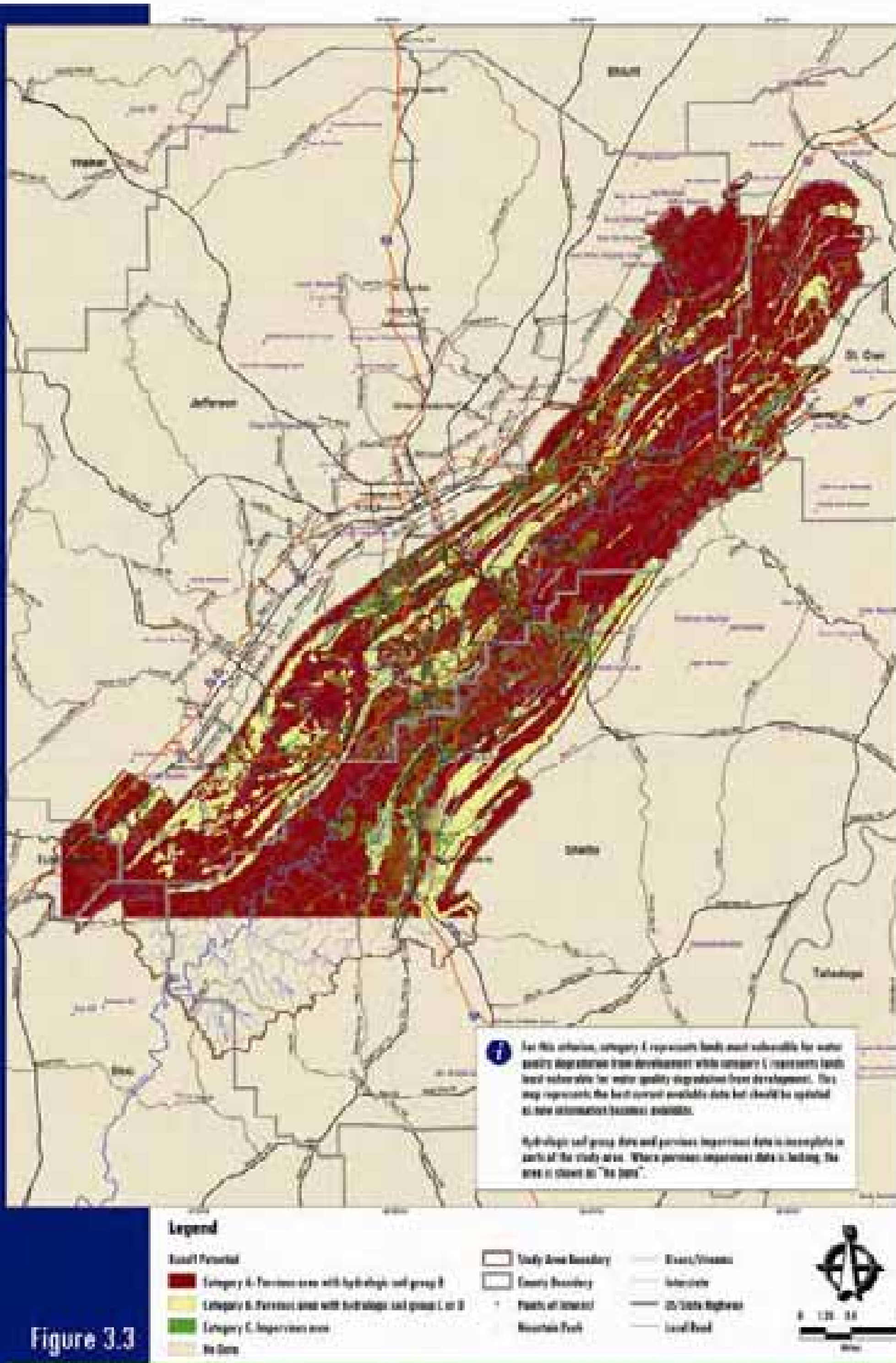


Figure 3.3

Upper Cahaba Watershed Study

Land Characterization Criteria - Runoff Potential

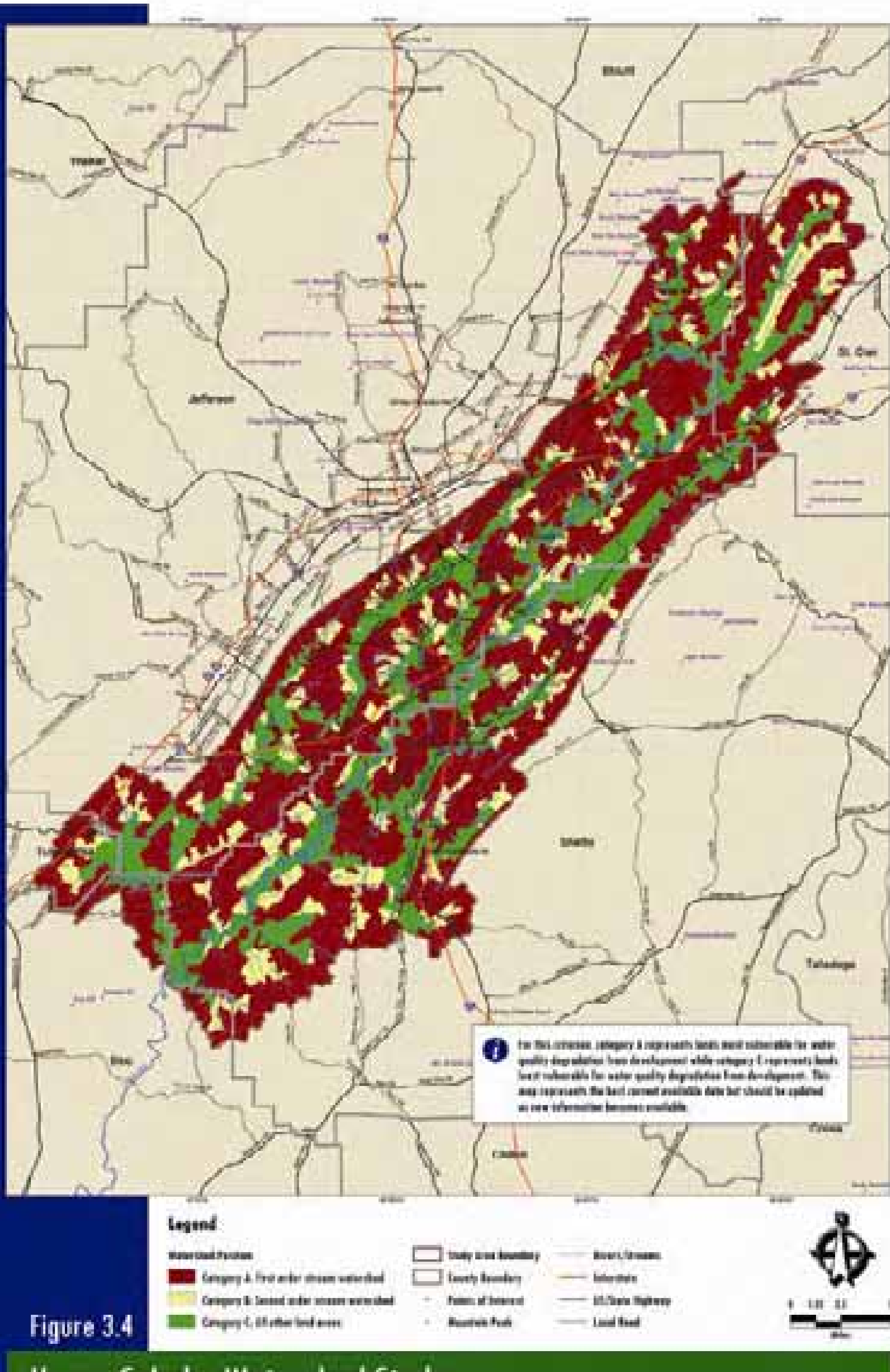


Figure 3.4

Upper Cahaba Watershed Study

Land Characterization Criteria - Watershed Position

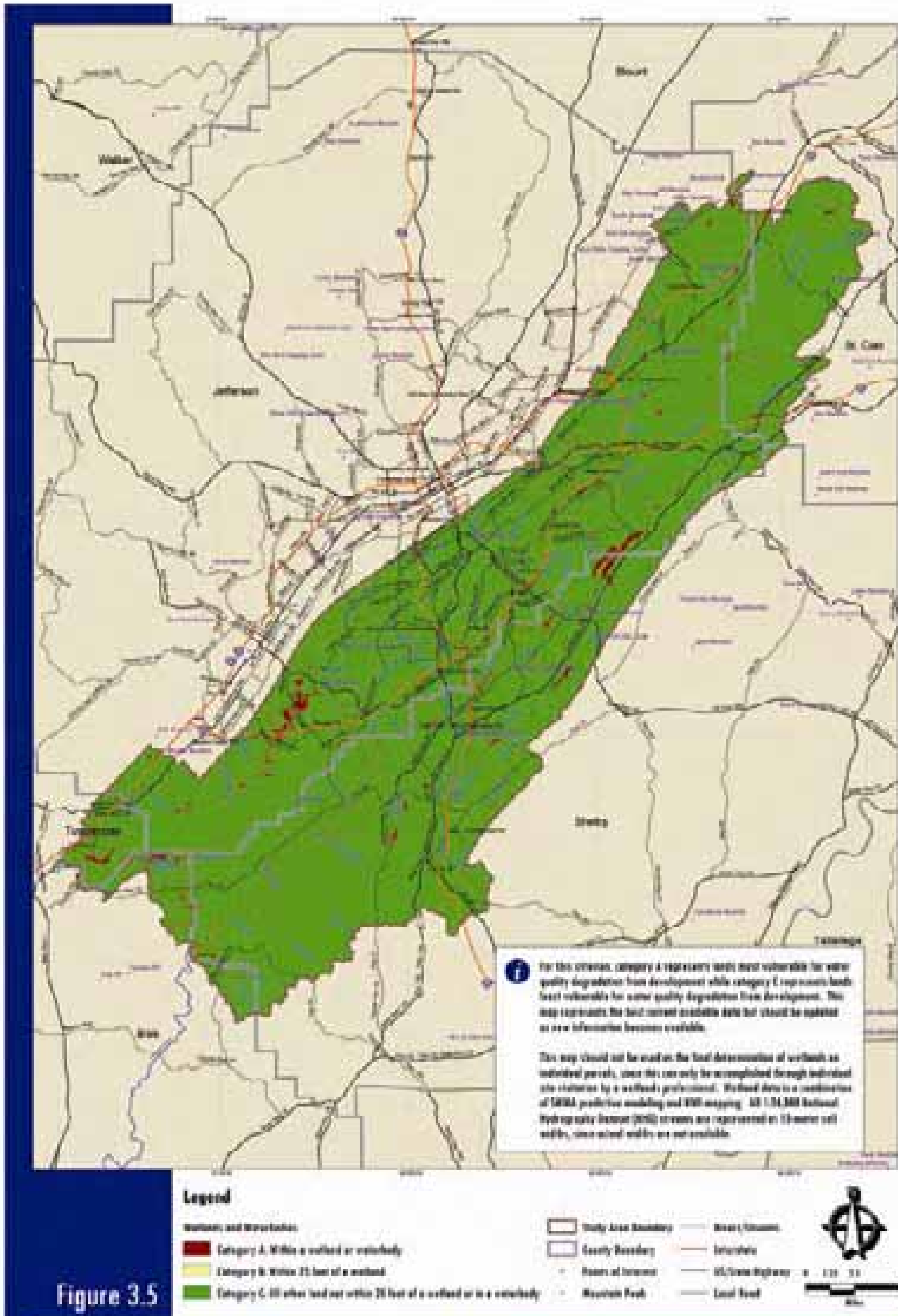


Figure 3.5

Upper Cahaba Watershed Study

Land Characterization Criteria - Wetlands and Waterbodies

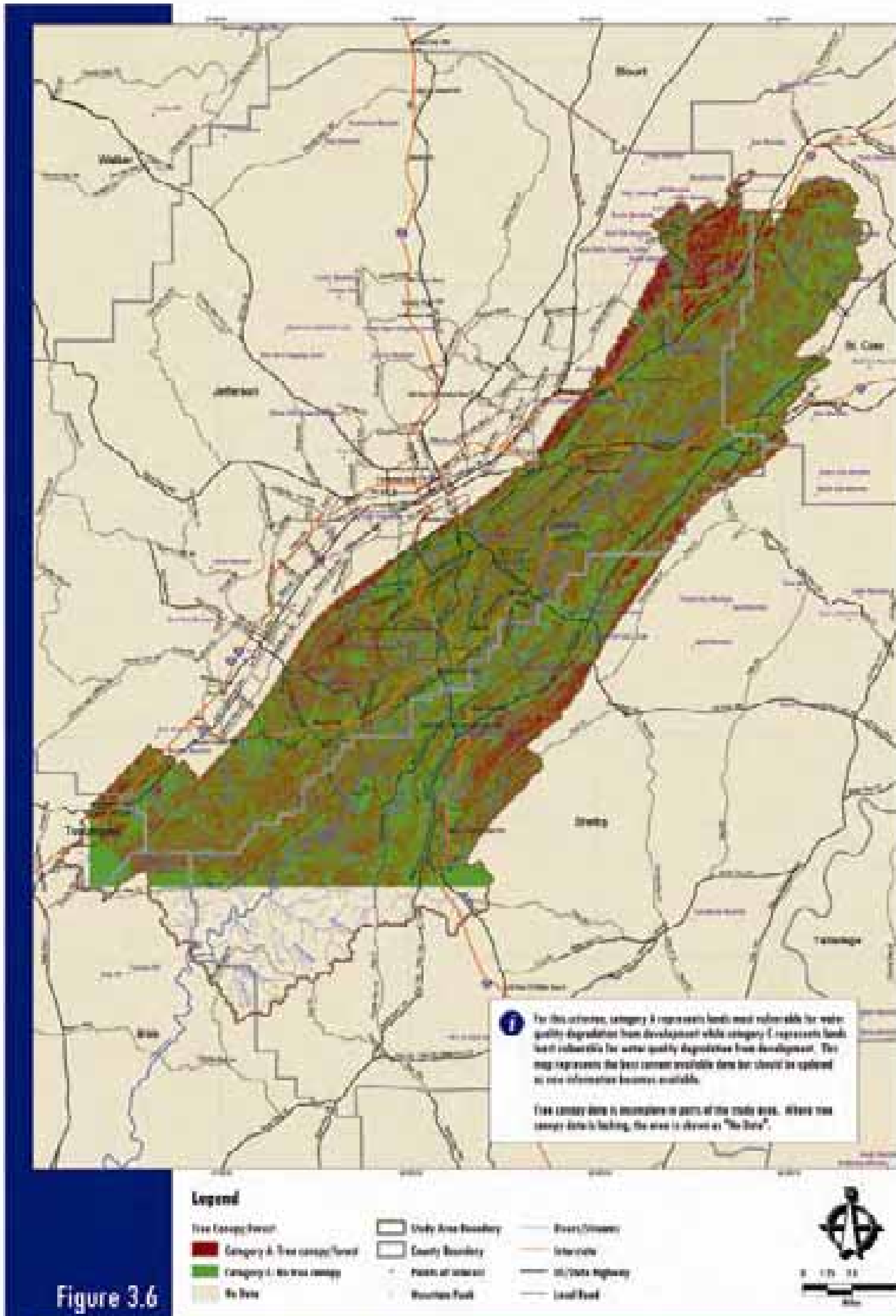


Figure 3.6

Upper Cahaba Watershed Study
Land Characterization Criteria - Tree Canopy/Forest

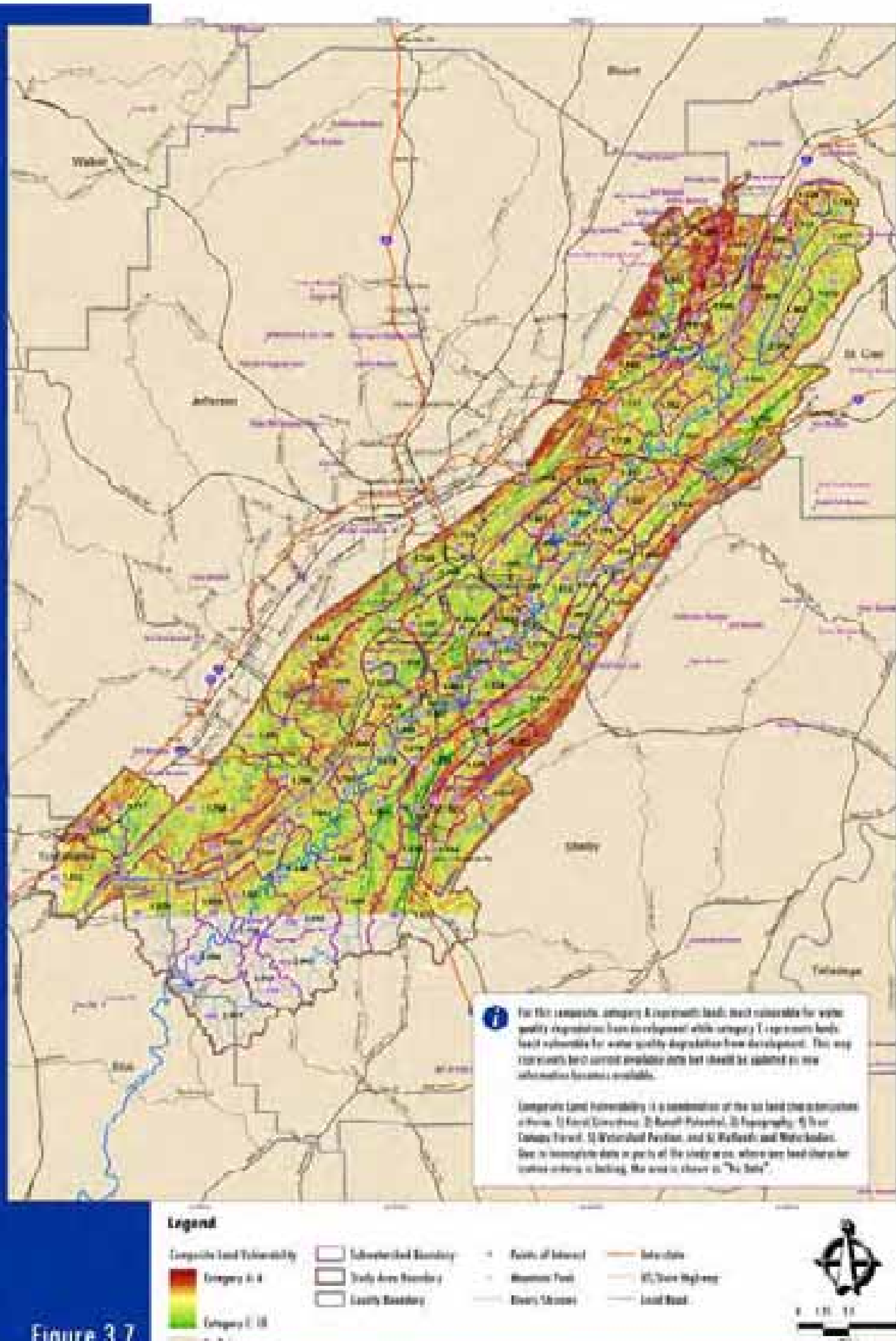


Figure 3.7

Upper Cahaba Watershed Study
Land Characterization Criteria - Composite Land Vulnerability

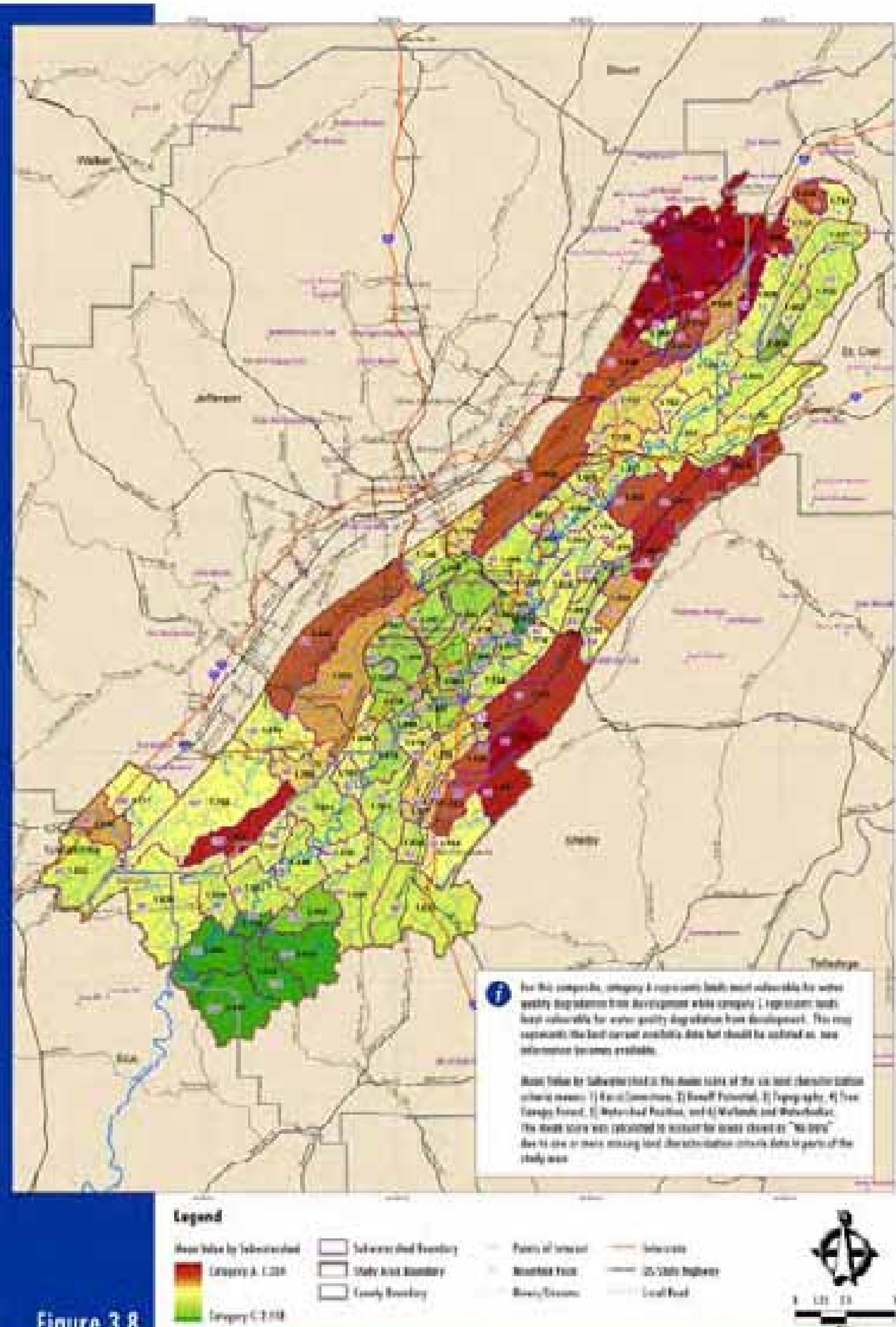


Figure 3.8

Upper Cahaba Watershed Study

Land Characterization Criteria - Mean Value by Subwatershed

Appendix B: Priority Screening Criteria

TABLE 4.1 Screening Criteria by Subwatershed

ID	MAP KEY	14-DIGIT HUC SUBWATERSHED NAME	MEAN VALUE BY SUBWATERSHED	WATER USE CLASSIFICATION	ABOVE DRINKING WATER INTAKE	INTACT FOREST	T&E SPECIES	303(d) LISTED STREAMS	DEVELOPMENT PRESSURE	OPEN SPACE CONNECTIVITY
1		Big Black Creek	1.284	Y	Y	Y	Y	Y	Y	
2		Big Black Creek	1.783	Y	Y	Y		Y	Y	
3		Big Black Creek	1.635	Y	Y	Y		Y		
4		Big Black Creek	1.735	Y	Y	Y		Y	Y	
5		Big Black Creek	1.548	Y	Y	Y		Y	Y	
6		Big Black Creek	1.448	Y	Y	Y	Y	Y	Y	
7		Big Black Creek	1.491	Y	Y	Y	Y	Y	Y	
8		Big Black Creek	1.455	Y	Y	Y		Y	Y	
9		Big Black Creek	1.837	Y	Y	Y		Y	Y	
10		Big Black Creek	1.830	Y	Y	Y	Y	Y	Y	
11		Big Black Creek	1.463	Y	Y	Y	Y	Y	Y	
12		Big Black Creek	1.669	Y	Y	Y		Y	Y	Y
13		Big Black Creek	1.808	Y	Y	Y		Y	Y	
14		Big Black Creek	1.414	Y	Y	Y		Y	Y	
15		Big Black Creek	1.419	Y	Y	Y		Y	Y	
16		Big Black Creek	1.862	Y	Y	Y		Y	Y	
17		Big Black Creek	1.459	Y	Y	Y	Y	Y	Y	Y
18		Big Black Creek	1.612	Y	Y	Y		Y	Y	
19		Big Black Creek	1.625	Y	Y	Y	Y	Y	Y	Y
20		Big Black Creek	1.866	Y	Y	Y	Y	Y	Y	Y
21		Big Black Creek	1.797	Y	Y	Y	Y	Y	Y	
22		Big Black Creek	2.006	Y	Y	Y	Y	Y	Y	
23		Big Black Creek	1.641	Y	Y	Y	Y	Y	Y	Y
24		Big Black Creek	1.841	Y	Y	Y	Y	Y	Y	
25		Cahaba River North	1.717	Y	Y	Y		Y	Y	
26		Little Cahaba	1.788	Y		Y	Y	Y	Y	Y
27		Cahaba River North	1.752	Y	Y	Y		Y	Y	Y
28		Cahaba River North	1.803	Y	Y	Y	Y	Y	Y	
29		Shades Creek	1.626	Y		Y		Y	Y	Y
30		Cahaba River North	1.720	Y	Y	Y	Y	Y	Y	
31		Little Cahaba	1.575	Y		Y		Y	Y	Y
32		Cahaba River North	1.857	Y	Y	Y	Y	Y	Y	
33		Cahaba River North	1.806	Y	Y	Y		Y	Y	
34		Little Cahaba	1.604	Y		Y	Y	Y	Y	

ID	MAP KEY	14-DIGIT HUC SUBWATERSHED NAME	MEAN VALUE BY SUBWATERSHED	WATER USE CLASSIFICATION	ABOVE DRINKING WATER INTAKE	INTACT FOREST	T&E SPECIES	303(d) LISTED STREAMS	DEVELOPMENT PRESSURE	OPEN SPACE CONNECTIVITY
35		Cahaba River North	1.647	Y	Y	Y	Y	Y	Y	
36		Cahaba River North	1.856	Y	Y	Y	Y	Y	Y	
37		Cahaba River North	1.801	Y	Y	Y		Y	Y	
38		Shades Creek	1.735	Y		Y		Y	Y	Y
39		Cahaba River North	1.774	Y	Y	Y		Y	Y	
40		Cahaba River North	1.884	Y	Y	Y	Y	Y	Y	
41		Little Cahaba	1.543	Y		Y		Y	Y	Y
42		Cahaba River North	1.868	Y	Y	Y	Y	Y	Y	Y
43		Shades Creek	1.749	Y		Y		Y	Y	Y
44		Cahaba River North	1.804	Y	Y	Y		Y	Y	
45		Little Cahaba	1.816	Y		Y		Y	Y	
46		Cahaba River North	1.815	Y		Y	Y	Y	Y	Y
47		Shades Creek	1.924	Y		Y		Y	Y	Y
48		Little Cahaba	1.932	Y		Y		Y	Y	
49		Cahaba River North	1.865	Y	Y	Y		Y	Y	
50		Little Cahaba	1.834	Y		Y		Y	Y	
51		Shades Creek	1.645	Y		Y	Y	Y	Y	Y
52		Cahaba River North	1.956	Y		Y		Y	Y	Y
53		Little Cahaba	1.668	Y		Y	Y	Y	Y	Y
54		Little Cahaba	1.841	Y		Y		Y	Y	Y
55		Shades Creek	1.689	Y		Y		Y	Y	
56		Cahaba River North	1.897	Y		Y		Y	Y	Y
57		Cahaba River North	1.880	Y		Y	Y	Y	Y	Y
58		Little Cahaba	1.759	Y		Y		Y	Y	Y
59		Cahaba River North	2.031	Y		Y	Y	Y	Y	
60		Cahaba River North	1.810	Y		Y		Y	Y	Y
61		Cahaba River North	1.887	Y		Y		Y	Y	
62		Cahaba River North	1.774	Y		Y		Y	Y	Y
63		Cahaba Valley	1.593	Y		Y		Y	Y	Y
64		Cahaba River North	1.875	Y		Y	Y	Y	Y	Y
65		Cahaba River North	1.958	Y		Y		Y	Y	Y
66		Cahaba River North	1.940	Y		Y	Y	Y	Y	Y
67		Cahaba River North	1.833	Y		Y		Y	Y	Y
68		Cahaba River North	1.925	Y		Y	Y	Y	Y	Y

ID	MAP KEY	14-DIGIT HUC SUBWATERSHED NAME	MEAN VALUE BY SUBWATERSHED	WATER USE CLASSIFICATION	ABOVE DRINKING WATER INTAKE	INTACT FOREST	T&E SPECIES	303(d) LISTED STREAMS	DEVELOPMENT PRESSURE	OPEN SPACE CONNECTIVITY
69		Cahaba River North	1.960	Y		Y		Y	Y	Y
70		Cahaba River North	1.928	Y		Y		Y	Y	Y
71		Cahaba River North	1.897	Y		Y	Y	Y	Y	Y
72		Cahaba River North	1.809	Y		Y		Y	Y	Y
73		Cahaba Valley	1.712	Y		Y		Y	Y	Y
74		Cahaba River North	1.885	Y		Y	Y	Y	Y	Y
75		Cahaba Valley	1.303	Y		Y		Y	Y	Y
76		Cahaba Valley	1.739	Y		Y	Y	Y	Y	Y
77		Cahaba River North	1.876	Y		Y	Y	Y	Y	Y
78		Cahaba River North	1.816	Y		Y		Y	Y	Y
79		Cahaba Valley	1.620	Y		Y	Y	Y	Y	Y
80		Shades Creek	1.705	Y		Y		Y	Y	Y
81		Cahaba Valley	1.547	Y		Y	Y	Y	Y	Y
82		Cahaba River South	1.788	Y		Y	Y	Y	Y	
83		Cahaba Valley	1.854	Y		Y	Y	Y	Y	Y
84		Cahaba River South	1.864	Y		Y	Y	Y	Y	Y
85		Cahaba Valley	1.732	Y		Y		Y	Y	Y
86		Cahaba Valley	1.623	Y		Y	Y	Y	Y	Y
87		Cahaba Valley	1.701	Y		Y		Y	Y	
88		Cahaba Valley	1.764	Y		Y	Y	Y	Y	Y
89		Shades Creek	1.691	Y		Y		Y	Y	
90		Cahaba River South	1.797	Y		Y	Y	Y	Y	
91		Cahaba River South	1.848	Y		Y	Y	Y	Y	
92		Cahaba Valley	1.838	Y		Y		Y	Y	Y
93		Shades Creek	1.832	Y		Y		Y	Y	
94		Cahaba River South	1.826	Y		Y	Y	Y	Y	
95		Cahaba River South	1.854	Y		Y	Y	Y		Y
96		Shades Creek	1.829	Y		Y	Y	Y	Y	
97		Cahaba River South	1.843	Y		Y	Y	Y	Y	
98		Cahaba Valley	1.872	Y		Y	Y	Y	Y	Y
99		Cahaba River South	1.834	Y		Y	Y	Y	Y	
100		Cahaba River South	2.002	Y		Y	Y	Y		
101		Cahaba River South	2.118	Y			Y	Y		
102		Cahaba River South	2.068	Y			Y	Y		

ID	MAP KEY	14-DIGIT HUC SUBWATERSHED NAME	MEAN VALUE BY SUBWATERSHED	WATER USE CLASSIFICATION	ABOVE DRINKING WATER INTAKE	INTACT FOREST	T&E SPECIES	303(d) LISTED STREAMS	DEVELOPMENT PRESSURE	OPEN SPACE CONNECTIVITY
103		Cahaba River South	2.043	Y				Y		
104		Cahaba River South	2.018	Y				Y		
105		Cahaba River South	2.017	Y				Y		
106		Shades Creek	1.810	Y		Y	Y	Y	Y	Y
107		Shades Creek	1.768	Y		Y	Y	Y	Y	Y
108		Shades Creek	1.777	Y		Y		Y	Y	Y
109		Shades Creek	1.538	Y		Y		Y	Y	

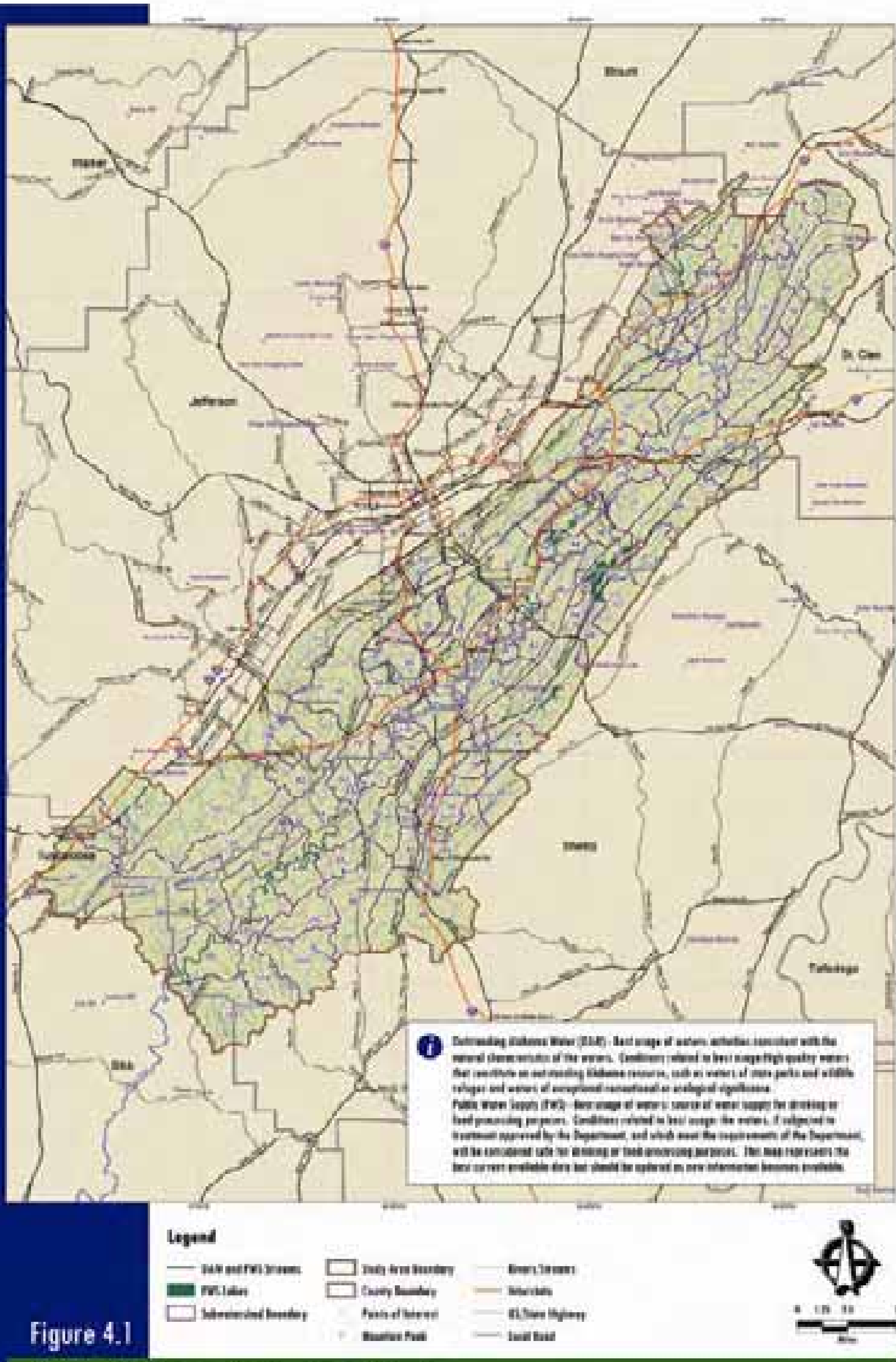


Figure 4.1

Upper Cahaba Watershed Study

Environmental Prioritization Screening - Water Use Classification

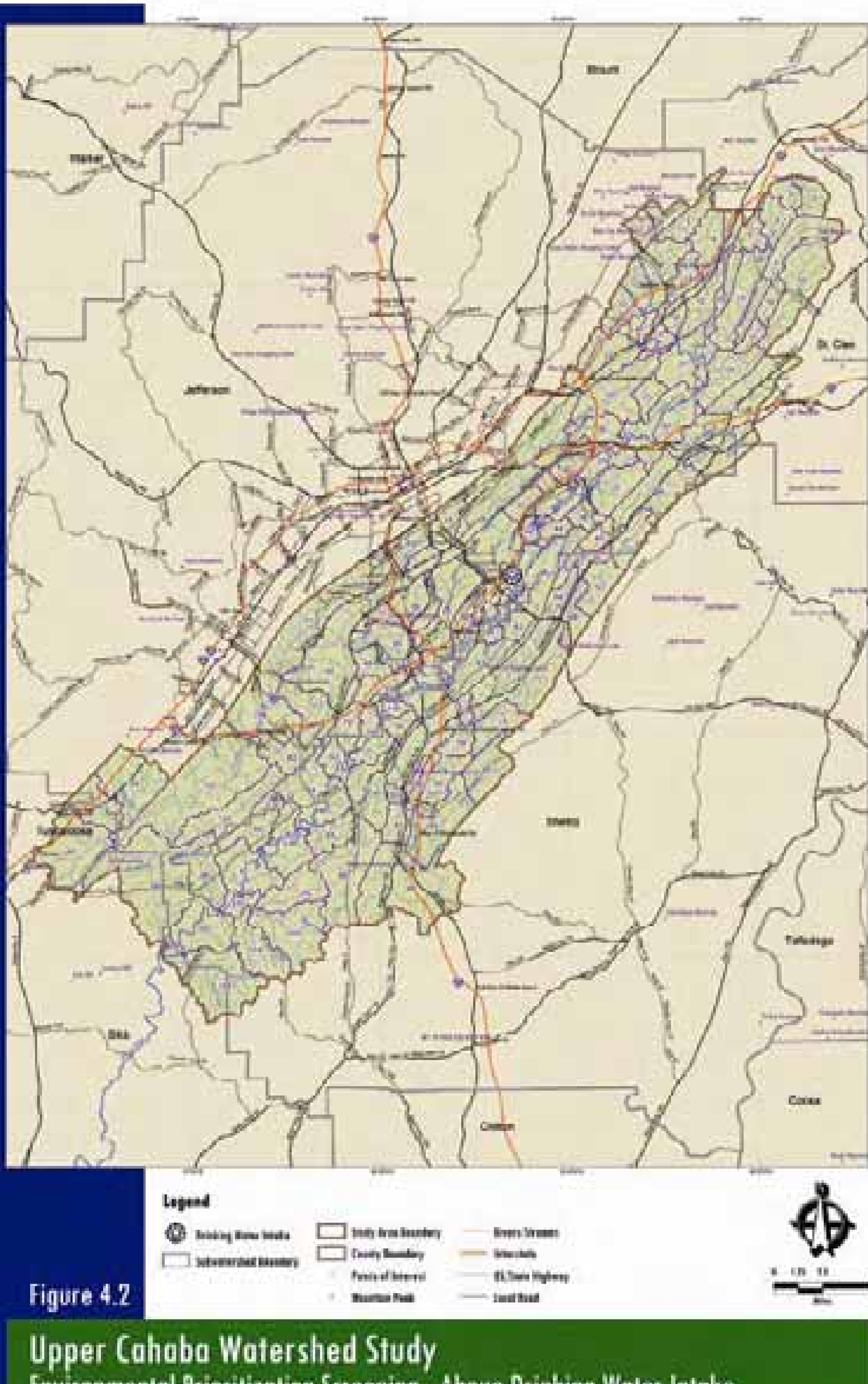


Figure 4.2

Upper Cahaba Watershed Study
Environmental Prioritization Screening - Above Drinking Water Intake

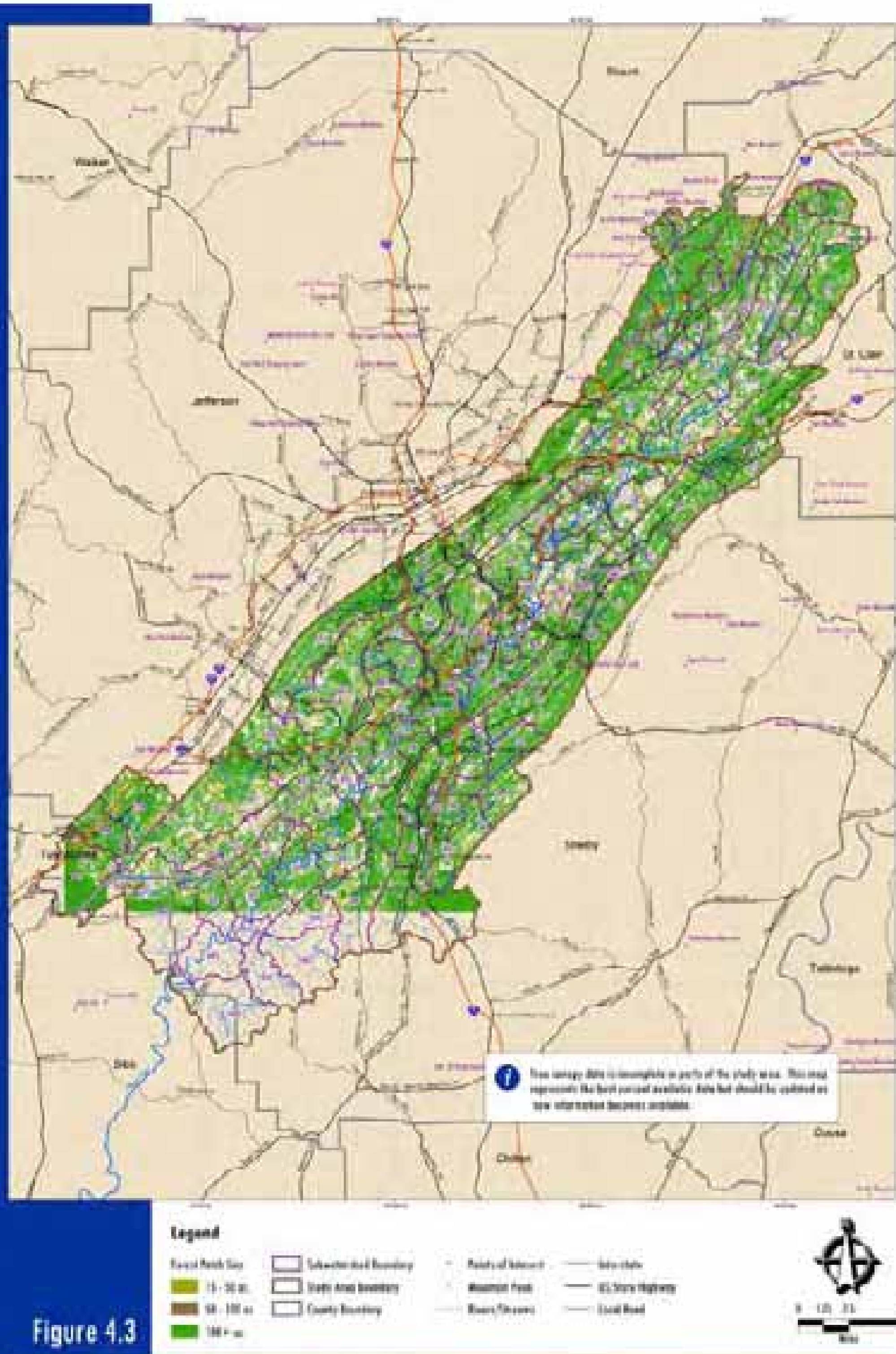


Figure 4.3

Upper Cahaba Watershed Study
Environmental Prioritization Screening - Intact Forest

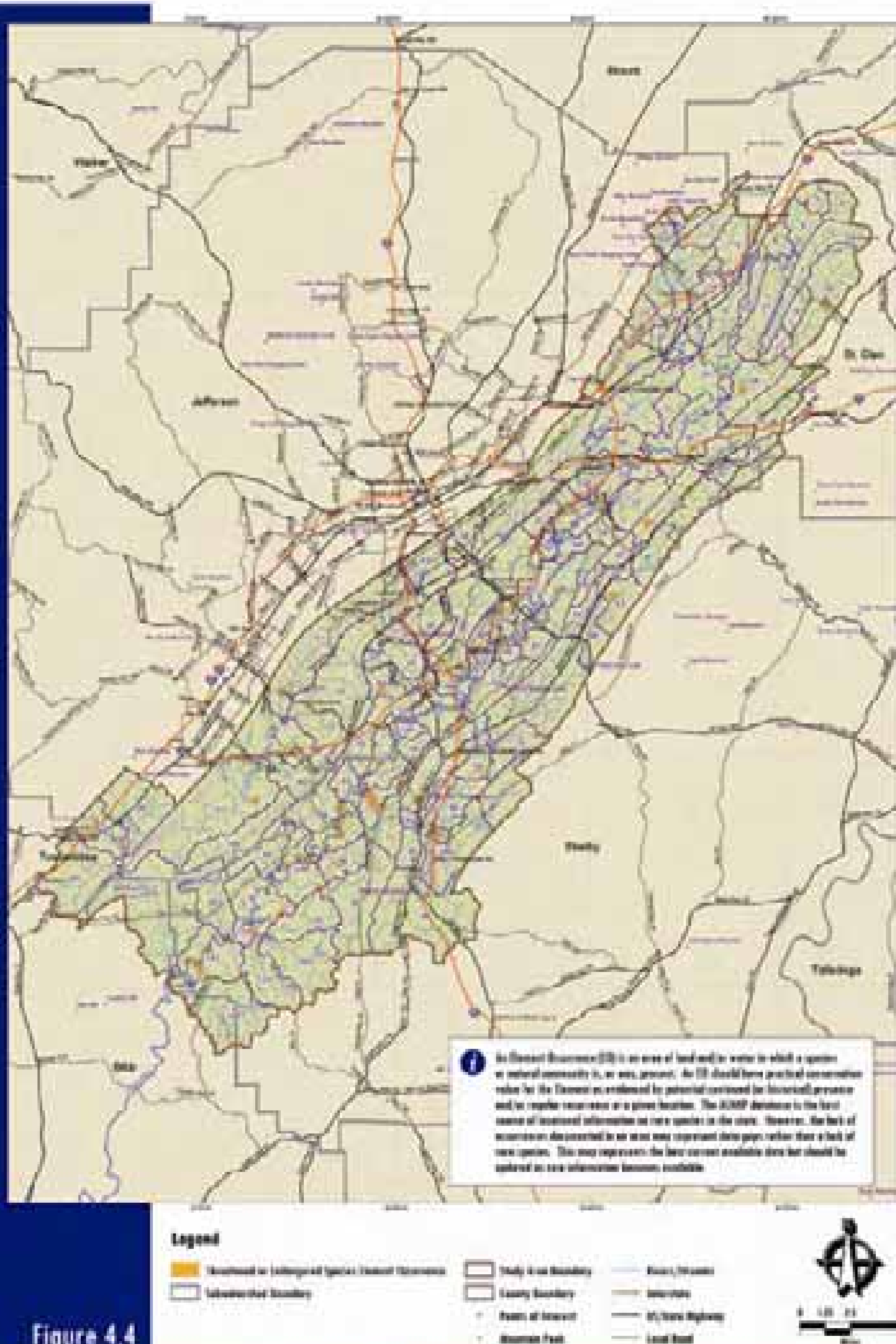


Figure 4.4

Upper Cahaba Watershed Study

Environmental Prioritization Screening - Threatened or Endangered Species

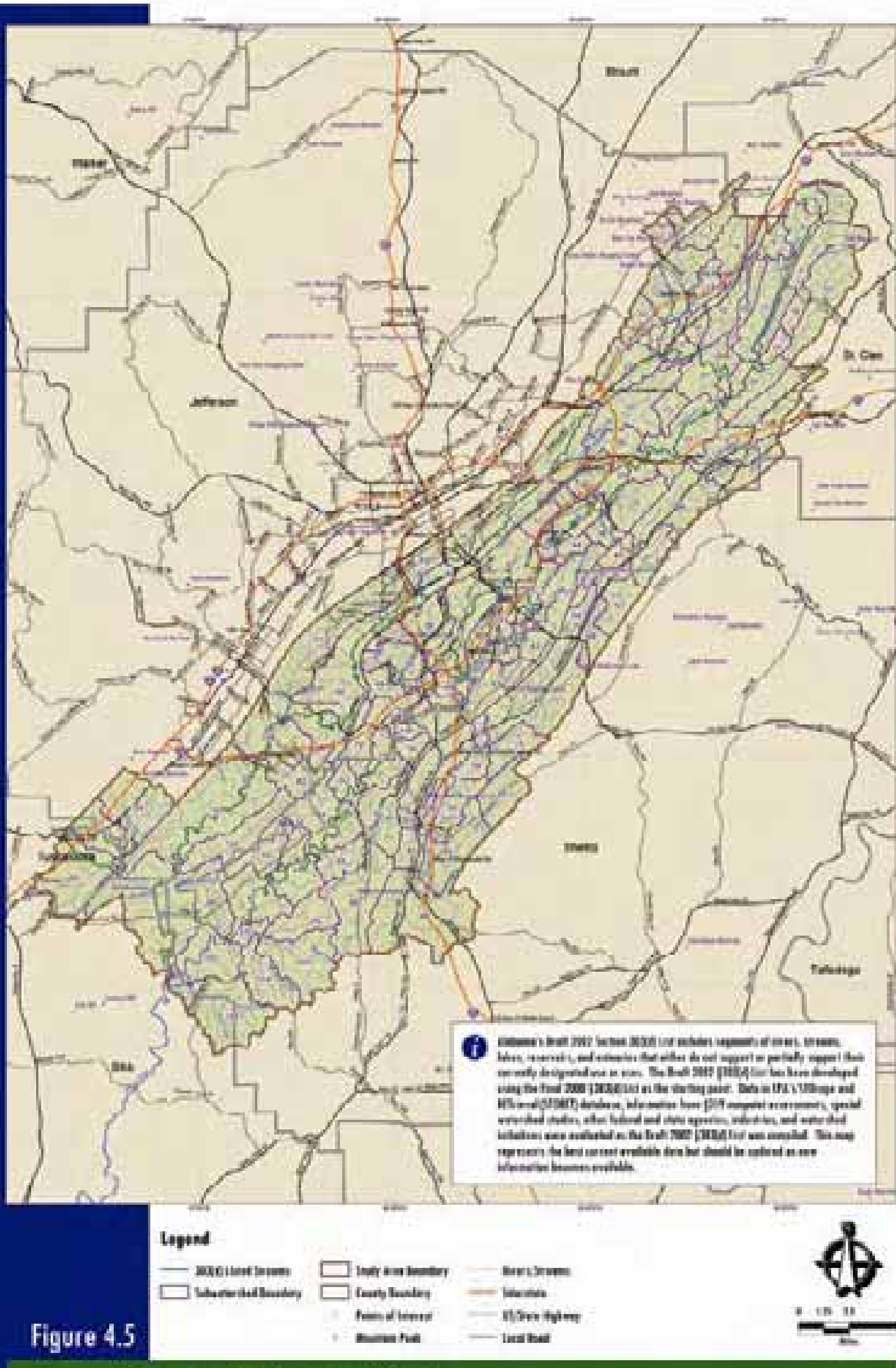


Figure 4.5

Upper Cahaba Watershed Study

Environmental Prioritization Screening - 303(d) Listed Streams

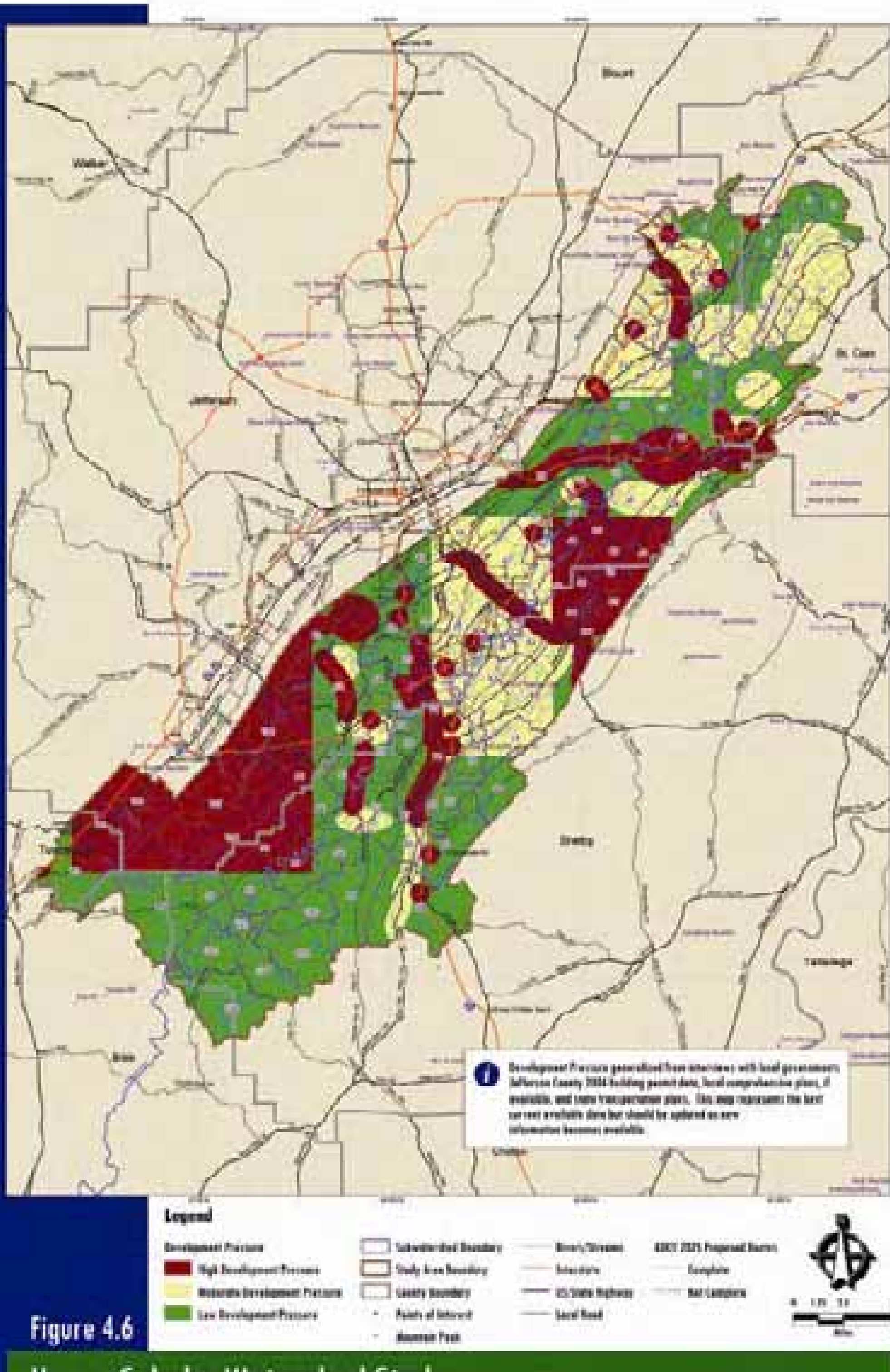


Figure 4.6

Upper Cahaba Watershed Study

Developmental Prioritization Screening - Development Pressure

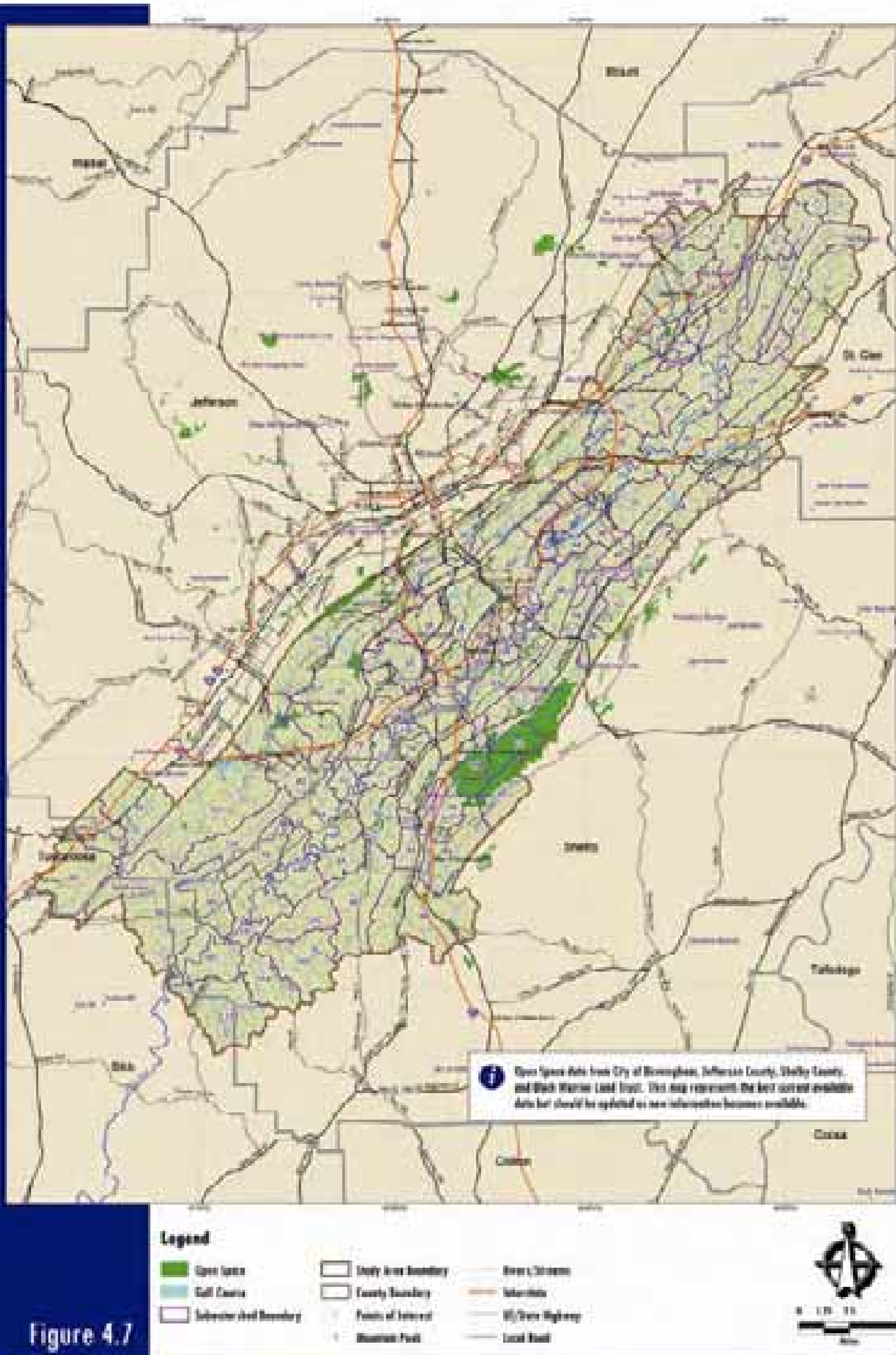


Figure 4.7

Upper Cahaba Watershed Study

Developmental Prioritization Screening - Potential Open Space Connectivity

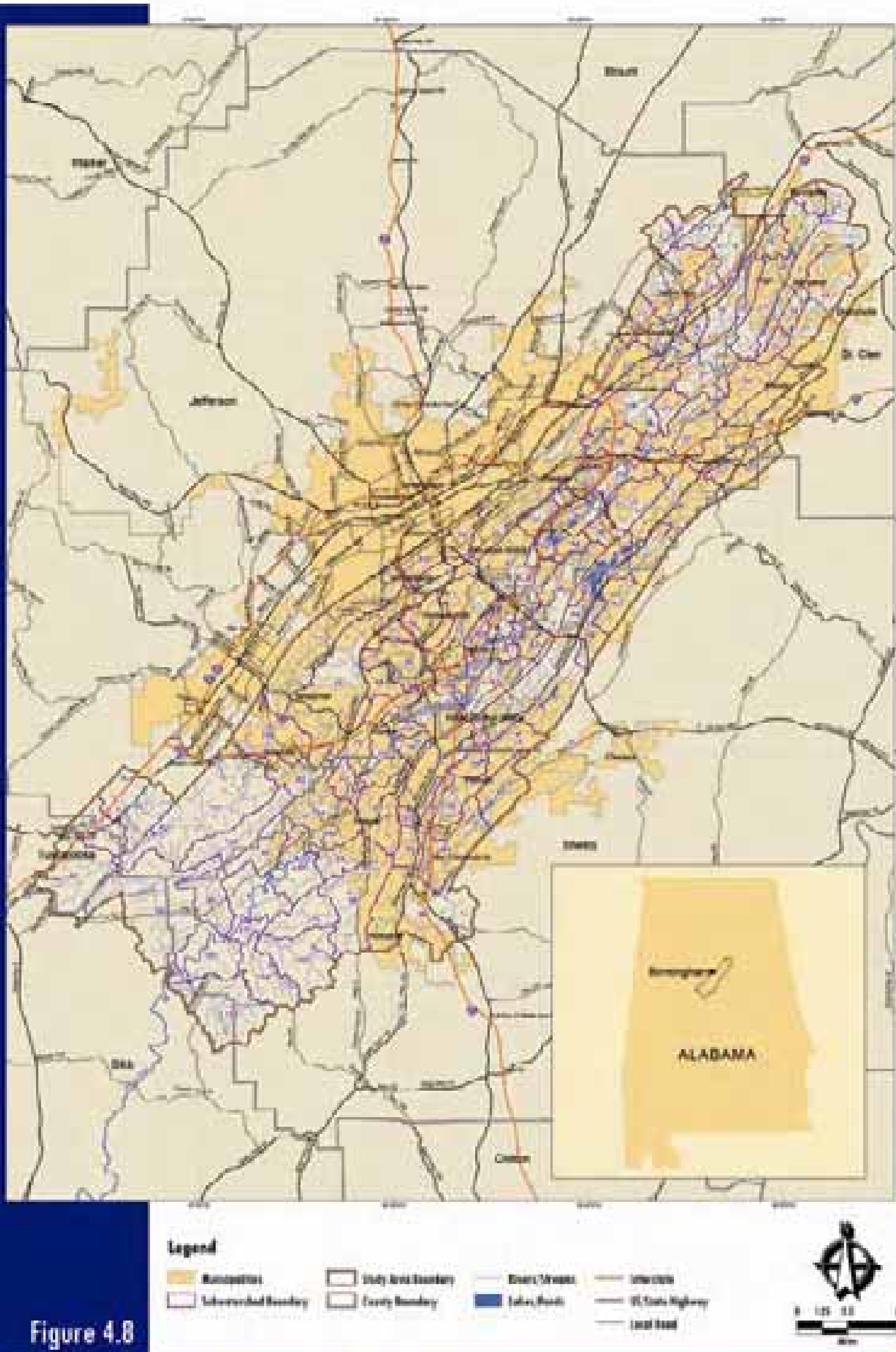


Figure 4.8

Upper Cahaba Watershed Study

Subwatershed Location Map

Appendix C:

C.1 The Upper Cahaba Consortium, Technical Committee, and Advisory Committee

The Cahaba River, in addition to being a primary source of drinking water for metropolitan Birmingham, is nationally recognized for its biodiversity and recreational value. Population growth and associated land development in the Upper Cahaba Watershed are growing concerns for everyone.

Recognizing the importance of the river, and the importance of planning in the watershed to protect water quality, the jurisdictions in the Upper Cahaba Watershed are working together to develop a coordinated approach to guide future development while protecting the Upper Cahaba River and its tributaries. In 2001, the municipal and county governments agreed to form the Upper Cahaba Watershed Consortium. All mayors and county commissioners who serve local governments within the Upper Cahaba Watershed were invited to participate as members of the Consortium; these governments include St. Clair, Jefferson, and Shelby Counties, and the Cities of Moody, Argo, Margaret, Branchville, Odenville, Springville, Clay, Trussville, Leeds, Birmingham, Irondale, Mountain Brook, Homewood, Vestavia Hills, Hoover, Bessemer, Indian Springs, Pelham, Helena, and Alabaster.

To guide the work of planning in the watershed, the Consortium designated a technical committee of local professionals with specific expertise pertaining to watershed planning. Technical Committee members include:

- *Frank Humber - Jefferson County Land Development, Lynn Wood - Jefferson County Environmental Services, Wayne Studyvin - Jefferson County Health Department, Woody Odom - Jefferson County Emergency Management Authority, Robert Kelly - Shelby County Department of Environmental Services, Randy Chafin - Birmingham Water Works and Sewer Board, Zhaleh McCullers - Stormwater Management Authority, Inc., Todd McDonald - Shelby County Department of Development Services, Joe Duncan - City of Trussville, *Virginia Williams - City of Hoover, Sam Gaston - City of Mountain Brook, Bill Gilchrist - City of Birmingham, Don Erwin - The Barber Companies, Tom Howard - USS Realty Management, John Grogan - Alabama Power Company, Beth

Stewart - Cahaba River Society, Chris Oberholster - The Nature Conservancy, Scott Phillips - Cahaba River Basin Clean Water Partnership, Guin Robinson - Region 2020, Paul McCaleb - CAWACO RC&D Council, Paul Kennedy - USDA-Natural Resources Conservation Service, Wendy Allen - Black Warrior/ Cahaba Rivers Land Trust, and Larry Goldman - US Fish and Wildlife Service.
**Co-Chairs*

- Ex-Officio as needed
  - Geological Survey of Alabama (GSA)
  - University of Alabama Engineering
  - University of Alabama, Birmingham (UAB) Engineering
  - Samford University
  - Auburn University Faculty
  - Alabama Department of Environmental Management (ADEM) Staff

The purpose of the Technical Committee is to advise the Consortium on studies to be conducted and, more importantly, what steps to take to protect the watershed.

The Advisory Committee was formed by the Consortium to ensure that members of the general public have adequate input to the planning process. The Advisory Committee's responsibility is to provide advice, information, and guidance to the Consortium and Technical Committee as needed on issues and recommendations from the Upper Cahaba Watershed Greenprint. This can include advice on policy and procedures for the Consortium. The Committee's other tasks will include assisting with design and promotion of public meetings during the Greenprint as well as dissemination of information. Advisory Committee members include:

- Business Representatives
  - Chris Matthews*, Michael Breed, Rob Fowler, Ken Lancaster, Bob Nelson, T.W. Pugh, Danny Smith, and Carol Walker.

- Civic Representatives
  - Gayle England*, Robert Crenshaw, Scott Douglas, Pat Feemster, Ouida Fritschi, John C. Harris, Jacque Meyer, Ralph Mitchell, Sammy Raviv, Margo Rebar and Art Segers.

- Environmental Representatives
    - Adam Snyder*, Peggy Gargis, April Guin, Jayme Hill, Henry Hughes, James Lowery, Carl Montgomery, Debbie Pezzillo, Larry Roddick, and Ernie Stokely.

**Co-chairs*

These diverse interests are committed to working together toward the vision of balanced development and water quality protection in the Upper Cahaba region. The Regional Planning Commission (RPC) of Greater Birmingham serves as the lead staff to the Upper Cahaba Consortium and the Technical Committee and coordinates all aspects of the Greenprint.

C.2 Previous Studies

The Greenprint is one of several efforts by the Consortium and others to understand the Upper Cahaba River and its watershed and how to best enhance water quality protection efforts. Other recent studies are summarized below.

Phase I

The first phase of the Upper Cahaba Watershed Greenprint was an 18-month process to develop the necessary tools to assess the condition of the Upper Cahaba watershed and identify approaches for land development planning and protection of the watershed in future years. This was the beginning of the establishment of a foundation for wise decision-making based on sound information.

Several conclusions arose in Phase I regarding the overall planning strategy for the Upper Cahaba watershed:

- Consortium governments should pursue a cooperative strategy for watershed planning and management.
- They should manage water resources as part of a comprehensive planning effort that includes regional economic sustainability, transportation, and quality-of-life issues.
- A variety of tools should be employed at large and small scales across the watershed; exploring these tools should be the primary focus of Phase II.

- Consortium governments should make efforts to achieve the highest practicable river protection and restoration through the promotion of concentrated development in certain areas and the preservation of open space in environmentally-sensitive areas.
- Any new development in the watershed must include best management practices (BMPs).
- To reduce stormwater runoff, best management practices should be retrofitted in already developed areas.

Surface Quality Screening Assessment of the Cahaba and Black Warrior River Basins

The purpose of this document, prepared by the Alabama Department of Environmental Management, is to provide an overview of recent data and assessment information that can be used to identify impaired stream segments for inclusion on the §303(d) list and to assist with the development of Nonpoint Source (NPS) watershed plans. The document includes a description of the methods used during the basinwide screening assessment. For each of the 96 subwatersheds, land use, nonpoint source estimates, permitting information, §303(d)/TMDL waterbodies, monitoring data and other assessment information are compiled in the Appendices. The document provides a summary of information available for each of the 42 impaired subwatersheds. This project was funded or partially funded by the Alabama Department of Environmental management (ADEM) using a Clean Water Act §319(H) Nonpoint Source (NPS) Demonstration grant provided by the U.S. Environmental Protection Agency (EPA) – Region 4.

Cahaba River Clean Water Partnership Management Plan

The Cahaba River Basin Clean Water Partnership (Cahaba River Basin CWP) was formed in 2002 and is a continuation of the Cahaba River Basin Project formed in 1996. It is comprised of stakeholders representing a variety of interest groups within the Cahaba River Basin, including Alabama Department of Environmental Management, Alabama Department of Conservation and Natural Resources, USDA/Natural Resources Conservation Service, city and county governments, The Nature Conservancy, utility boards, and the Cahaba River Society. One task of the Cahaba River Basin CWP is to identify environmental problems in the Cahaba River Basin and discuss improvement measures to help alleviate these problems. The Cahaba River Basin CWP used a technique known as Comparative Risk Assessment (CRA) to determine priority rankings of environmental problems in the Cahaba River Basin and subsequently aided in the development of action strategies to implement environmental improvement measures.

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