ENVIRONMENT

The Environment is defined by the dictionary as the circumstances, objects, or conditions that surround us and the aggregate of social and cultural conditions that influence the life of an individual or community. Natural features such as wooded hillsides, scenic valleys, rivers, creeks, and open fields are especially important in establishing a unique character and providing amenities, which make a community special. These amenities also provide additional, less visible qualities, such as cleaner air, recreational areas, and wildlife habitat that are equally important to a community. It can be argued that rapid growth and development has a very dramatic effect on the physical and social environment of a community. This growth can affect many of the characteristics which made the community unique, or that its residents feel are important. Therefore, development should preserve and promote an overall high quality of life while allowing a reasonable economic return. This Element is prepared from an environmental perspective and is to be used as one factor, just like the other elements of this plan, in determining the future land use plan.

ENVIRONMENT SUMMARY HIGHLIGHTS

While acting as an attraction to new residents, prime agricultural land, wooded hillsides, and stream corridors are the factors that are most impacted by new development.

Flooding caused by urban and suburban development is increasingly affecting both the major and minor tributaries. In the early 1990's only several creeks, such as Gunpowder and Elijah's Creeks experienced significant flooding, however, this Plan notes that many others now are affected, such as Sand Run, Woolper, Big Bone, and many smaller tributaries of the Gunpowder Creek watershed. Regional and local stormwater detention, as well as erosion control and enforcement, need to be addressed in more detail in local regulations.

Soils in Boone County are generally not well suited for septic leach activity. Water line extensions must be carefully examined to determine its effect on water usage and resulting effect on septic performance.

Development and environmental conservation can benefit each other instead of being treated as opposing factors. There are innovative tools that can provide incentives, tradeoffs, or simply good design to result in development patterns that make use of or conserve natural resources instead of building over them. These objectives can be achieved without excessive regulation.

Special corridor studies need to be conducted on a continuing basis to consider natural areas in Boone County for innovative development design, conservation, recreation, or preservation.

BACKGROUND

The Greater Cincinnati Metropolitan Area has undergone dramatic changes over the last 50 years that have altered the natural landscape forever. The existing pattern of suburban development has continued to spread unabated during this 50 year period into most areas of Metropolitan Cincinnati. Boone County has been no exception to these suburban development patterns. In fact, Boone County has been one of the fastest growing Counties in the Metropolitan Statistical Area for several decades. This growth is projected to continue at a similar rate well into the future.

The county is located less than 15 miles from downtown Cincinnati, has three interstate highways, an international airport, a regional shopping mall, and almost 40 miles of river frontage, however, a significant part of the county can still be considered rural. The rural character of Boone County is a desirable environmental quality which attracts people to become residents of Boone County. Ironically this quality, which attracts many new residents to Boone County, is often replaced by the development built to accommodate those residents.

Prime agricultural land, woodland areas, scenic valleys, stream quality, and hillsides are the most significant features altered by development. The extension of water and sanitary sewer lines determine the rate and location of growth as much as any other single factor. As Boone County growth continues and environmental issues become more critical, issues such as water quality, air quality, noise and light pollution, stormwater, and decreased open space all can combine to affect the quality of life within Boone County.

METHODOLOGY

The purpose of this Element is to identify development impacts on the environment within the twenty-five year planning horizon, and determine how Boone County can continue to develop without losing the qualities that make Boone County a unique place to live. This element identifies the physical and social characteristics of the environment that should affect the nature of development. The degradation of these characteristics can have a significant impact on the quality of life within Boone County. Therefore, the physical and social factors which establish development restrictions for any particular site should be used to enhance the quality of a development and ensure proper integration with its surroundings. Physical factors specify the environment's capability of supporting development within the limits of engineering technology, while social factors indicate the suitability of a site for development based on culturally defined values. These two classifications are intended to constitute an inventory of the environment and are meant to be advisory rather than absolute. The classifications should affect the design of new development. They should not be used as a sole determinate of whether or not a specific site should develop, unless a specific study shows this to be the case. The Environment Element is intended to guide development, not stop it. The description of the characteristics for physical and social categories is as follows:

Physical Factors Classifications:

Capable - The characteristics of this physical factor of the environment can support all types and intensities of urban use, subject to some site specific restrictions on design.

Limited Capability - The characteristics of this physical factor have some restrictions in ability to support urban uses due to existing physical conditions; low to moderate density urban uses can be accommodated if designed and constructed within appropriate performance standards.

Very Limited Capability - The characteristics of this physical factor have serious environmental hazards regarding development, and have very little potential of being adapted for urban land uses.

Social Factors Classifications:

Suitable - The characteristics of this social factor are appropriate for all types and intensities of urban use, subject to site specific design restrictions.

Limited Suitability - The characteristics of this social factor have some restrictions for urban uses; low to moderate density uses are possible with appropriate design restrictions and performance standards.

Very Limited Suitability - The characteristics of this social factor have very little appropriateness for urban uses of any kind because of their high social value.

The following information on the environment of Boone County has been provided by and modified from the 1978 Reconnaissance Report 1. The analysis of the data involves physical and social factors that, when considered separately or jointly, result in quantities of land at specific locations throughout the county that have varying degrees of restrictions for development. Limits on the land development at higher densities can be due to one or more physical or social environmental constraints. The conclusions drawn from this analysis indicate potential future locations for development, as well as areas that need to be preserved or protected from development.

PHYSICAL FACTORS INVENTORY

This inventory of the physical factors of the environment examines 10 factors which affect development capabilities. The analysis is based upon the soil data contained in the United States Department of Agriculture Soil Conservation Service publication Soil Survey of Boone, Campbell, and Kenton Counties, Kentucky, published in 1973. **Table 3.1** consolidates in table form the development capability analysis for the 10 physical factors.

SURFACE DRAINAGE

Stream Tributaries - Natural drainage networks provide efficient storm water collection systems, and ultimately are the headwater system for a natural water supply. Runoff from urban and agricultural uses add suspended soil particles and chemicals which lower water quality and consequently increase water purification costs. Runoff from land uses sited close to a stream's natural drainage channel can irrevocably contaminate a stream's purity, fill stream channels with sediment, cause flooding and erosion, and destroy the aquatic and animal life balance, thereby permitting uncontrolled algae and bacteria development.

Table 3.1 - Rating System for Boone County Environment Physical Capability Summary

Physical Criteria	1. Capable	2. Limited Capability	3. Very Limited Capability
1. Surface Drainage a. Tributary drainage system Source: designations on soil survey maps		150-300' from centerline or banks of perennial streams; 50-150' from centerline or banks of intermittent streams	150' from centerline or banks of perennial streams; 50' from centerline or banks of intermittent streams
b. Flood plains and flood buffers Source: soil survey properties noted plus overlay of Corps of Engineers USGS designated 1973 floodzone		500' control zone from all dams, levees and other floor embankments	1937 flood of record (includes intermediate regional flood)
c. Alluvial Soils subject to sheet flooding Source: soil survey maps			Following alluvial soils; AsA, AsB, Bo, Cg, Eg, Hn, Hu, Ln, Mk, No
d. Other surface drainage: Source: soil survey maps			Areas of standing water (i.e. lakes, ponds, perennial streams, springs) and lakes or ponds intermittently filled with water (i.e. marsh, swamp, wet spots and intermittent streams)
2. Soil Drainage a. Permeability Source: soil survey, table 4, page 40	All parts greater than 0.6 inch/hour	Any part 0.2-0.6 inch/hour	Any part below 0.2 inch/hour
b. Depth to seasonal high water table Source: soil survey, table 4, page 40	More than 1.5 feet from surface	.5-1.5 feet from surface	0-.5 foot from surface
3. Soil Foundation a. Soil Materials - comprehensive strength Source: soil survey, table 4, page 40	Sandy - silt GW, GP, SM, GM, GC, SC, SW, SP	Silt - clay ML, CL	Clay MH, CH, OH, OL
b. Depth to bedrock Source: soil survey, table 4, page 40	More than 3 feet from surface	2-3 feet from surface	0-2 feet from surface
4. Erosion and other hazards a. Slope/erosion Source: soil survey, table 4, page 40	Sand - gravel GW, GP, GM, GC, SW, SP, SC, SM, 0-1%	12-18/25%	18/25% and over
	Silt - clay ML, CL, 0-6%	6-12%	12% and over
	Clay MH, CH, OH, CL, 0-6%	6-12%	12% and over
b. Other Hazards Source: symbols on soil survey maps		Stoniness, rock outcrops, chart fragments, scabby land	Depressions, gullies, quarries, gravel pits, bedrock escarpments and others; severely eroded spot, blow-out, wind erosion, areas of gravel, clay spot, sand spot, all made land

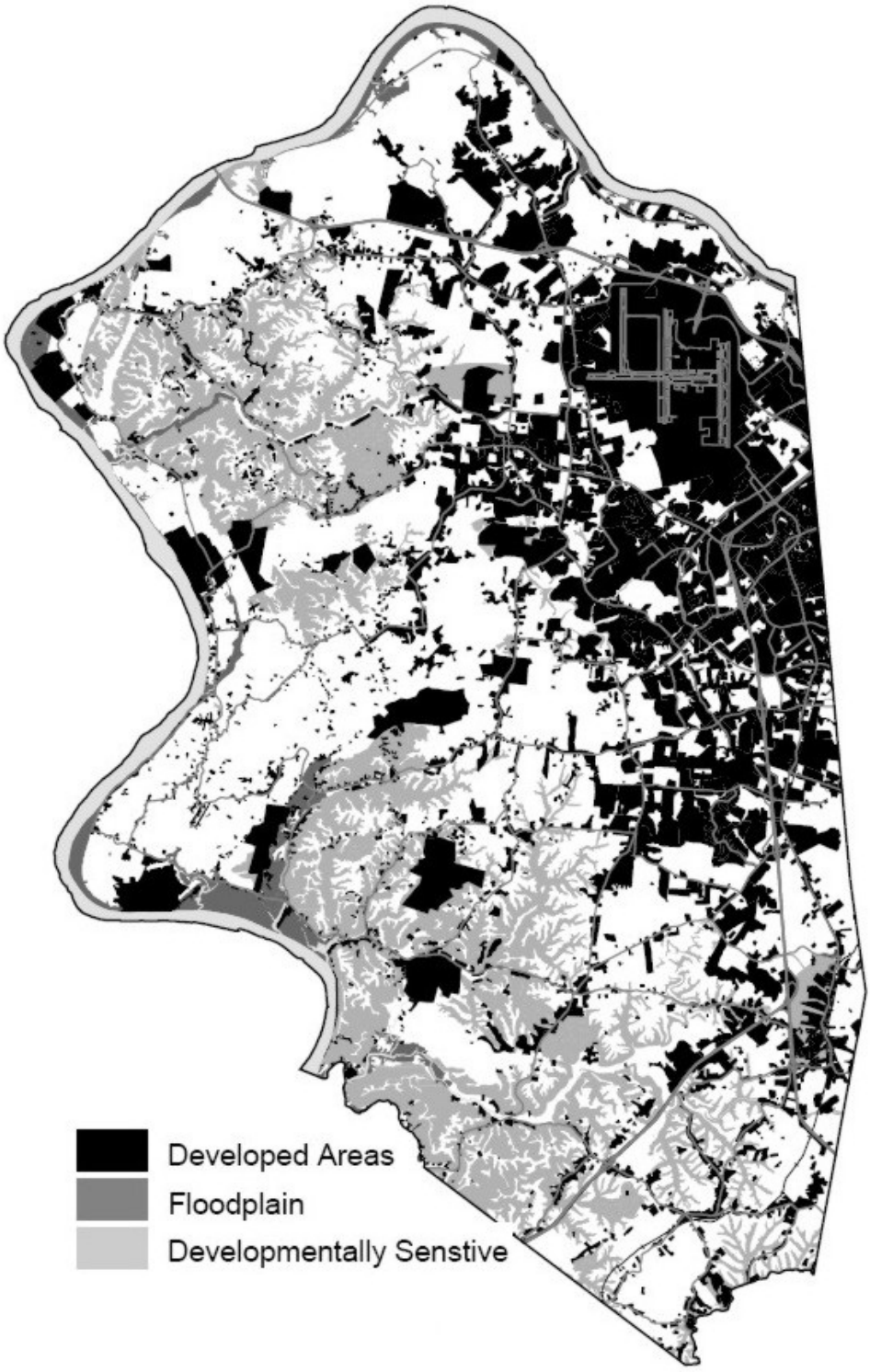
Source: KZF Incorporated

Artificial storm drainage systems can often handle increased stormwater runoff volumes, but cannot accomplish natural water filtering processes, or replenish local surface and underground water supplies. The effects of development on natural drainage systems should be further studied, as well as the benefits of maintaining natural vegetation as a filter along streams. Maximum runoff limits, as established through specific drainage basin calculations, can also keep stream pollution levels within manageable limits and reduce flooding. Throughout Boone County, the effects of commercial and industrial development on stormwater conditions have long been understood and planned for. However, the potential cumulative stormwater runoff impacts from residential development occurring in Boone County cannot be overlooked by stormwater management officials. Even with required detention basins and other facilities that control the rate of stormwater flow, the overall amount of stormwater reaching the county's creeks is increasing as a result of new impervious areas. Because of the difficulties in implementing public regional stormwater detention, studies such as those being conducted in the Banklick Creek watershed that suggest vegetation and buffer areas as one way that local communities can minimize storm runoff should become more common. Aside from regional detention, Boone County has made improvements in the upper Gunpowder Creek watershed that help water flow downstream. Before the next comprehensive plan update process, the Sanitation District #1 of Northern Kentucky is planned to absorb stormwater management throughout most of the developed areas of Northern Kentucky. Two notable exceptions are the City of Florence and the City of Walton which plan to continue to operate their own systems. In the meantime, municipalities and counties continue to administer stormwater requirements and maintain public stormwater facilities.

Glaciers determined the topography of Boone County and also created a vast network of streams which cover the entire county. As the land descends to the Ohio River, major tributaries are formed, including Mud Lick, Big Bone, Gunpowder, Lick, Middle, Woolper, Sand Run, and Elijah's Creeks. Also, included are many smaller tributaries and intermittent streams. This natural drainage system provides an efficient storm water collection system, as well as a natural water supply.

Flood Plains - Flood zones are defined by historical records of high flood water levels or by engineering estimates of the volume and channel changes which may affect, or be affected by urban improvements within the drainage network. **Figure 3.1** identifies floodplains which correspond to areas that were flooded during the 1937 flood.

Figure 3.1 - Developmentally Sensitive Areas



Although the highest flood of record occurred on the Ohio River in 1937, it is not the worst that could possibly occur. Since that time, the fourth and sixth greatest floods since 1858 occurred in 1945 and 1964 respectively. U.S. Army Corps of Engineers studies of the Ohio River Basin indicate that more critical combinations of storms and runoff can reasonably be anticipated to occur in the future.

Protective flood control structures do not alleviate all flood zone hazards. In fact, they may even increase high water levels upstream from a backwater dam, or alter the natural channel through which a flooding pattern would be expected, or alter the water table and underground drainage pattern serving local areas.

As was learned in the 1993 Mississippi River floods and the 1997 Ohio River and Licking River floods, flood plains and zones are not suitable for permanent urban uses. These areas must also be protected from urban improvements on adjacent lands which may alter drainage patterns and volumes.

In Boone County, the lands designated as flood zones include primarily bottom lands along the Ohio River and its major tributaries, however, minor tributaries are experiencing flooding problems as more impervious area is created in each watershed. Portions of the upper Gunpowder, Woolper, Elijah's Creek, and Mud Lick watersheds frequently experience flooding. The most extensive flood zone area is the lower East Bend Bottom at the mouth of Gunpowder Creek. Spots of moderate flood hazard from possible dam breaks are located downstream from small dammed lakes scattered throughout the county.

The Federal Emergency Management Agency (FEMA) is currently updating its flood plain mapping. For decades, the Flood Insurance Rate Maps have been used by public agencies and citizens to determine many site related issues

regarding flooding extent, precautions, and insurance needs. Because of the age and inaccuracies, FEMA is preparing Digital Flood Insurance Rate Maps that can be readily corrected and updated based on local conditions. This effort will also incorporate local flood or drainage studies that have been conducted for specific streams or communities.

Alluvial Soils - Alluvial soils are composed of the remains of former stream beds and deposits of materials generated by natural water erosion. Such soils are found in designated flood zones of major rivers, and along the banks of tributary streams. Alluvial soils are highly permeable, are subject to high water tables, and are usually connected with underground streams or aquifers.

Urban uses aggravate the flood prone conditions and contribute pollutants to the stream or water table. Special care needs to be taken in developing urban land uses upstream from sensitive flood areas to avoid aggravating problems. Alluvial soils are often highly erodible, serve as aquifer recharge areas, and should be addressed in development.

SOIL DRAINAGE

Permeability - Soil permeability is a measure of the rate and depth to which a soil absorbs water. Permeability rates are determined by the soil's porosity, slope, depth to bedrock, depth to seasonal high water table, vegetation cover, and other factors.

Almost all land in Boone County, except river and stream valley bottoms and a small number of isolated locations are subject to permeability limitations. Nearly half of the undeveloped land area within Boone County contains soils which have poor permeability (0.63 inches per hour or lower). This land area which is located within the southern and western portion of the county primarily has slopes of 20% or greater. The land area which has a permeability of 0.63 to 2.00 inches per hour covers approximately 50% of the county and is primarily comprised of slopes of less than 20%. These areas are usually prime agricultural land or agricultural land of state-wide importance. This also happens to be the part of Boone County which is projected to experience rapid residential development within the 25 year planning horizon. Severely impermeable soils are found primarily along ridgelines where the bedrock is near the surface and in low-lying areas where the water table is high.

Soils of poor permeability are subject to ponding and runoff since the soil cannot absorb concentrated storm waters. Nonporous surfaces of urban uses, on or adjacent to impermeable soils, can significantly increase the runoff volume, and aggravate ponding, erosion, and surface water pollution.

Since soils of poor permeability will not filter water, neither will the soils filter or absorb septic effluent or other surface pollutants. An extreme health hazard can be created when such pollutants are directly mixed with storm and surface waters. When poor permeability is caused by high water tables, septic systems and general urban uses can transfer pollutants directly into the streams and the ground water supply. Major advancements have been achieved in Boone County by implementing the regional sewer system that has eliminated many individual treatment systems. Boone County Fiscal Court has assisted with the installation of sanitary sewers for existing subdivisions served by individual treatment systems by funding up to 1/3 of the assessment costs. This type of activity should be encouraged.

Finally, poorly drained soils are subject to frost action and settling which can crack foundations, fragment roads, displace utility lines, and generally damage or impair urban improvements. Public sewerage, artificial drainage systems, special road bed fills and foundation designs can overcome some permeability limitations through increased cost and exacting design criteria.

Depth to Seasonal High Water Table - Water filters through porous soil until it reaches a substratum material with nonporous characteristics, normally bedrock or clay deposits. Water so entrapped will back up toward the surface forming a ground water table, or flow though underground bedrock fractures or limestone deposits until it is collected and filtered back up through natural stream beds. In both circumstances, ground water is an important resource since it provides a naturally filtered water supply. Areas of high water table are easily polluted since runoff from urban areas can pass pollutants directly into the ground water table. Heavy storms can also back the water table up to the surface and cause surface ponding and flooding. Urban uses provide additional storm runoff and aggravate this problem.

Soils of moderate water table depth are usable when subject to exacting design and performance standards. In Boone County, extremely high water tables occur in only a small number of thin belts along the Ohio River and a few other scattered areas. There are more areas of moderate depth water tables, concentrated primarily on ridgelines in the northeastern uplands of the county. The depth to a particular area's water table should always be addressed before developing on it. As the ground water level gets closer to the surface, potential pollution and construction problems increase. Very shallow water table depths are risky areas on which to develop, and should not contain urban uses. High and moderate depths are developable.

SOIL FOUNDATION

Strength of Soil - Soils vary considerably in compressive strength and stability. Sandy silts are the most stable; clays the least. Slope, depth to bedrock, vegetation cover and ground water drainage patterns are related factors which determine soil material use limits.

On flat to shallow sloped lands, all soils are usable for development (aside from water table limitations). Because all soil types are more subject to erosion when the ground cover is removed, erosion control measures are vital in preventing sediment from leaving the developing site. All soils will erode on moderately to steeply sloped lands, particularly where such lands have been stripped of tree and ground cover. Clay and silty clay soils, however, are particularly susceptible to mudslides when steeper slopes are present in areas with shallow bedrock depth and little tree cover.

According to the USDA Soil Survey (1989) all soils contain some form of limitation for urban uses. Ridgelines, stream beds of the lower reaches of major steams, sloping lands, and the upper reaches of stream valleys are the most notable. The rugged terrain in some of the western and southwestern parts of Boone County contains broad areas of poor soil conditions for development. More moderate conditions prevail in the gentler topography of the northeastern portion of the county.

Depth to Bedrock - Like soil materials, bedrock characteristics have more impact when they occur with other factors, than when they exist alone. The presence of shallow bedrock conditions increase trenching and other utility placement costs. Select fill must sometimes be used to absorb storm runoff or provide pads for roadbeds, parking, and building foundations. While such actions are costly improvements, the resulting modifications are not environmentally hazardous. When shallow bedrock depths occur on impermeable flat lands, however, high water tables are likely to be created, which are subject to flooding and/or groundwater contamination. Steep slopes with shallow bedrock depths, Kope geologic formations, and unstable soils without tree cover are landslide prone. When these situations exist, the capability of the land to support urban uses without serious environmental hazards is minimal.

Major concentrations of extremely shallow bedrock depths are located in the northern portion of the county along the steep hillsides that overlook the Ohio River, and in some stream beds. The southeastern portion of the county between Walton, Richwood and Beaverlick also has a large area of shallow bedrock depth. In addition, the Gunpowder Creek Valley and Woolper Creek Valley have many areas which have shallow bedrock depths. Most of the land in the northeastern portion of the county, which includes the airport and most of the City of Florence, does not contain this limitation for development.

Erosion and Other Hazards

Slope/Erosion - Erosion hazard is caused by the combined effects of soil material characteristics and slope. Sands and gravel can support specially designed structures on steeper slopes, while silts and clay soils become unstable on steeper slopes.

Other factors contributing to erosion hazard at lower slope percentages include the absence of tree and ground cover, shallow depth to bedrock, low permeability, and shallow surface drainage channels. Erosion from improperly modified slopes often disrupts natural drainage channels, pollutes surface water runoff, and cause mudslides.

Steep slopes descending into stream valleys and bottom lands of small streams are highly erodible. These extend into the western and northern edges of the county. Less steep upper slopes near ridgelines are moderately erodible, while ridgelines, plateau, and large stream bed areas are free from significant erosion hazard.

Most soils within Boone County are considered to be highly erodible soils, therefore, during the construction of any site in which the ground cover has been removed erosion control measures are extremely important until such time as ground cover can be re-established. The sediment which is removed from sites diminishes the water quality, which not only affects drinking water, but inhibits the many recreational aspects that water provides, such as fishing. Sediment fills in drainage channels can aggravate flooding and cause more property damage.

SOCIAL FACTOR INVENTORY

In this inventory of the social factors of the environment, six factors are presented and analyzed. Each factor includes important information which is meant to provide a guide when determining the environmental suitability of development within Boone County. Summaries of the results of this analysis are contained within **Table 3.2**.

Table 3.2
Rating System for Boone County Environment
Social Capability Summary

Social Criteria	1. Suitable	2. Limited Suitability	3. Very Limited Suitability
1. Agricultural Values Source: soil survey capability units	All other soils	Some specialty and continuous row crops under general conservation practices of capability units 11w1, 11w2	Truck, specialty and continuous row crops with limited conservation practices of capability unit 1
2. Wildlife Habitat - Source: soil survey, Table 3, page 37		Well suited for woodland wildlife	Well suited for wetland wildlife
3. Woodlands - Source: USGS maps		Areas designated with woodland cover	Urban woodlands - i.e. woodland cover within urban areas
4. Parks, Recreation and Institutional Areas Source: property line maps, field surveys		All private golf courses, county clubs, cemeteries, hospitals, etc.	All existing or proposed publicly held land for recreation, conservation purposes
5. Historical/Cultural Source: property line maps, Corps of Engineers inventories and lists supplied by local organizations		Locally recognized historic sites, structures and settlements of over 100 years of age	Publicly designated landmarks; National Register of Historic Places, sites and districts
6. Scenic - Source: USGS maps, aerial field surveys		Ridgelines or other points, areas or corridors with offer natural vistas; broad areas of natural beauty	Ridgelines or other points, areas or corridors which offer unique and outstanding natural vistas; major scenic landmarks or areas

Source: KZF Incorporated

Agricultural Values

The U.S. Department of Agriculture grades the agricultural potential of different soil types and assigns them to a capability classification. The classifications are based on the suitability of soils for field crops employing normal field management techniques.

Farmlands in the path of urban growth have rapidly disappeared in recent years in metropolitan areas across the nation. Land that is good for farming; flat to gentle slopes, well-drained, cleared of dense vegetation, moderate to deep bedrock; also happens to be the most suitable land for urban development. The rapid rate of turnover of farmlands to urban uses across the United States is a cause for concern. Growing urban populations in our nation will increase demand for continued agricultural productivity, while they displace agricultural activity. Increased energy and transportation costs may also require urban areas to depend more on local agricultural production than before. Prime agricultural land is important for the sustainability of a region.

The suburban growth patterns found within Boone County are very similar to those found throughout the country. In 1994, 85,338 acres of land which is considered to be developable land existed within Boone County, while in 2004, 73,091 acres was considered developable. Of the 1999 developable land acreage, 47,605 acres or 55.7%, is land which is either prime agricultural land or agricultural land of state wide importance as defined in the Agriculture Element of this plan. Therefore, within the 25 year planning horizon large portions of the most suitable agricultural land which remains within the county could disappear if current development trends continue.

Agricultural lands provide the majority of the open space within a community, as well as creating a visual identity that often defines the character of a community. As pressures increase to develop the prime and state wide important agricultural lands of the county, the character of Boone County will be altered. Future studies and visioning efforts should determine whether Boone County will retain the rural identity of the county, or whether agricultural lands should be developed. If the agricultural lands should develop in a more urban manner, then standards should be established which attempt to preserve the unique character of these areas.

Woodlands

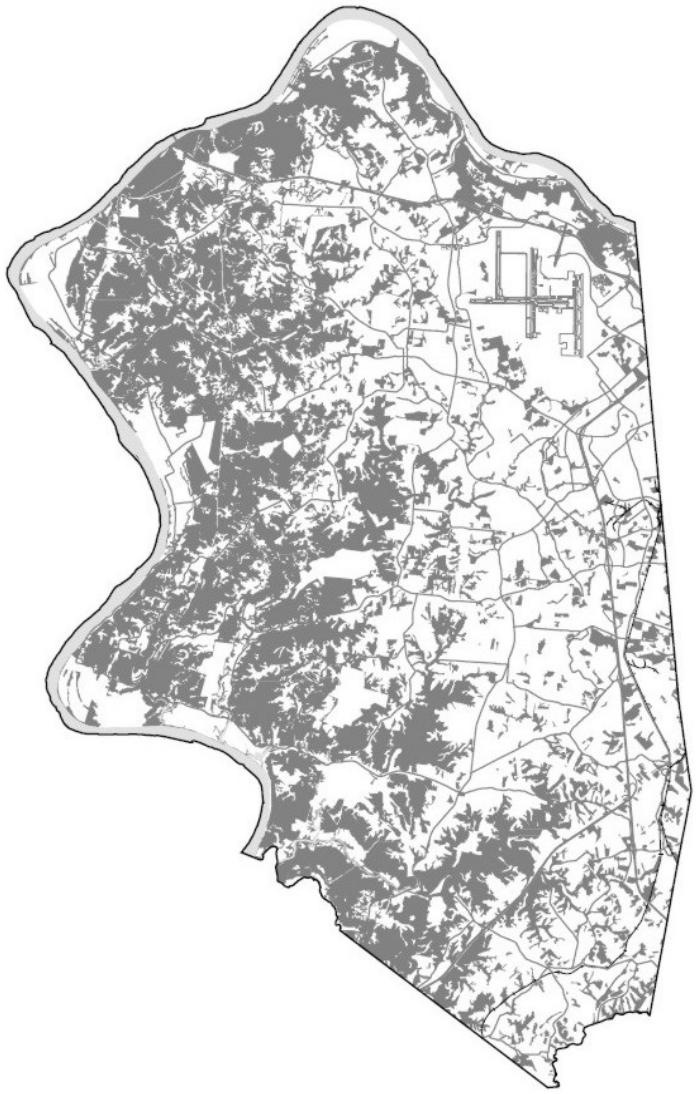
Woodlands are significant natural resources as well as valuable social landscape features. Trees improve the quality of life within a community by reducing the visual impacts between conflicting land uses, and by reducing noise, light, and air pollution. In addition, tree roots stabilize soils by reducing storm runoff volumes, velocity, and soil erosion. Tree roots also stabilize stream banks, and filter runoff before it reaches and pollutes streams. Woodland cover diminishes the effects of strong winds, filters air pollutants, adds humidity, creates shade, and provides specialized wildlife habitats, as well as providing a visual beauty to the landscape.

The slopes of stream valleys in the western portion and along the northern edge of Boone County are heavily wooded, while the eastern uplands have limited and scattered forest cover. While it is important to preserve the wooded areas

in the less developed areas of the county, it is even more imperative to protect the scattered vegetation remaining in the urbanized portions of the county and along major public roadways for both function and appearance.

Boone County contains approximately 57,286 acres of woodlands (see **Figure 3.2**), of which approximately 32,734 acres are located within areas of the county containing slopes over 20 percent. The remaining 24,552 acres of woodlands are located on slopes less than 20 percent and are considered to be easier to develop. Of these 24,552 acres, 4,297 acres are woodlands located on land which is either prime agricultural land or agricultural land of state-wide importance. These woodland areas primarily exist within the areas projected to experience rapid growth within the 25 year planning horizon.

Figure 3.2 - Woodlands



In 2002, the Northern Kentucky Urban and Community Forestry Council conducted a study of the tree canopy cover on both private and public property in Boone County and mapped this resource (see **Figure 3.3**). Boone County Forest Canopy Cover: Public Health and Safety Function Analysis and Development of Guidelines for Environmental Protection determined the size location and relative quality of forest canopy on tracts over ten acres in size in rural areas and five acres in size in incorporated areas. The document also describes many of the public health and productivity benefits of a healthy community-wide forest cover, and makes general recommendations on how Boone County should preserve and improve forest cover.

Figure 3.3 - Tree Canopy Cover

The methodology of the study identified forest cover as three crown size classifications, large, medium, and small, which correspond generally to the age and maturity of the forest. **Table 3.3** shows the summary acreage statistics for Boone County while **Table 3.4** displays canopy cover key issues and recommendations..

Table 3.3
Boone County Forest Canopy Cover

	Area in acres	Percent of County
Boone County	164,469	
Large crown canopy	2,865	2%
Medium crown canopy	17,398	11%
Small crown canopy	39,132	24%
Total canopy cover	59,396	36%

Table 3.4 - Boone County Forest Canopy Cover Key Issues and Recommendations

Key Issues	Rationale	Recommendations
Management of Existing Forest Resources	To provide greater benefits and maximize resources by establishing proper and professional management of forest resources	1. maintain and update the countywide forest canopy inventory and encourage inventories of public trees 2. Consult with the State Division of Forestry to create forest management plans and guidelines 3. encourage municipalities to create and adopt management plans for their public trees and forests 4. develop and maintain County and municipal urban forestry boards that are active in tree planting, maintenance projects, and public education
Reforestation of Critical Areas	To provide and guarantee continued benefits of future canopy cover	5. Prioritize critical areas of the county without adequate forest cover 6. target key forest resources for acquisition or protection 7. develop planting and reforestation plans and programs for private and public properties without adequate forest cover 8. provide incentives for tree planting during development and reforestation of agricultural lands
Education	To promote the acceptance and implementation of forest protection guidelines and regulations	9. prepare new educational materials and organize existing information on forest and tree related topics 10. disseminate educational information to target groups and individuals on a regular basis 11. create and sponsor public awareness events 12. encourage communities to become a Tree City USA - a program of the National Arbor Day Foundation

Sixty-six percent of the forest cover in the county has been classified as small crown. This means the forest cover is largely a result of agricultural field areas being left fallow for twenty or more years, or routine timber harvesting occurring on the sites. The large crown forest areas comprise only five percent of the total forest and only 1.7 percent of Boone County's land cover, mainly on steep slopes and in stream corridors. Only one percent of the county's forest resources exist within incorporated boundaries.

The American Forestry Association, through research and numerous studies, determined in 1999 that the following forest canopy cover rates are desirable in order to realize the health, energy saving, and environmental benefits of trees:

- 60 percent in low density residential areas;
- 40 percent in high-density residential areas;
- 25 percent in mixed commercial use areas;
- 10 percent in highly urbanized downtown areas.

The Boone County Canopy Cover Study examined in detail forest affects on air quality, stormwater management, floodplains, ground water recharge, erosion, steep slopes, and analyzed where the existing forest canopy lies in relation to future land usage and zoning. The Study describes the benefits of tree canopies to offset the effects of impervious areas. The Study analyzed these topics through a critical area's assessment and presented the following recommendations:

Wildlife Habitat

The capability of land to support wildlife is determined by types and patterns of vegetation, and by the supply and distribution of water. These factors are closely related to properties of soil types. The U.S. Department of Agriculture rates the potential of soils to accommodate three types of wildlife: wetland, woodland, and open land. Wetland wildlife requires soil conditions least capable of supporting urban uses. Woodland wildlife can exist within and adjacent to urban land uses, but is susceptible to habitat loss. Open land wildlife can be found within croplands, pasture and meadowlands, often adjacent to areas of urban use.

Preservation of wildlife habitats is utilitarian, as well as having social value. Various species of wildlife perform ecological functions necessary to control bacteria, plant, and insect growth in natural drainage areas. Some species of predator wildlife are required to control wildlife population cycles. The loss of habitat can also result in animal control problems to residents and automobiles because of displaced animals searching for food and nesting areas. Woodland wildlife should be the primary concern in Boone County, because of the extent of woodland habitat and its vulnerability to urban growth. Corresponding with the pattern of woodlands, woodland wildlife habitats appear predominantly on the western side of Boone County, and diminish to small and isolated spots in the eastern and more urban portion of the county.

Parks, Recreation and Institutional Properties

Value is assigned to these sites because some have unique environmental characteristics, others provide open space, and some provide active recreational areas. All of these features will affect potential adjacent urban use patterns. This category would include conservation areas, parks, golf courses, country clubs, cemeteries, and some public institutions. These sites are addressed in detail and identified in the Recreation Element.

Historical/Cultural

This category identifies sites and facilities of historical or cultural significance. Depending on the unique setting or special features of each site, urban uses on or adjacent to the site may be precluded or subjected to strict design or performance standards.

Boone County possesses a visible legacy of its past in the many historical sites which have been preserved throughout the county. Generally, these are buildings which have been spared destruction by urban development, of which the rural western portion of the county has the greatest number of these sites.

Boone County also has vestiges of its more distant past in many archaeological sites throughout the county. According to archeologists there are identified sites in Boone County that date from four major prehistoric periods, going back as far as 8,000 B.C. Particularly, the Ohio River flood plain and the hilltops which overlook the river, and various other bottomlands in the county should be recognized as possessing archaeological value. Proposals for urban development in these areas should be evaluated with regard to their impact on specific sites. More detailed information regarding the importance of Historical and Cultural sites can be found within the Historic Preservation Element.

Scenic

The unique glacial topography of Boone County offers many astounding vistas of the Ohio River and its bottomlands. The steep tree covered hillsides which parallel the river and creeks, and the valley bottoms themselves offer majestic countryside vistas of a quality not commonly found within 15 miles of a major city. The views and vistas of such natural beauty are arguably some of the most important amenities to residents within the county. They help to establish a quality of life desired by the residents of Boone County. Therefore, scenic areas within Boone County that are identified by special study, should be protected from insensitive development. It should also be recognized that Boone County has over 40 miles of Ohio River frontage of which the majority is adjoined with steep hillsides. Therefore, the river views will propel future development which can disrupt or destroy the scenic hillsides. There are extensive recommendations, prepared mainly by the Hillside Trust, that present accepted methodologies to influence new development design so that the hillside views are not changed dramatically. A study should be conducted to identify significant scenic areas, and to outline measures to be taken to preserve or enhance these views. The Geographic Information System (GIS) should be used as a tool to accomplish this task.

In Boone County there is a broad area of scenic value in the flood plains along the Ohio River, and along the valleys of major tributary streams on the western side of the county. Outstanding scenic areas include a series of cliffs along the Ohio River bordering the north edge of the county which afford dramatic views of the Ohio River and beyond. Notable man-made features such as individual historic homes/farm buildings, and the towns of Burlington, Petersburg, Rabbit Hash, and Belleview/McVille also provide scenic amenities to the county.

ANALYSIS OF PHYSICAL AND SOCIAL FACTORS

To determine the environmental impacts to the county within the 25 year planning horizon it must be ascertained what areas of the county will develop and how they will develop. The Population, Housing, and Business Activity Elements of the Comprehensive Plan identify the areas of Boone County which are projected to experience rapid growth in the short range, as well as the 25 year planning horizon. In addition, these Elements generally identify the type of land uses which will develop within these areas. When examining where the growth of Boone County will occur, one needs to consider where the developable land is within the county. The physical and social factors outlined above establish the areas of the county where limitations and restrictions may exist for development. These factors can be used to identify areas which will need special protective measures if they are to be developed. For example, the land areas which are located within flood plains or have slopes over 20% are considered to be developmentally sensitive, because of the environmental hazards which can result from the development of these areas (see **Figure 3.1**). Therefore, development should not occur within these areas unless environmental impacts can be mitigated.

Of the 164,120 acres of land within the county, approximately 43,701 acres of land were developed in 1999, and 50,493 acres were developed in 2004. The land area within the county which was undeveloped and classified as Developmentally Sensitive in 2004 is approximately 25% or 40,544 acres of land. The remaining undeveloped land which is capable of supporting most urban land uses totals approximately 73,091 acres or 45% of the land area within Boone County. As projected within the Population Element, the maximum population that could be physically accommodated under the current development density is 238,780 (estimated). This number is not an estimate, limitation, or forecast; instead it is intended to provide a projection based on existing development densities and trends applied to all remaining developable land in the county. For the purpose of this projection, developable land was defined as all land in the county not classified as Developmentally Sensitive (DS) in the Future Land Use Element. This projection provides one of many pieces of information used to prepare the Future Land Use Plan. The conclusions of this Environment Element must be used in conjunction with the conclusions of all the other elements in this Comprehensive Plan.

Water Quality

Boone County contains 26 different watersheds in which the developable areas within the county can be determined (see **Figure 3.4**). Six of the 26 watersheds contain 57.95%, of the total land area within the county and approximately 60.6%, or 51,749 acres of the total developable area within the county. These watersheds are as follows: Mudlick Creek, Gunpowder Creek (Upper Basin), Big Bone Creek (Upper Basin), Woolper Creek, Sand Run Creek, and Elijahs Creek basins. **Figure 3.4** identifies the land areas of each watershed in Boone County as well as the existing sanitary sewer pump stations. These pump stations are significant in that these areas can develop at much greater densities because of the availability of public sanitary sewer. These areas will likely develop much more rapidly than other areas of the county because of the potential for public sanitary sewer. The Public Facilities and Services Element identifies the importance of sanitary sewer and water to these areas in greater detail, as well as identifying some of the incremental effects of development within these areas. The areas which are projected to exceed, or which have exceeded the 2020 OKI Regional Council of Governments traffic zone population projections as outlined in the

Population Element, are primarily located within the six watersheds mentioned above. These watersheds currently have a rural character. Therefore, it is possible to determine the amounts of woodlands and agricultural lands which may be developed. The rural character that many residents desire may be at risk if development within these areas is not sensitive to the environmental factors mentioned within this element.

Figure 3.4 - Watersheds

In accordance with Section 303 (d) of the Clean Water Act, the State of Kentucky has developed a list of water bodies that do not meet their designated uses and are declared impaired waters. Being listed as such, a Total Maximum Daily Load (TMDL) must be developed for these waters. Both Elijah's Creek and segments of Gunpowder Creek were listed for TMDL development in the 1998 report issued by the Kentucky Natural Resources and Environmental Protection Cabinet Division of Water. Since that time, TMDL's have been developed and approved by the Environmental Protection Agency - Region 4 for these two streams and there has been discussion of studying Woolper Creek and Sand Run Creek. Most of the pollution issues center around siltation, high nutrient levels, and low dissolved oxygen, while Gunpowder Creek in particular includes industrial sources and urban runoff issues. According to the Kentucky Division of Water, Gunpowder Creek and Elijah's Creek have been "severely impacted" by de-icing fluids used by the airport. The general public, the media, and groups like the Sierra Club Water Sentinels have expressed concern over the pollution, especially since the airport is undergoing expansion. The airport has implemented a glycol recovery and recycling system, and an aeration system in attempts to decrease permit violations. Much of these facilities came on line early in 2004 and their success will be determined over time. An important consideration is that the creeks have been impacted by this pollution for many years and may require an extended period of time to recover even after the impact is decreased to an acceptable level because of pollution and anaerobic conditions within the stream sediment.

The Kentucky Agriculture Water Quality Act was passed in 1994 to bring Kentucky into compliance with federal laws. The goal of the act is to protect surface and ground water from potential pollutants as a result of agriculture and forestry operations. The act did not establish any new water quality laws other than requiring that all agriculture and forestry operations of ten or more acres develop and implement a water quality plan by October 23, 2001. The Boone County Conservation District continues to assist in developing individual water quality plans. The water quality plan

consists of best management practices (BMP) identified by the Kentucky Agriculture Water Quality Authority (AWQA) that keep non-point source or runoff pollutants such as sediment, animal waste, and fertilizers and pesticides from reaching our waterways. The AWQA asks landowners to address water quality issues in the areas of crops, farmstead, livestock, pesticides and fertilizers, silviculture, and streams and other waters. Not only are landowners required to install best management practices, they are also required to document their efforts to improve and protect the natural resources of the Commonwealth. By writing and carrying out a water quality plan, producers and landowners can be assured that they are helping to protect our water.

The analysis of physical factors shows that Boone County could encounter environmental degradation, economic loss, and safety hazards if urban uses are not developed properly and environmental hazards are not accommodated. The county can accommodate growth to complement existing development and allow new development, if proper controls and design standards are followed. The capability inventories for each of the ten physical factors and six social factors should be taken into consideration by developers and planners as part of the review of sites for potential urban uses.

IMPACTS ON THE ENVIRONMENT

With the developable land areas identified within the county it is possible to identify the environmental impacts which can be created by development of these areas for the county and the metropolitan region.

First, if the six watersheds identified in the Water Quality Section follow the same development pattern as the developed areas of the county, then these areas will develop primarily as single-family residential. This low density land use consumes vast areas of land and requires the extension of, and creation of many new community resources for support. Therefore, it is likely that the majority of the prime farmland and farmland of state wide importance within the county will be lost within the 25 year planning horizon. In addition, large areas of woodlands, and wildlife habitats which depend on these woodland areas will be destroyed. This type of development will likely change the visual appearance of Boone County. These visual characteristics, which are often considered by a community as one measure of the quality of life, may be altered by this future development.

The developed acreage in 1999 was 43,701 acres, while the developed acreage in 2004 was 50,493 acres. If that current rate of development is extrapolated to the 2030 planning horizon, a total of 84,453 development acres could be anticipated. When compared to the total acreage of Boone County, this indicates that there is a supply of developable land beyond the planning horizon. However, this supply of land would be increasingly comprised of steeper, less accessible ridge tops and hillsides further west in the county.

Low density land use requires people to travel much further distances to their places of employment, schools, shopping, and recreation. Across the United States experience has shown that existing road systems are becoming overwhelmed and congested with traffic, affecting the air quality of the county and the region. Federal regulations which include the Clean Air Act Amendments of 1990 (CAAA), and the Transportation Efficiency Act of the Twenty-first century (TEA 21, follow-up legislation to ISTEA) were created to limit the effect that increasing mobility in the future in metropolitan regions have on air quality. The effect that low density development has on the transportation system and how it relates to the federal legislation for the county and the region is explained in further detail in the Transportation Element.

Low density development prevents efficient mass transit alternatives, and weakens the ability of the region to create a sustainable environment. The Earth Summit of 1992, and the follow-up conference "From Rio to the Capitals," which was held in the Commonwealth of Kentucky in 1993, attempted to educate the world about sustainable development and methods to address our concurrent needs of job creation and environmental preservation. Sustainability is the concept that there is a finite capacity of the Earth to provide resources and absorb waste created by the built environment. In addition, sustainability incorporates a biological approach to the built environment in which the waste and pollution of one use constitute welcomed inputs for another use. Thus, all material processes will be cyclical by design. In the last few years, the concept of Sustainability has become more mainstream, and has given rise to similar concepts, such as “Smart Growth.” These ideas promote compact, efficient, orderly development similar to “older” concepts like Growth Management. The American Planning Association (APA) has defined “Smart Growth” as:

> ***Smart Growth*** *- Planning, regulatory, and development practices and techniques founded upon and promoting the following principles: (1) using land resources more efficiently through compact building forms, infill development and moderation in street and parking standards in order to lessen land consumption and preserve natural resources; (2) supporting the location of stores, offices, residences, schools, recreational spaces, and other public facilities within walking distance of each other in compact neighborhoods that are designed to provide alternate opportunities for easier movement and interaction; (3) providing a variety of housing choices so that the young and old, single persons and families, and those of varying economic ability may find places*

to live; (4) supporting walking, cycling, and transit as attractive alternatives to driving; providing alternative routes that disperse, rather than concentrate, traffic congestion; and lowering traffic speeds in neighborhoods; (5) connecting infrastructure and development decisions to minimize future costs by creating neighborhoods where more people use existing services and facilities, and by integrating development and land use with transit routes and stations; and (6) improving the development review process and development standards so that developers are encouraged to apply the principles stated above.

Most of the focus of sustainability efforts have been on water conservation, establishment of greenway/recreation networks, and development design that fits with the natural landscape. A local example of a sustainable effort is the Van Melle candy factory, located on Turfway Road in Boone County. Here, much of the interior office and factory lighting is provided by roof skylights with special reflectors. Photo voltaic cells assist in electricity generation, and the company has experimented with windmill power generation. Simple issues, such as orientation of proposed buildings toward the sun, window technology, and use of site vegetation are items routinely overlooked in typical Boone County development. Sustainability promotes the thought of long term impacts and benefits of good design.

Low density residential development creates direct and indirect environmental impacts. Direct impacts include decreases in air quality from increased automobile miles traveled, increased waste products such as yard waste in landfills, water quality issues from increased stormwater runoff containing many household and yard chemicals, and sanitary sewage. Indirect environmental impacts can include the extensions of public services, increased transportation distances for daily products, and a greater consumption of natural resources such as trees and oil.

SPECIAL STUDIES

The Boone County Recreation Task Force, during 2000, suggested that each stream valley system in Boone County be studied in detail to determine its suitability for development and for its potential as a recreation/natural area corridor. These analyses should be used not as a pro-development or anti-development statement, but as a resource for land use and recreation planning. Path systems that connect natural areas and residential development are a potential result of these types of planning efforts.

Sand Run Creek Preliminary Ecological Study

As an example of this type of study, a Preliminary Ecological Survey of the Sand Run Creek Watershed in northern Boone County was performed in August of 1999. The Environmental Resource Management Center at Northern Kentucky University prepared this report to provide preliminary ecological information regarding existing wildlife habitats. The document examines plant species diversity, rare species, unique landscape features, ecosystem health, historical features, and potential long-term management opportunities. This project was prompted by the Boone County Fiscal Court as a result of land donations by an area developer, which raised the potential for a significant public recreation corridor. This Survey was also prepared in conjunction with the 2000 Boone County Parks and Recreation Master Plan analysis and recommendations.

The Survey concluded that the ecological integrity of the Sand Run Creek watershed is relatively high compared to other watersheds in the Greater Cincinnati/Northern Kentucky region. The most significant ecological features of the watershed are the relatively undisturbed stream channel and associated riparian corridor, the contiguous riparian forest canopy and associated forested hillsides that collectively extend for nearly five miles, the absence of garbage, urban debris, sewage, and other signs of human impacts, the abundance of natural pools and riffles in the creek that provide critical habitat for aquatic life, and the potential for wetlands restoration and enhancement activities in the Ohio River bottoms for wildlife habitat, mitigation, recreation, and environmental education. Other such studies or ecological surveys of watersheds should occur.

Western Boone County Study

The 1995 Comprehensive Plan recommended that a study of the western part of Boone County be undertaken so that before these areas begin to develop and the rural character is changed, a visioning process is undertaken which identifies how these areas should develop, and what characteristics should be preserved to foster and promote a quality of life desirable for future generations to come. During 1996, 1997, and 1998, the Western Boone County Study was prepared by the Boone County Planning Commission. Although never reviewed at a public hearing or adopted as an official planning tool or land use control document, it does contain valuable research in report form and suggests a series of specific corridor and area plans for specific locations in the western part of the county. The Planning Commission reviewed the findings of the report in August of 1998 and suggested that the study be accepted as a technical report and its recommendations be considered as future work projects for the Planning Commission. The study is not proposed as a land use regulatory tool by this Comprehensive Plan.

Banklick Creek Watershed Analysis and Issue Characterization Project for Education and Outreach (BACE) Based on a four-year, interagency prioritization process coordinated by the Kentucky Division of Water, the Banklick Creek watershed was designated as one of the three "highest-priority" watersheds in the Licking River region. The severity of its water quality and quantity problems, the large number of stakeholders (land owners, businesses, and agencies affected by the creek's conditions), the high rate of projected growth, and the large number of water quality violations contributed to this designation. Most of the watershed is in Kenton County, however, a portion of the head waters area is in eastern Boone County, primarily east of Dixie Highway. The BACE project was designed to assist the Banklick Watershed Council to prioritize issues, set goals, and identify potential solutions to flooding and water quality problems. A major goal of the project was to establish the connection between forest cover, stormwater impacts, and landowner activities. The project has identified critical areas for protection and restoration and recommended many ways for individuals and agencies to positively affect water conditions in the Banklick watershed. This project's findings are important for Boone County because it creates a model for similar activity within watersheds, such as Gunpowder Creek, Mudlick Creek, Sand Run Creek, Elijah's Creek, Woolper Creek, and Middle Creek that either are or are expected to experience the same issues and potential solutions as the Banklick Creek.

COMPREHENSIVE ENVIRONMENTAL LIBRARY FOR BOONE COUNTY

The Goals and Objectives for the Environment Element recognize the need for a comprehensive environmental plan that connects local land use decisions with state or federal air and water quality regulations, and identifies any gaps in environmental regulation that should be addressed. This Plan should determine specifically what state and federal regulations exist for Boone County, how existing state and federal regulation affect development in Boone County, what issues need local attention, and how the development should be located and designed in Boone County to minimize or mitigate negative impacts. Since the internet has become a prevalent, easily-used tool for the general public to research data, policy, and regulations, citizens can readily access state and federal information. The Boone County comprehensive environment plan should also function as a directory resource and help direct citizens to agencies and web sites that can best provide information. The Plan should examine issues including:

- Documentation and update of flood prone locations in Boone County.
- Log of local flood events and damage statistics
- Periodic TMDL reports for major creeks
- Development site erosion
- Examples of energy efficient design in the county
- Remedial efforts intended to correct pollution problems
- Open space statistics
- Urban forest benefits
- Comparison of air quality statistics over time
- recommendations for using on-site plant materials for erosion control measures and using removed plant materials for mulch, etc.

The Florence and Boone County Urban Forest Boards have continued to implement projects for approximately fifteen years. Both Boards have projects planned for 2005 and beyond. In addition, Urban Forest Boards should promote trees as a significant natural resource within Boone County during development. In addition, the trees that will be removed by development should be handled as a resource rather than as a waste product which is burned or thrown away.

Stormwater regulations should be applicable to all types of development, and should be in effect before the undeveloped areas develop to prevent flooding, and costly stormwater control measures in the future.

TOOLS FOR LAND CONSERVATION

This section presents two potential tools for a community to achieve a well-designed balance between development and green space.

Transfer of Development Rights (TDR) and Purchase of Development Rights (PDR) programs are based on the concept that property owners have a bundle of different rights subject to reasonable local land use regulations. These include the right to use land, lease, sell and bequeath it, borrow money using it as security, construct buildings on it, develop it, or protect it from development. Normally all of these rights pass from seller to buyer, however, they do not have to. These types of programs allow the property owner to separate and sell their right to build on the land separate from the other property rights. A TDR program allows private interests to purchase these development rights to use on designated lands elsewhere. A PDR program allows the government or non-profit organizations to purchase the

development rights with the responsibility to prevent development on the subject parcel(s) according to program objectives. As can easily be seen, both types of programs are voluntary and intended to pursue a community objective while offering the property owner an incentive regarding compensation for property rights. In many of these programs, there is not an outright sale of property but the sale of a conservation or agricultural easement. The property owner is capable of enjoying all the remaining rights on the property that have not been sold. For example, a farmer can continue an agricultural operation forever, while no, or a reduced number of houses, industrial development or other urban land use would be developed. These programs can enable considerable beneficial estate planning options and tax benefits for the property owner as well.

Kentucky has a Purchase of Agricultural Conservation Easement Program (PACE), however, generally, Boone County land is now too expensive to make this program viable by itself. Some communities have used a designated tax, or leveraged PACE funds with a local bond. TDRs are permitted by state law and referenced by the Boone County Zoning Regulations. They must be based on a fair and equitable appraisal formula for generating land values and exchange methods.

To address the Adopted Goals and Objectives of the 2000 Boone County Comprehensive Plan, the Boone County Fiscal Court requested that the Staff of the Boone County Planning Commission conduct a feasibility study of two growth management tools which have been employed elsewhere in the United States. The purpose of this study is to evaluate how Purchase of Development Rights (PDR) and Transfer of Development Rights (TDR) programs have been used by other communities and to determine whether either technique may be appropriate in Boone County. An Advisory Group composed of individuals representing a range of interested parties in Boone County was assembled for this study. The group was selected by the staff and created as a sounding board for varied interests, which range from farmers and residents to homebuilders and the economic development community. The Advisory Group was brought together five times during the study process. The five meetings included a kickoff meeting, a presentation of the PDR/TDR case studies by American Farmland Trust, a presentation of the draft study, and two final roundtable discussions of the study.

Transfer of Development Rights

Transfer of Development Rights was initially developed to protect historic properties. Approximately 50 counties, towns, and municipalities in the U.S. have developed TDR programs in order to protect farm and ranchland (AFT 2001). By early 2000, a total of 67,707 acres had been protected across the United States through TDR; 60 percent (40,583) of this total was in Montgomery County, Maryland (AFT 2001). TDR operates on the fact that property is owned as a “bundle of rights” and that the right to develop can be severed from the property and transferred (Mittra 1996; Michigan Agricultural Experiment Station [MAES] 1999). Most TDRs function as agreements between private land owners and developers. They are best described as follows:

> TDR programs allow landowners to transfer the right to develop one parcel of land to a different parcel of land. Generally, TDR programs are established by sections of local zoning ordinances. In the context of farmland protection, TDR is used to shift development from agricultural areas to designated growth zones closer to municipal services. The parcel of land where the rights originate is called the "sending" parcel. When the rights are transferred from a sending parcel, the land is restricted with a permanent conservation easement. The parcel of land to which the rights are transferred is called the "receiving" parcel. Buying these rights generally allows the owner of the receiving parcel to build at a higher density than ordinarily permitted by the base zoning (AFT 2001).
>
> While TDR programs are typically set up and administered by government agencies, the development rights of a property are sold and bought on the open market. As a result, the value of development rights is partially a function of the real estate market (MAES 1999). The key role of government in a TDR program is to define sending and receiving areas and oversee the transfer of development rights. The TDR agency also holds and monitors the conservation easement drafted to protect the sending area parcel. Some programs have established a TDR Bank, which may purchase development rights from a seller and hold them until they can be sold to an interested buyer. TDR banks have been used to initiate a program and generate a local market for transferrable development rights.

Purchase of Development Rights

Purchase of Development Rights (PDR) programs “compensate property owners for restricting the future use of their land” (AFT 1998e). The first PDR program was developed in Suffolk County, New York in 1974, and by 1980 PDR programs were operating in a number of localities in the northeastern United States (Daniels 1991; Broward County Planning 2000). The goal of most PDR programs is to keep land available for agriculture and to maintain open space or agricultural land in the form of large (and ideally contiguous) tracts. These programs operate on the notion that landowners have numerous rights, including the right to develop, right to lease, sell, borrow against, or mine their property. Landowners also have the right to restrict development of their land. This entire “bundle of property rights” is typically transferred with a property to a buyer when ownership changes hands.

PDR programs separate the development rights from the “bundle” and pay landowners for them. The value of the development rights is usually bought by a government agency or other organization (e.g., a land trust) set up expressly for that purpose; the terms of the agreement are stipulated in a legally binding conservation easement that remains with the property deed (Diehl and Barrett 1988). Participants retain ownership of the property and all of the other property rights and can live on, farm, bequeath, sell, or transfer the property, providing that it remains undeveloped under the terms of the conservation easement. Conservation easements placed on property deeds for the purposes of PDR are usually perpetual, although some programs provide for termination of the terms of the easement after a set number of years (Peters 1990; Broward County Planning 2000). This buy back option has not been utilized yet in any known cases. Most easements restrict the use of property to agriculture, although variations on this theme are common. Conservation easements also typically allow construction of farm buildings and housing for employees and family members.

The Kentucky PACE program is a small, state-level PDR program designed to protect farming on the best farmland in the state. The program has acquired or been donated easements covering over 20,649 acres of Kentucky farmland. A total of 585 applications are currently pending for a total of over 115,000 more acres statewide.

PDR/TDR Study Conclusions

The characteristics of both PDR and TDR were explored at length using detailed case studies and data from current literature on the subject. Important issues and necessary implementation steps for both techniques were discussed in general terms. A "toolbox" of other land conservation techniques was also examined. This research was then assessed relative to Boone County. Together, data from existing PDR and TDR programs, a review of current literature, and an analysis of Boone County lead to the following conclusions:

- This study suggests that land conservation in Boone County concerns both farmland and open space;
- Conservation of both farmland and open space requires utilization of the entire "toolbox" of land conservation techniques presented in this study;
- At this time, Transfer of Development Rights is not a feasible land conservation tool for Boone County;
- Purchase of Development Rights is currently a feasible addition to the existing tools in Boone County’s toolbox of land conservation techniques;
- The residents of Boone County must be involved in determining whether a PDR program is established and how it is funded;
- To achieve success, a PDR program will require phased implementation over a minimum 3-year period;
- Implementation of a PDR program in Boone County would require: amending Kentucky law; extensive public education/outreach; a community visioning process; a county-wide open space plan/map; formation of a PDR board; development of funding sources; and the creation of at least one full-time staff position.

This study was initiated to evaluate both PDR and TDR techniques. The results of the study indicate that PDR is a workable tool for Boone County at this time. However, it is important to stress that PDR is only one of a number of tools designed to preserve open space and make farming viable. Some tools (PDR, Ag Districts, differential assessment for taxes) help make farming more lucrative. Others (zoning and Conservation Subdivision Design) encourage orderly and cost-effective growth in Boone County by concentrating development near existing or planned infrastructure and affecting the physical design of development.

Scenic Areas

Criteria should be established which help define and map the scenic areas within Boone County. If these areas are to develop, standards should be created which outline the procedures and methods necessary to protect and minimize negative impacts to the scenic landscape. In addition, standards should be developed for the vast areas of Developmentally Sensitive land within Boone County. These standards should establish procedures for how these areas may develop without creating an environmental hazard.

Requirements for the control of dust, noise, dirt on public right-of-ways, and erosion in all public and private construction activity should be reviewed and revised where needed. In addition, the re-establishment of ground cover and reuse of resources such as removed trees for mulch, lumber, or firewood should be evaluated.

CONCLUSION

Overall, land planning in Boone County should enable the developable lands to be developed at a higher density, thus reducing the need to develop the developmentally sensitive areas. This would be the most effective way of preserving the environmental characteristics of the rural portions of the county, while reducing the air pollution within the region and making mass transit more feasible and effective. In 1995, the Comprehensive Plan observed that Boone County had almost three times as much undeveloped land, not including developmentally sensitive, as developed land. The

conclusion was that unless development occurs in a low density form, there should be ample developable land to allow continued growth within Boone County beyond the 25 year planning horizon. In the decade since 1995, however, development has occurred at a lower density than was proposed on the 2020 Future Land Use Map (contained in the 1995 Boone County Comprehensive Plan), as well as at lower densities than permitted by the existing zoning. This means that Boone County development will affect more acreage than had been shown on the 2020 Land Use Map during the 1995 Plan update. As a result, the 2025 Land Use Map (2000 Boone County Comprehensive Plan) included additional development areas outside the 2020 Land Use Map urban areas particularly for residential development. These areas were planned for development partly because they were in watershed areas that are consistent with future sanitary sewer service plans. Based on the developed and non-developed acreage analysis, and the difficulty experienced by the community in constructing necessary infrastructure since the 2000 Comprehensive Plan update, it appears that significant additional development areas, particularly for residential development, do not need to be provided for in the 2030 Future Land Use Plan. This, of course would be a subject of review in future Comprehensive Plan updates. As Boone County's development continues, design will become increasingly important. Attention to water runoff, traffic congestion, and visual impacts will require more attention so that the cumulative impacts of development can be addressed.