

# Innovative Floodplain Management



Although Hurricane Floyd had decreased in strength to a Category 2 hurricane before reaching North Carolina's coast, the City of Kinston-Lenoir County was devastated by severe flooding.



# Case Studies

## KINSTON, NORTH CAROLINA



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More than 75 percent of the homes located in floodplains in Lenoir County were substantially damaged and /or repeatedly flooded following Hurricanes Fran, Dennis, and Floyd

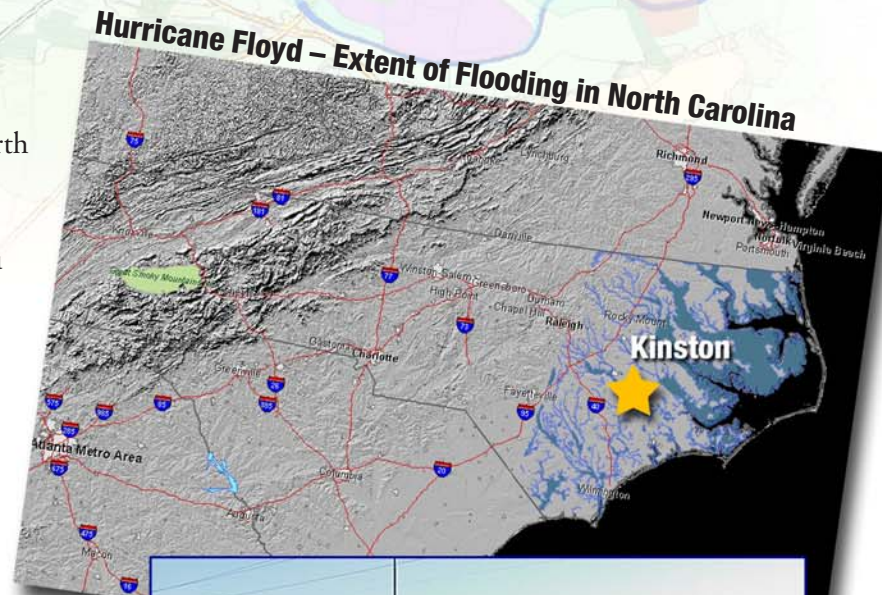
Successful floodplain management depends on a combination of detailed documentation, mitigation planning, community education, and project marketing. The City of Kinston-Lenoir County, North Carolina, used Geographic Information Systems (GIS) to integrate these elements into a model floodplain management program. The results, as you will see, are very impressive.

### Background:

Tropical Storm Floyd formed in the Atlantic Ocean on September 8, 1999. The storm moved eastward across the ocean, steadily gaining strength and increasing concerns along the eastern seaboard. By September 13, Floyd had developed into a dangerous, Category 4 hurricane, with sustained winds of 155 miles per hour. Fortunately, by the time Floyd made landfall, it had decreased in strength to a Category 2 hurricane. Although sustained winds at the time of landfall had dropped to 110 miles per hour, the storm devastated regions of North Carolina. The City of Kinston was particularly hard-hit.

Floyd dumped more than 13 inches of rain on Kinston in 24 hours. A significant factor in the record flood level, in addition to the heavy rainfall, was that a previous storm, Hurricane Dennis, had lingered off the coast for several days. The rain from Hurricane Dennis saturated the ground of the entire drainage basin. As a result, the basin soil, which would typically absorb a portion of the precipitation, was fully saturated and, therefore unable to absorb any additional rainfall produced by Hurricane Floyd. The Neuse River crested in Kinston at 38.8 feet, more than 10 feet above flood stage. The impact was crippling. All aspects of community life came to a halt. Lenoir County documented that more than 75 percent of the homes in the floodplain were substantially damaged and/or repeatedly flooded following Hurricanes Fran [September 5, 1996], Dennis [September 5, 1999], and Floyd [September 16, 1999].

After having suffered from repeated flooding and losses, the City of Kinston-Lenoir County made a commitment to consciously reduce their risks and proactively incorporate floodplain management planning into their community. Using GIS as the technical foundation for their flood plain management planning, local officials developed and utilized relevant databases and tracking functions to produce graphical images to aid in planning, implementing, and tracking a comprehensive floodplain management program.

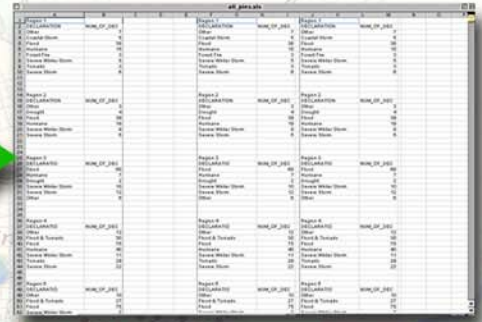




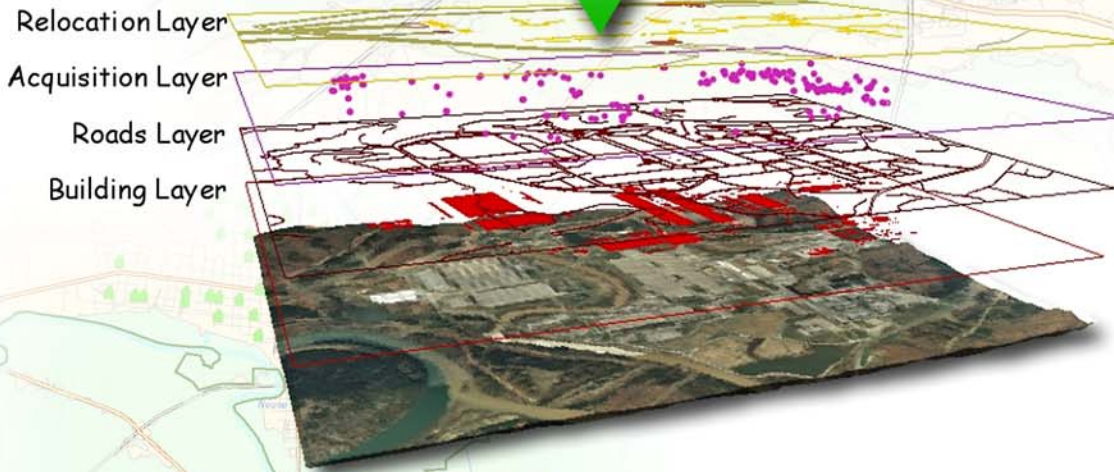
# FEMA Mitigation Case Studies



Map



Database



## Geographic Information Systems (GIS)

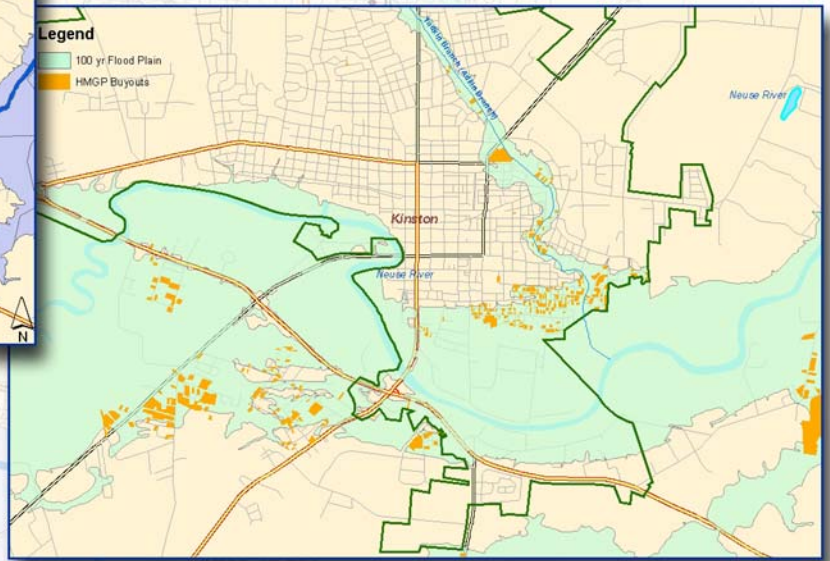
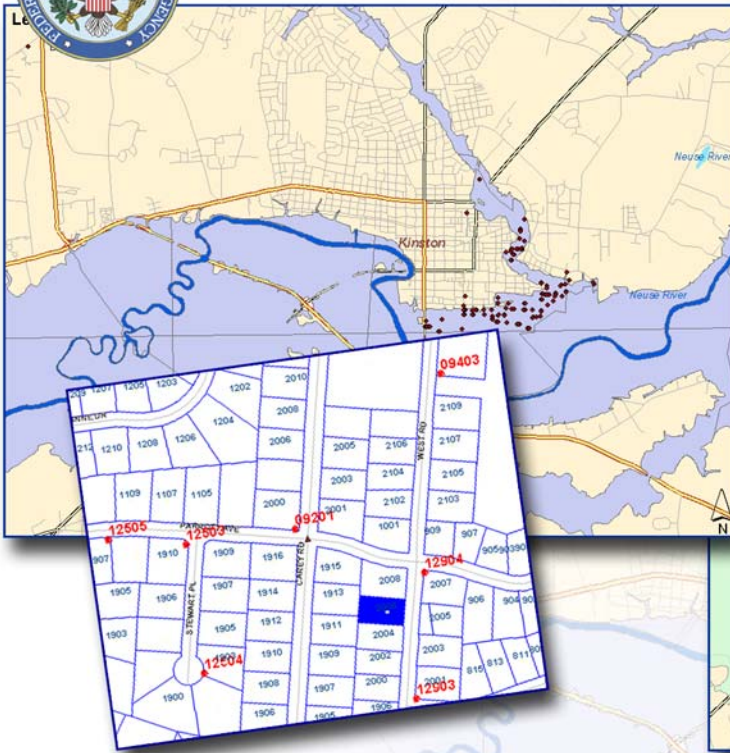
GIS links maps and databases to produce graphical layers that can help communities organize their resources (e.g., community funding, first responders, shelters, infrastructure development, funding) to develop effective mitigation strategies. Databases can include boundary information, infrastructure information, demographics, and property statistics. Examples of information that communities include in their databases follow:

Boundaries	Infrastructure	Demographics	Property Statistics
<ul style="list-style-type: none"> <li>• City and county limits</li> <li>• National Flood Insurance Programs (NFIP) flood zones</li> <li>• Flood evacuation zones</li> <li>• Wetlands</li> <li>• Watersheds</li> <li>• County voting blocks</li> <li>• Land-use zones</li> <li>• Green spaces</li> <li>• Public lands and parks</li> </ul>	<ul style="list-style-type: none"> <li>• Transportation systems</li> <li>• Dams and levees</li> <li>• Utilities</li> <li>• Critical facilities</li> <li>• Hazardous waste disposal and storage sites</li> <li>• Flood gauges</li> </ul>	<ul style="list-style-type: none"> <li>• Population density</li> <li>• Special needs population density               <ul style="list-style-type: none"> <li>• Handicapped</li> <li>• Elderly</li> <li>• Infants</li> <li>• Children</li> </ul> </li> <li>• Socio-economic data               <ul style="list-style-type: none"> <li>• Homeowners</li> <li>• Renters</li> <li>• Annual incomes</li> <li>• Absentee owners</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Type and degree of damage data</li> <li>• Repetitive loss flood claim data</li> <li>• Tax parcels</li> <li>• Property addresses</li> <li>• Finished floor elevation</li> <li>• Tax card information</li> <li>• Appraised values</li> <li>• Farm animal operations</li> <li>• Schools and colleges</li> <li>• Hazard Mitigation Grant Program (HMGP) acquisition properties and costs</li> <li>• HMGP elevation properties and costs</li> </ul>



# FEMA Mitigation Case Studies

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The City of Kinston updates the GIS data regularly and uses such information for effective project planning and management. Such information is useful in the various stages of mitigation planning and disaster efforts.

### Pre-Disaster Mitigation Planning

Planners can use GIS to predict the impacts on the infrastructure, buildings and people for a variety of disaster scenarios. The City of Kinston-Lenoir County used GIS to show the 100- and 500-year floodplains and identify susceptible structures.

### Risk Reduction

Planners can use GIS to track mitigation efforts. The City of Kinston-Lenoir County used GIS to track the progress of floodplain property acquisitions.

### Disaster Response

Emergency responders can use GIS to access critical information to aid in disaster response. The City of Kinston Fire Department uses GIS to obtain critical information for responding to emergency calls.

### Disaster Recovery

Local officials can use GIS to access the community's needs. Kinston developed a demographic profile of the floodplain that helped to identify how many homes and in what price range were needed to accommodate residents wishing to relocate outside of the floodplain.

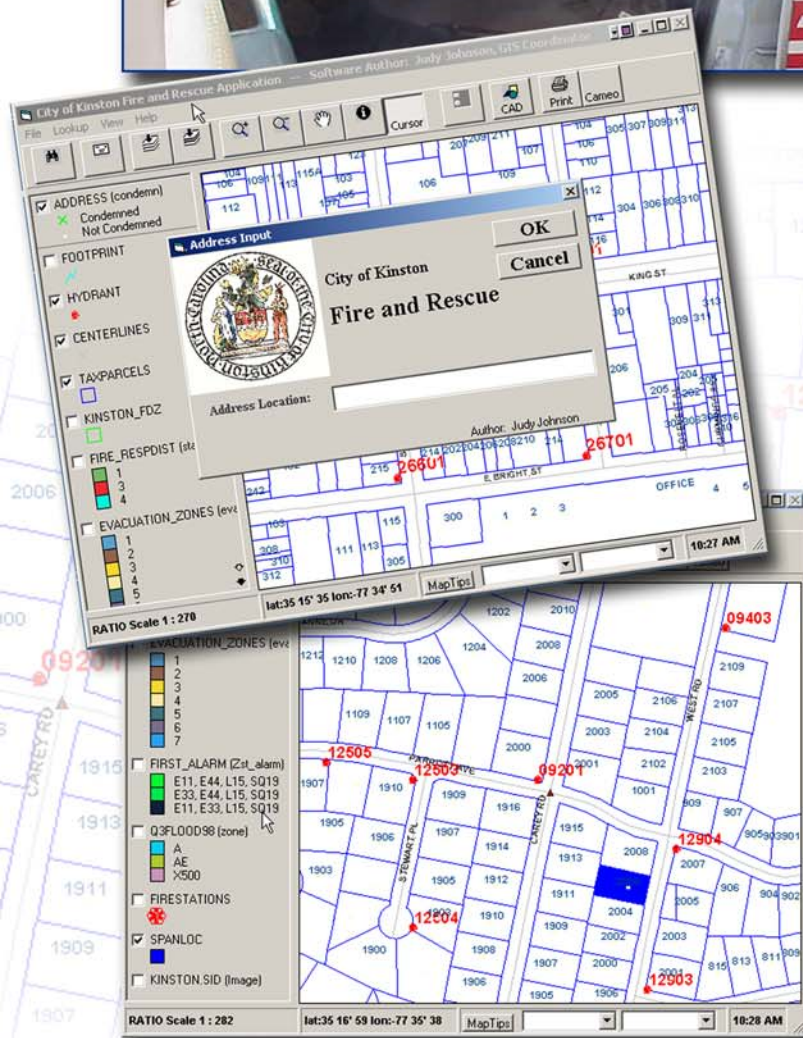
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## City of Kinston Fire Department

An example of GIS use for emergency response is the implementation of an innovative program by the Kinston Fire Department. Each fire emergency response vehicle is equipped with a laptop computer containing the most recent GIS data for properties in the community, including homes and businesses located in the floodplain. If a unit is called to a flooded home to rescue the residents, the emergency responder can access critical pieces of information, such as how many people reside at the house or if any of the residents are handicapped and will require special assistance.

# Case Studies

KINSTON, NORTH CAROLINA



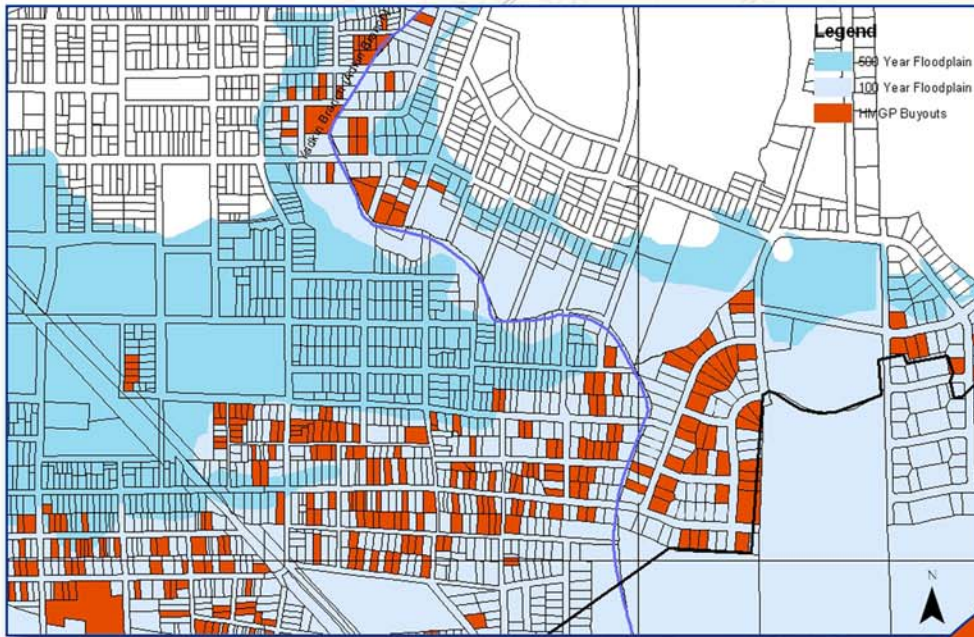
### Hazard Mitigation Grant Program (HMGP) Acquisition and Management

Local officials used GIS to graphically illustrate the 100- and 500-year floodplains and the HMGP acquired lots to help local officials illustrate the benefits of proactive floodplain management and to plan for future acquisitions.

The Floodplain Administrator for the City of Kinston, Tommy Lee, through the city planning department, recommended to the city council that Kinston set a goal for the city to remove all residential structures from the floodplain. Through systematic efforts, the City of Kinston and Lenoir County have already acquired over 1,000

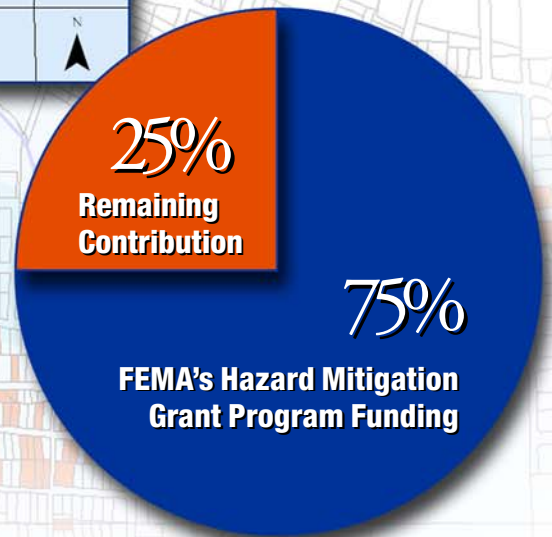
properties with FEMA's HMGP funds.

Approximately 225 properties remain to be acquired.



#### HMGP Acquisitions – Kinston, North Carolina

The Federal Emergency Management's (FEMA) Hazard Mitigation Grant Program (HMGP) offers 75% of the funds to pay for the acquisition of properties located in floodplains. State and local governments or possibly the property owners must contribute the remaining 25%. In Lenoir County, approximately \$30 million came from the HMGP program and the balance of the funds (\$10 million) was received from the state.

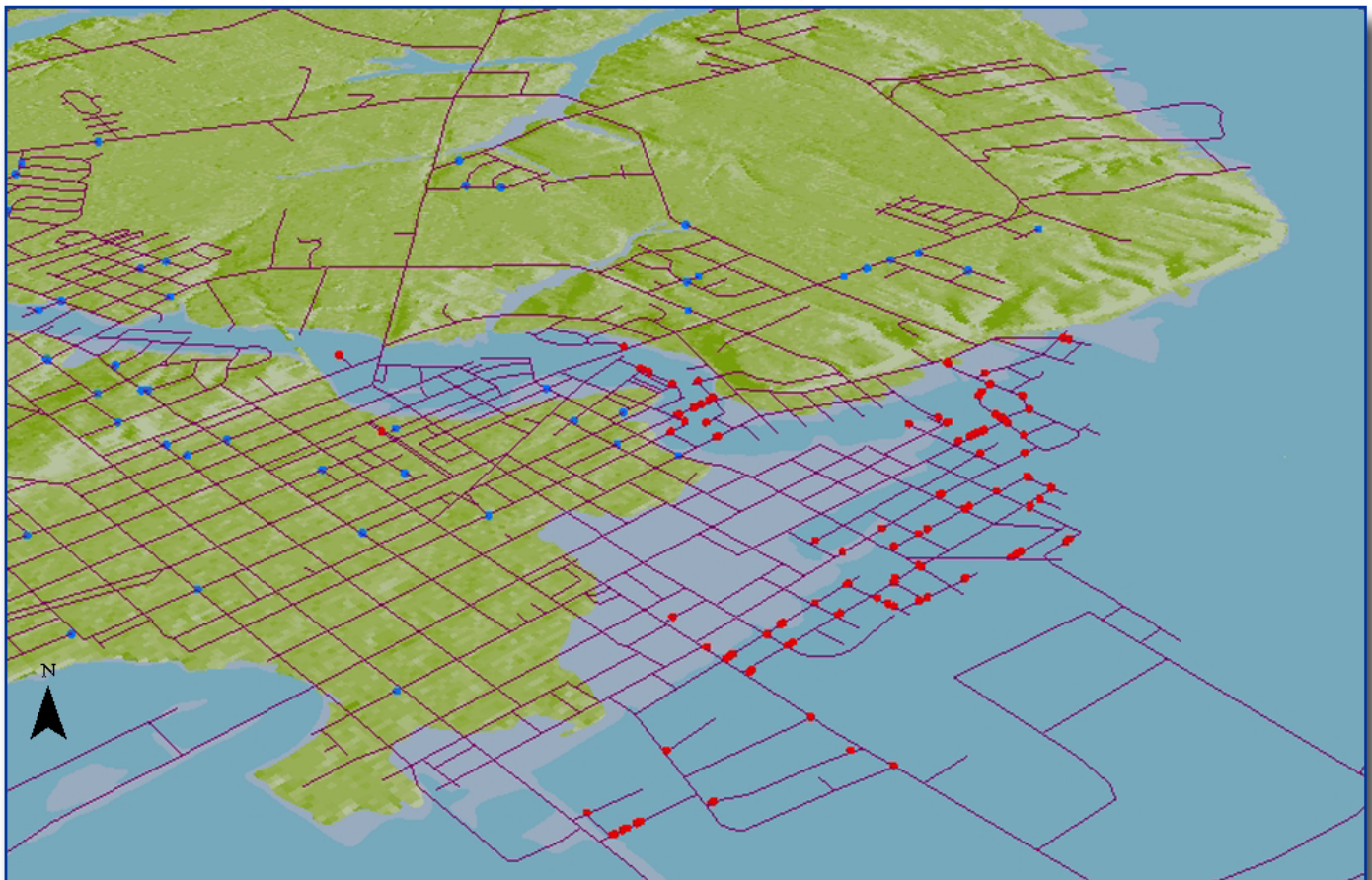




### Relocation Strategy

A successful acquisition program requires a thoughtful and coordinated relocation plan. Kinston officials recognized the importance of protecting the social and economic base of their community. If residents leave the community following the purchase of their homes, the community ultimately suffers by losing part of its tax base. As a result, the acquisition program was structured in a way that allowed residents to move into the same neighborhoods together, so that residents could maintain their social contacts and their children would still have the same friends in their new schools.

Because HMGP acquisitions are voluntary, residents must be interested in participating and must also understand the implications of their decisions. By using GIS as an educational and marketing tool to illustrate the acquisition plans and benefits, local officials were able to generate community support. Ninety-seven percent of the homeowners in acquired homes relocated to housing in the City of Kinston, resulting in minimal impact to the tax base. This is a testament to the community-based approach and the GIS technology that the City of Kinston used in developing their mitigation strategy.



**HMGP Acquisitions and Relocations – Kinston, North Carolina**

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### The North Carolina Permanent Replacement Housing Program

In addition to social and economic needs, homes are needed for resident relocation for any acquisition program. A partnership between the Office of the Governor, the Department of Correction, and the Division of Emergency Management was established to build replacement houses for Hurricane Floyd victims in North Carolina. The Governor's relief fund provided \$1,500,000 for construction materials. The Department of Correction established a wall panel manufacturing operation within a prison, utilizing inmate labor, to produce high quality, low cost building components. This cooperative approach of organizations combining their resources was integral to rebuilding the community.



Approximately 100 new homes will be built in the City of Kinston as a result of this partnership and other volunteer programs, making the community much better prepared to accommodate the migration of residents to new homes outside of the floodplain. In addition to individual housing units, a 1920's era abandoned high school was converted into housing units for the elderly.

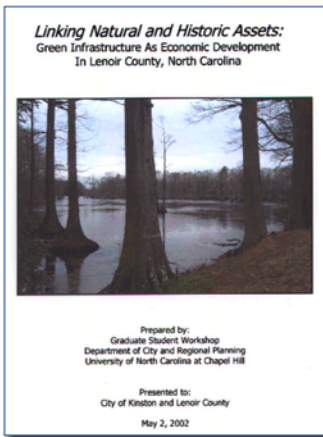
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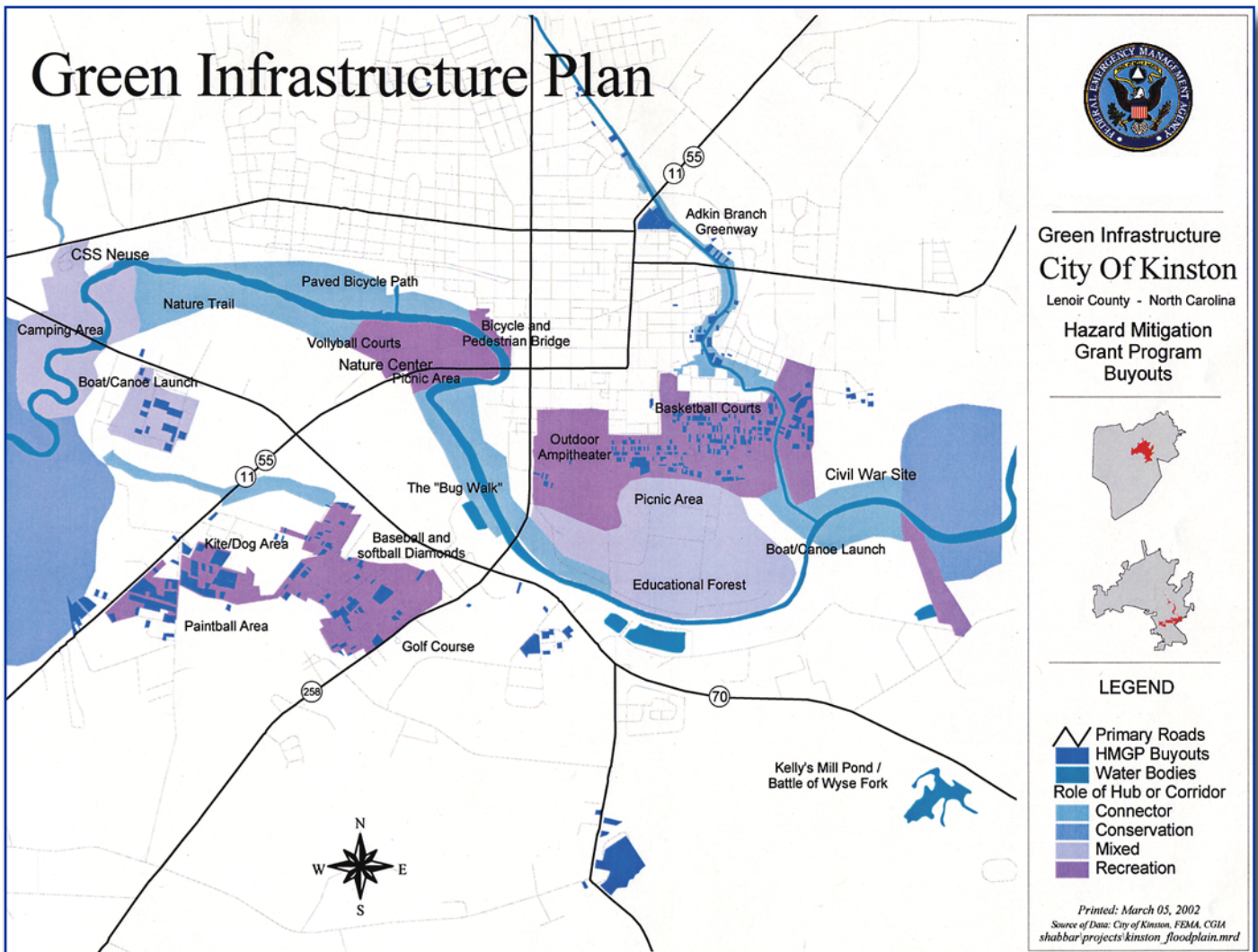
### Lenoir County Green Infrastructure Plan



A requirement of FEMA's HMGP is that the purchased property must be maintained as open space. Viewing this requirement as an opportunity, the City of Kinston, in partnership with the Conservation Fund and the University of North Carolina at Chapel Hill Graduate Student Workshop, developed a green infrastructure plan that redevelops areas as open spaces that create amenities and services to benefit the overall community.

The green infrastructure plan focuses around three areas: heritage tourism (e.g., a Civil War site and historic buildings), passive recreation (e.g., an educational forest and nature trail), and active recreation. Using GIS, officials analyzed land in the floodplain area to assess its suitability for conservation or recreational uses. Hub areas were identified for appropriate activities and linked with connectors or greenway segments to allow residents and visitors

to travel throughout the county, by foot, bicycle, canoe, or car to experience the diverse activities and landscapes of the region.



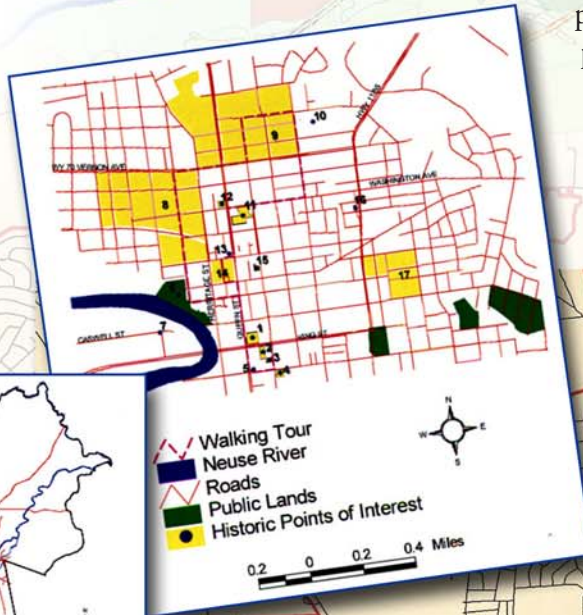
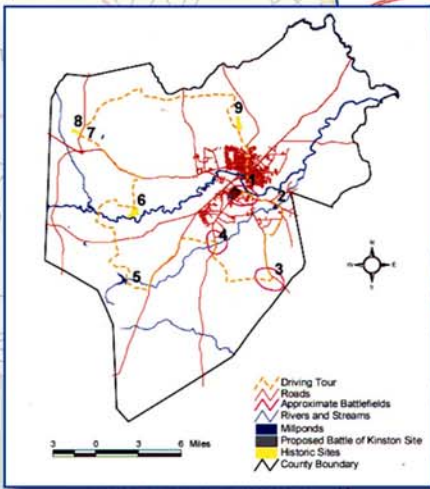


### Lenoir County Green Infrastructure Plan

The scenic Neuse River runs through the center of the community, providing excellent opportunities for river travel, walking and bicycling. Hurricane Floyd and subsequent property buyouts created opportunities to expand existing trails and add new ones. Based on the existing greenway infrastructure and HMGP acquisitions, this plan identifies 14 potential greenway segments and several additional canoe launches to be developed in order to provide greenway connectivity to the historic and recreational assets. A special walking tour for historic Kinston and a driving tour of sites in Lenoir County were also developed as connectors. This creative and effective

planning of acquired properties and other publicly owned land illustrates a variety of ways to maintain open spaces and promote sustainable development.

**Driving Tour of Lenoir County**



**A Walking Tour of Historic Kinston**





# FEMA Mitigation Case Studies

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When planning mitigation strategies, communities must address a number of political, emotional, economical, and logistical issues. The City of Kinston handled these in a model way, by taking a holistic and inclusive approach to making and implementing decisions. GIS technology provides integral documentation, planning, and educational and marketing tools to produce, implement, and track a comprehensive floodplain mitigation plan that addresses both the community's needs and mitigation goals.

**Community Needs**

**Mitigation Goals**

**GIS**

**Documentation Tool**

**Planning Tool**

**Education and Marketing Tool**

**Comprehensive Floodplain Mitigation Plan**

