Stormwater Element
Data and Analysis

Introduction

The Stormwater Management Data and Analysis Report addresses the requirements of the Local Government Comprehensive Planning and Land Development Regulation Act and the Florida Administrative Code, Chapter 9J-5.011, as well as the needs of the City of Gainesville, as they pertain to drainage. The element has been named Stormwater Management because that title is more representative of current engineering design and practice with regard to drainage issues.

The purpose of this report is to describe the City's stormwater management system, assess the system's ability to provide necessary protection to residents, structures, and the environment including groundwater resources.

Stormwater management systems affect the aesthetic and ecological character of the City. Within the City of Gainesville, stormwater management has been an important aspect of the development process for the last two decades. As a result, the City has been able to achieve growth in recent years while minimizing impacts on and preserving the natural function of its creeks, sink holes and lakes.

Through the policies and regulations proposed in this element, the City has endeavored to develop a stormwater management plan that will enhance the ability of natural systems to provide flood control and water quality treatment. Stormwater management design which minimizes the alteration of natural features and increases groundwater recharge is a primary ambition for this plan.

The issues raised in this element affect the community in several ways. The proper management of surface water resources is essential to maintaining the quantity and quality of groundwater resources. As the City grows, the associated increase in impervious surface area requires that the City continue to provide review of the design, installation and maintenance of public and private stormwater management facilities, in order to ensure the safety of citizens and property during storm events, and to protect water quality and creek ecosystems.

MAJOR NATURAL AND MAN-MADE DRAINAGE FEATURES

Stormwater runoff is the water that flows across the surface of the earth during or after a storm event. It is affected by:

* rainfall,
* natural drainage features such as topography and soil types, and
* man-made structures such as culverts, and retention and detention basins.

Stormwater management addresses:

* quality,
* volume, and
* rate of stormwater flow.

NATURAL DRAINAGE FEATURES

Rainfall

The mean annual precipitation for Alachua County for the thirty-year average through 1997 was approximately 53 inches. About 52 percent of the total rainfall occurs during the months June through September. For the Greater Metropolitan area of Gainesville, a rain event of 7.9 inches distributed over a twenty-four hour period is considered a twenty-five-year 24-hour storm event. This means that a storm of this intensity has a four percent probability of occurring or being exceeded each year. A ten-year 24-hour storm event contributes 6.8 inches of rainfall during a 24-hour period. This intensity of storm has a ten- percent probability of occurring or being exceeded each year.

Natural Watershed Characteristics

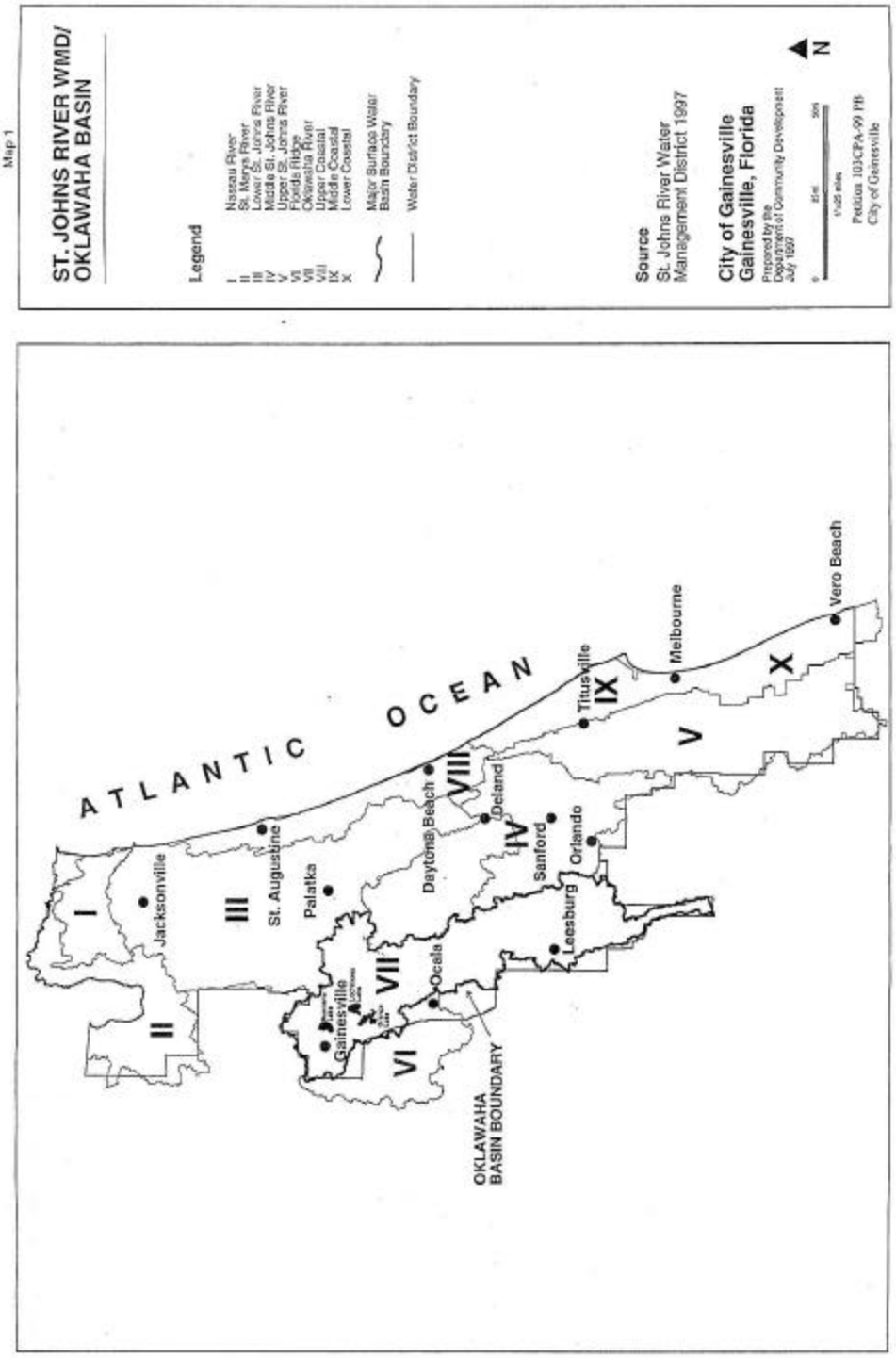
Basin Classification

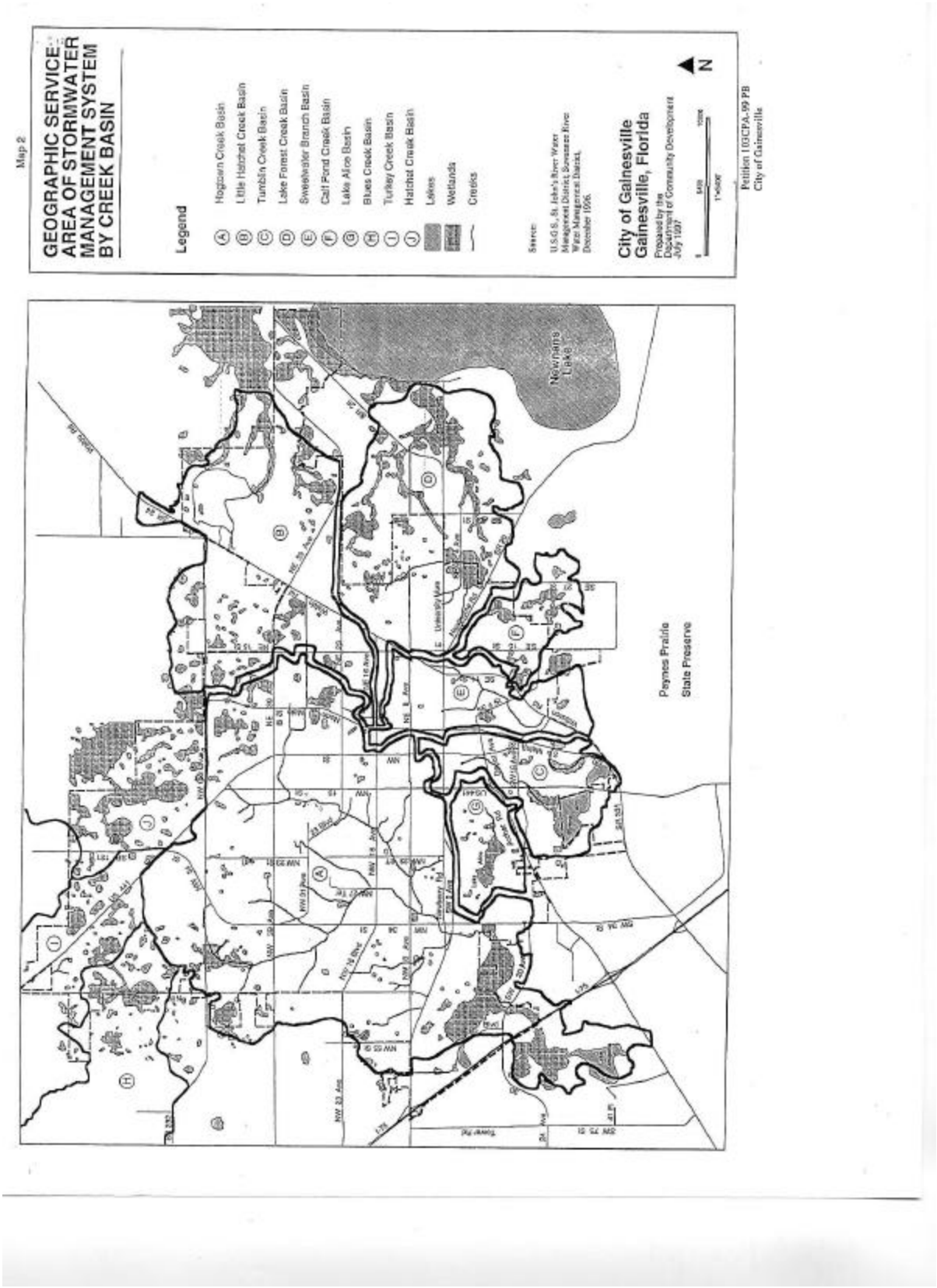
The City is primarily located within the Oklawaha River Basin, a major regional watershed (see Map 1). Within the Oklawaha River Basin, the City is divided into two sub-watersheds, the Florida Ridge Basin and the Orange Lake Basin. A small portion of the City, in the vicinity of the Northwood subdivision near the northwest city limits, is in the Santa Fe River Basin under the management of the Suwannee River Water Management District.

The two major basin types within the Gainesville area are depression basins and stream basins. Depression basins are those watersheds which have no outlet for stormwater runoff except by percolation into the groundwater and evapotranspiration. Stream basins are those watersheds which drain stormwater runoff via natural streams and man-made channels ultimately discharging into wetlands, lakes or sinkholes.

The City area is divided into ten creek basins (see Map 2) based upon the creek system. Several of these basins extend beyond the City limits and into Alachua County. Very little water leaves the urban area as surface water flow. Only the Little Hatchet and Lake Forest Creek basins have discharges which eventually outfall to the St. Johns River via the Newnans Lake system.

Map 1


ST. JOHNS RIVER WMD/
OKLAWAHA BASIN
Legend
I Nassau River
II St. Marys River
III Lower St. Johns River
IV Middle St. Johns River
V Upper St. Johns River
VI Florida Ridge
VII Okleneita River
VIII Upper Coastal
IX Middle Coastal
X Lower Coastal
Major Surface Water Basin Boundary
Water District Boundary
Source
St. Johns River Water Management District 1997
City of Gainesville
Gainesville, Florida
Prepared by the Department of Community Development July 1997
Petition 103CPA-99 PB
City of Gainesville
N
ATLANTIC OCEAN
Jacksonville
St. Augustine
Palatka
Daytona Beach
Deland
Titusville
Melbourne
Vero Beach
Sanford
Orlando
Leesburg
Ocala
Gainesville
OKLAWAHA BASIN BOUNDARY


Map 2
GEOGRAPHIC SERVICE AREA OF STORMWATER MANAGEMENT SYSTEM BY CREEK BASIN
Legend
A Hogtown Creek Basin
B Little Hatchet Creek Basin
C Tumblin Creek Basin
D Lake Forest Creek Basin
E Sweetwater Branch Basin
F Calf Pond Creek Basin
G Lake Alice Basin
H Blues Creek Basin
I Turkey Creek Basin
J Hatchet Creek Basin
Lakes
Wetlands
Creeks
Source:
U.S.G.S., St. John's River Water Management District, Suwannee River Water Management District, December 1996.
City of Gainesville
Gainesville, Florida
Prepared by the Department of Community Development July 1997
N
Petition 103CPA-99 PB
City of Gainesville
Newnans Lake
Paynes Prairie State Preserve

Description of Creek Basins

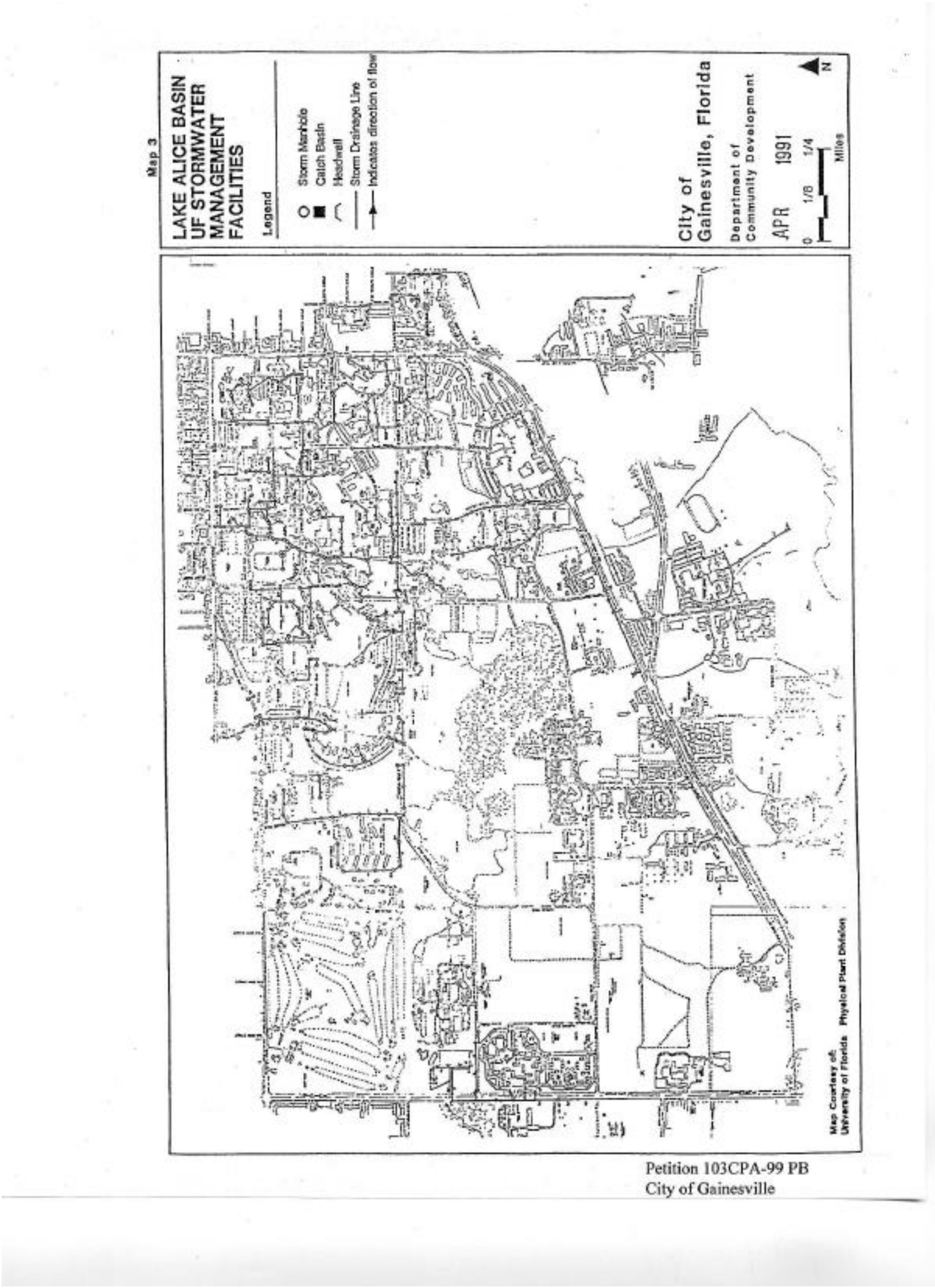
Table 1 lists the basin name and indicates the predominant land use types and the degree of reliance on man-made structures within the watershed.

TABLE 1
CREEK BASINS

Basin Name	Predominant Land Use Type	Predominant Character	Watershed Size (acres)
Hogtown Creek	Residential	Natural	12,500
Little Hatchet Creek	Public Facilities, Industrial Agriculture	Channelized	2,884
Tumblin Creek	Residential Commercial Industrial	Natural and Channelized	1,976
Lake Forest Creek	Education Residential	Channelized	4,547
Sweetwater Branch	Residential Commercial Industrial	Channelized	1,690
Calf Pond	Residential Agriculture	Channelized	1,024
Lake Alice	Education	Natural	1,059
Blues Creek	Residential	Natural	4,976 (estimated)
Turkey Creek	Residential	Channelized	5,640 (estimated)
Hatchet Creek	Industrial	Natural	17,548 (estimated)

Notes: Lake Alice is the drainage basin for the University of Florida. The City of Gainesville has no maintenance responsibility for this basin (see Map 3). There are approximately 150 depression basins within the City. See Future Land Use Element for specific land use designations within basins.

Source: City of Gainesville 1980 - 2000 Comprehensive Plan, December 1979, St. Johns River Water Management District; Suwannee River Water Management District, December 1996; City of Gainesville Department of Community Development, February 1999.



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Recharge Characteristics

Stormwater runoff is collected by creeks and discharged directly into the Floridan Aquifer through the Alachua and Haile Sinks. For further discussion of aquifer recharge characteristics, refer to the Conservation, Open Space and Groundwater Recharge Element.

Wetlands

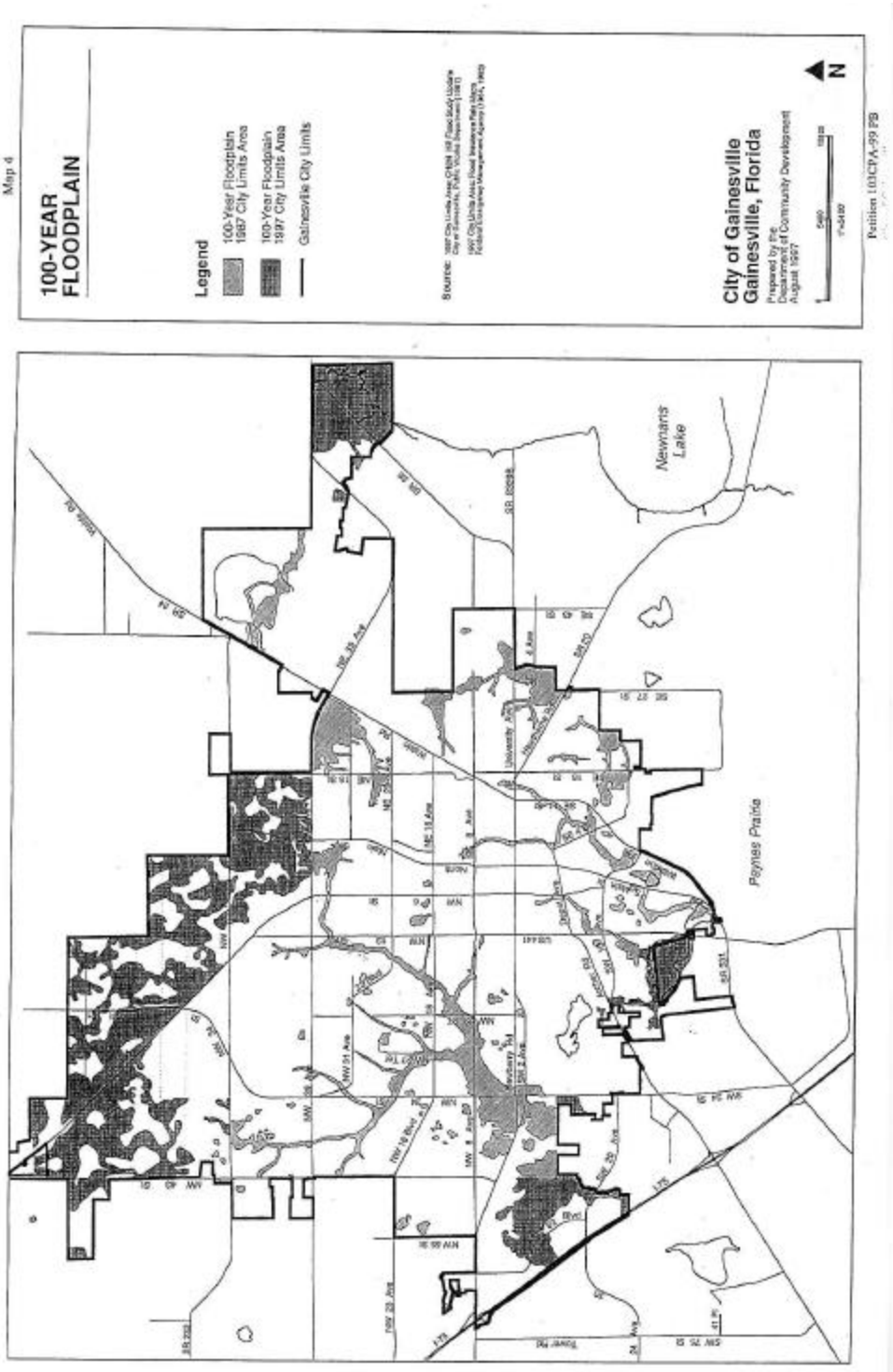
There are approximately 2,330 acres of wetlands within city limits. These wetlands are located along the floodplains of various creeks, while others exist as isolated wetlands. Isolated wetlands are natural depressions storing either surface waters or floodwaters. Trees and other wetland vegetation help slow the speed of the floodwaters, thereby preventing soil erosion. One of the most valuable functions of wetlands is the ability to maintain or improve the quality of surface waters by removing nutrients and reducing the sediment loads entering receiving water bodies. For additional discussion of wetlands, see the Conservation, Open Space and Groundwater Recharge Data and Analysis Report.

Flood Zones

A flood is a temporary inundation of land resulting from an unusual and rapid accumulation of stormwater runoff. The extent of a flood is described in terms of its frequency of occurrence.

The City regulates development in both the 10-year floodplain (flood channel) and the 100-year floodplain. The flood channel is that portion of a watercourse and any adjacent area that must remain unobstructed in order to safely discharge the stormwater runoff resulting from a 10-year 24-hour rainfall event. The floodplain has a dual function. First, it includes the necessary area for the flood channel to convey stormwater. Second, it also includes an area that temporarily stores stormwater runoff until the storm event is over and the capacity of the watercourse is no longer exceeded. A 100-year floodplain has a 1% chance of occurring or being exceeded every year. The 100-year floodplain is shown on Map 4.

Single-family subdivisions that were platted prior to September 1990 and with all subdivision infrastructure improvements made prior to September 1990, are regulated as if they are in the 100-year flood plain. This provision is designed to alleviate any hardships on property-owners resulting from revisions made to the flood elevation maps in 1990. Development on these lots will be governed by floodplain requirements with regard to minimum first floor elevation and floodproofing requirements.


Map 4
100-YEAR FLOODPLAIN
Legend
100-Year Floodplain 1987 City Limits Area
100-Year Floodplain 1997 City Limits Area
Gainesville City Limits
Source:
City of Gainesville
Gainesville, Florida
Prepared by the Department of Community Development August 1997
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Paynes Prairie

Topography

Drainage basins are delineated by topography (the relative positions and elevations of the natural or man-made features of an area that describe the configuration of its surface). Water flow occurs in basins. Topographic highs establish the divides between basins. Surface elevations in the City range from approximately 50 feet to 190 feet above mean sea level (msl).

Soils and Geology

Alachua County is part of the Central Florida Ridge within the Central Highlands of the Atlantic Coastal Plain. It has four major geological formations which have influenced soil development. They are the Ocala Group, the Hawthorn Formation, the Alachua Formation and the Plio-Pleistocene Terrace Deposits.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some soils are shallow to bedrock. Clayey or wet soils typically have poor percolation rates. Stormwater design is very dependent on soil type. For a more detailed discussion of Gainesville's soils, refer to the Conservation, Open Space and Groundwater Recharge Data and Analysis Report.

MAN-MADE DRAINAGE FEATURES

The City's stormwater management system also includes but is not limited to constructed facilities such as swales, channels, storm sewers, culverts and detention and retention facilities. These components typically perform two primary functions:

* conveyance; and
* storage

Swales, channels, culverts and storm sewers collect and convey stormwater to particular destinations such as sink holes or lakes. Detention facilities store stormwater runoff temporarily and release it slowly to natural receiving water bodies. The temporary holding allows some purification through the settling of suspended solids. Retention facilities store stormwater runoff and do not discharge directly to surface waters; instead, the runoff is released through evaporation or percolation into the ground. Some facilities perform both retention and detention functions.

STORMWATER CHARACTERISTICS

The quantity of stormwater runoff is diminished by infiltration, transpiration, evaporation, surface storage and other losses. The magnitude of these losses is a function of climate, soils, geology, topography and, most importantly, land use.

Development has four distinct yet interrelated effects on stormwater runoff:

* total runoff volume changes;
* flow rate characteristics change;
* capacity of receiving systems can be diminished; and
* water quality can be degraded.

As an area becomes urbanized, the volume and rate of runoff increase as the flow of stormwater is concentrated in shorter time periods than those produced under natural conditions. These shorter time periods are caused by increases in impervious surface area, which reduce the opportunity for infiltration, evaporation, transpiration, and depression storage. Figure 1 illustrates water balance prior to and after development. As can be seen in the illustration, surface runoff is minimized under pre-development conditions. Post-development opportunities to intercept stormwater are diminished and surface runoff is considerably increased. Pavement and buildings typically contribute almost all of the rainfall upon their surface immediately to stormwater runoff.

Figure 2 illustrates the effect impervious surfaces associated with development have on streamflow rate. Development results in higher and more rapid peak discharges and increased runoff volumes.

Figure 1 Water Balance

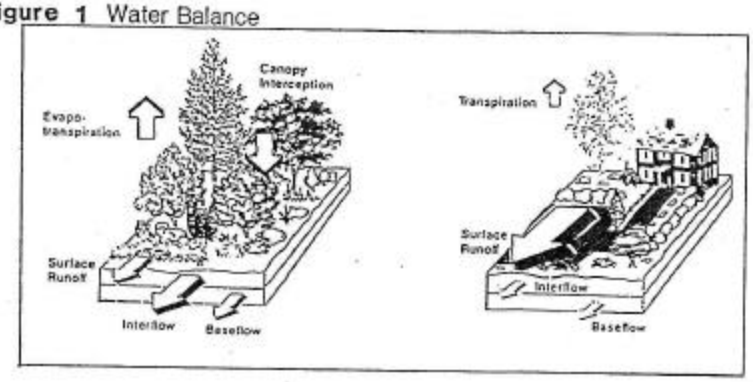

Figure 2 Streamflow

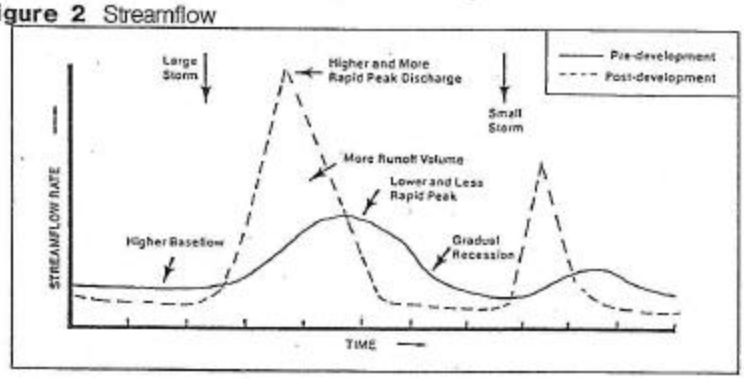

Figure 3 Response of Stream Geometry

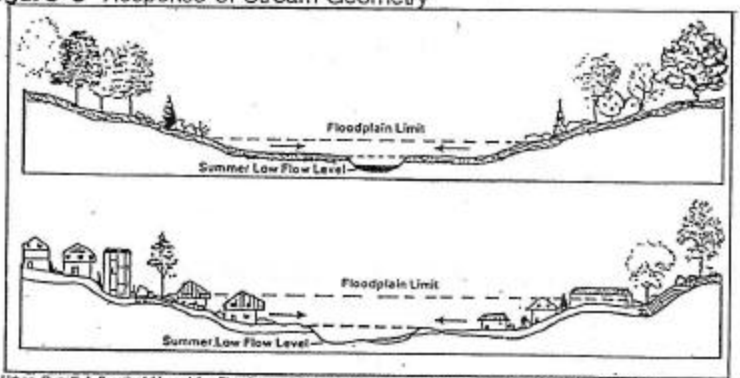

Figure 1.1 Controlling Urban Runoff: A Practical Manual for Planning and Designing Urban BMPs by Thomas R. Schueler Department of Environmental Programs Metropolitan Washington Council of Governments APR 1991

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Increased stormwater flow rates can result in the erosion of vegetative banks along a receiving watercourse. This erosion contributes to downstream accumulations of sediment and debris. Ultimately, the natural balance in the watercourse's ecosystem is disrupted resulting in less diversity of vegetation and a less reliable watercourse to carry stormwater runoff. In response to increases in flow rate and volume of stormwater runoff, flood zones associated with a watercourse increase in size. These changes in stream geometry are shown in Figure 3.

If the receiving system is a storm sewer pipe network, increased levels of stormwater runoff can exceed network capacity and cause flooding of roadways and structures.

All land use affects water quality. In undeveloped areas, many physical, chemical and biological processes interact to neutralize the effects of most of the materials found in the runoff. As urban land uses intensify, these processes are disrupted and the amount and types of potential pollutants increase. Pesticides, fertilizers, animal wastes, oil, grease and heavy metals are washed into receiving waters with stormwater runoff. Studies have shown that 90% of the pollutant load can be found in the "first flush" or approximately the first inch of stormwater runoff. Stormwater quality can be improved by treating the "first flush".

It is current practice to mitigate stormwater impacts of urbanization through the use of detention and retention facilities.

OPERATIONAL RESPONSIBILITY FOR DRAINAGE FACILITIES AND INVENTORY OF DRAINAGE FACILITIES

City-maintained Facilities

Storm Channels and Storm Drains

Maps Series A (appendix) shows major and minor channels within the creek basins previously described in Table 1. The City currently maintains approximately 70 miles of open channels and 130 miles of storm sewers (SMU, 1988: 2-7).

Retention and Detention Facilities

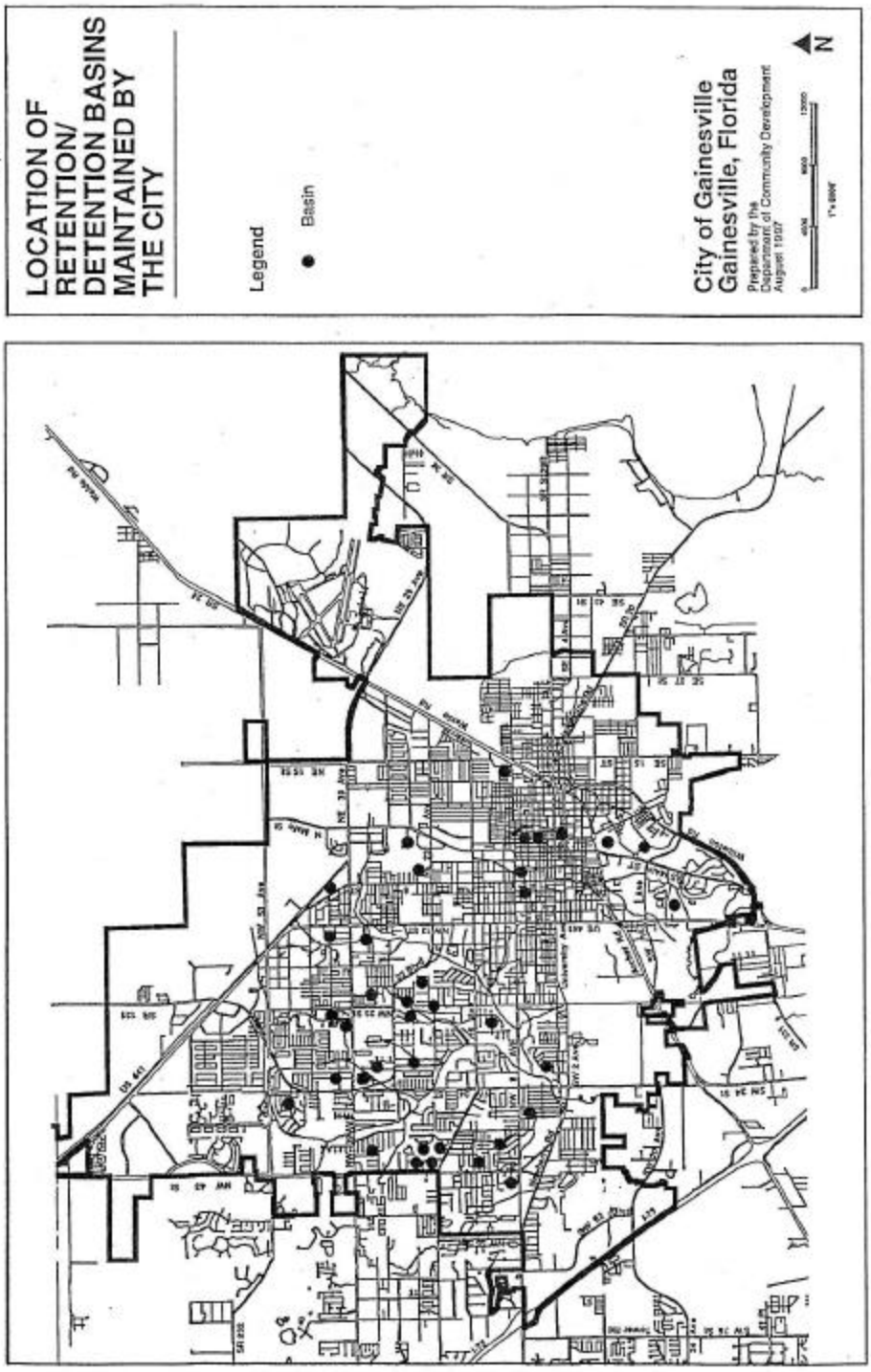
There are over 60 City-maintained detention/retention areas located in the City as shown on Map 5 and listed in Table 2. Table includes basins on City-owned property and in subdivisions with publicly accepted roadways and drainage facilities.

Table 2
RETENTION/DETENTION FACILITIES MAINTAINED BY THE CITY OF GAINESVILLE

Map 5 Key	Subdivision/Facility Name	Number of Basins per location
1.	MetroCorp	1
2.	Landmark Woods II	2
3.	Landmark Woods I	2
4.	Timberbrooke II	2
5.	Timberbrooke	2
6.	Citizen's Park	3
7.	Kirkwood West	1
8.	Coventry	3
9.	Chatworth Court	1
10.	The Valley	1
11.	Royal Gardens	1
12.	Foxgrove	1
13.	Westmoreland 4	1
14.	Raintree	6
15.	Springtree	2
16.	Willow Creek	2
17.	Palmetto Woods	1
18.	Pine Meadows	1
19	Central Park	1
20.	Renaissance	1
21.	S.E. 2nd St, 1100 Block	1
22.	Sandhill	1
23.	Hamilton Park	1
24.	Pine Breeze	1
25.	Cedar Creek	1
26.	Hidden Oaks	1
27.	Pebble Creek	1
28.	Wood Creek	1
29.	Foxfield	1
30.	Hancock Village	2
31.	Xanadu	1
32.	Foxcroft Manor (swales and rear yard)	1
33.	Hermitage	5
34.	Hibiscus Park	2
35.	Thomas Center	1
36.	Police Station	1
37.	Parking Lot 21	1
38.	Parking Lot 9	1
39.	Regional Transit System	1
	Total	61

Source: CH2M Hill, Stormwater Management Utility Program, Phase I Report, May 1988.

Map 5



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Major Culverts

There are 90 major culverts within the City as of 1992. Map Series B (see appendix) shows the culvert locations in each creek basin.

Roadway Drainage Facilities

There are approximately 680 lane miles of street surface within the City. Approximately 430 lane miles have drainage facilities, typically curb and gutter or swales, associated with them. Semi-paved roadways are shown by Map Series C (see appendix) to have deficient drainage systems associated with them.

University of Florida, State and County-Maintained Facilities

The University of Florida maintains all stormwater management systems on the main campus (see Map 3). The Lake Alice Basin consists of an 83-acre lake and 976 acres of tributary land. Lake Alice is a depression basin, with no outflow into the City system (CH2M Hill, 1987).

The Florida Department of Transportation maintains the drainage facilities which serve the State Highway System and Alachua County maintains those drainage facilities serving county-maintained roads (see Map 6).

Privately-Maintained Facilities

City development regulations have required on-site retention/detention facilities since the mid-1970s to manage stormwater. Stormwater management improvements must be completed prior to occupancy. Property owners are responsible for the proper maintenance of these stormwater improvements.

City-Maintained Facilities In Other Jurisdictions

The City of Gainesville does not operate or maintain any stormwater management facilities outside of city limits.

Shared Facilities

The City does not operate any joint stormwater facilities with other jurisdictions. However, since stormwater is directed to natural drainage basins, the basins are shared with Alachua County to the extent they extend beyond the city limits.

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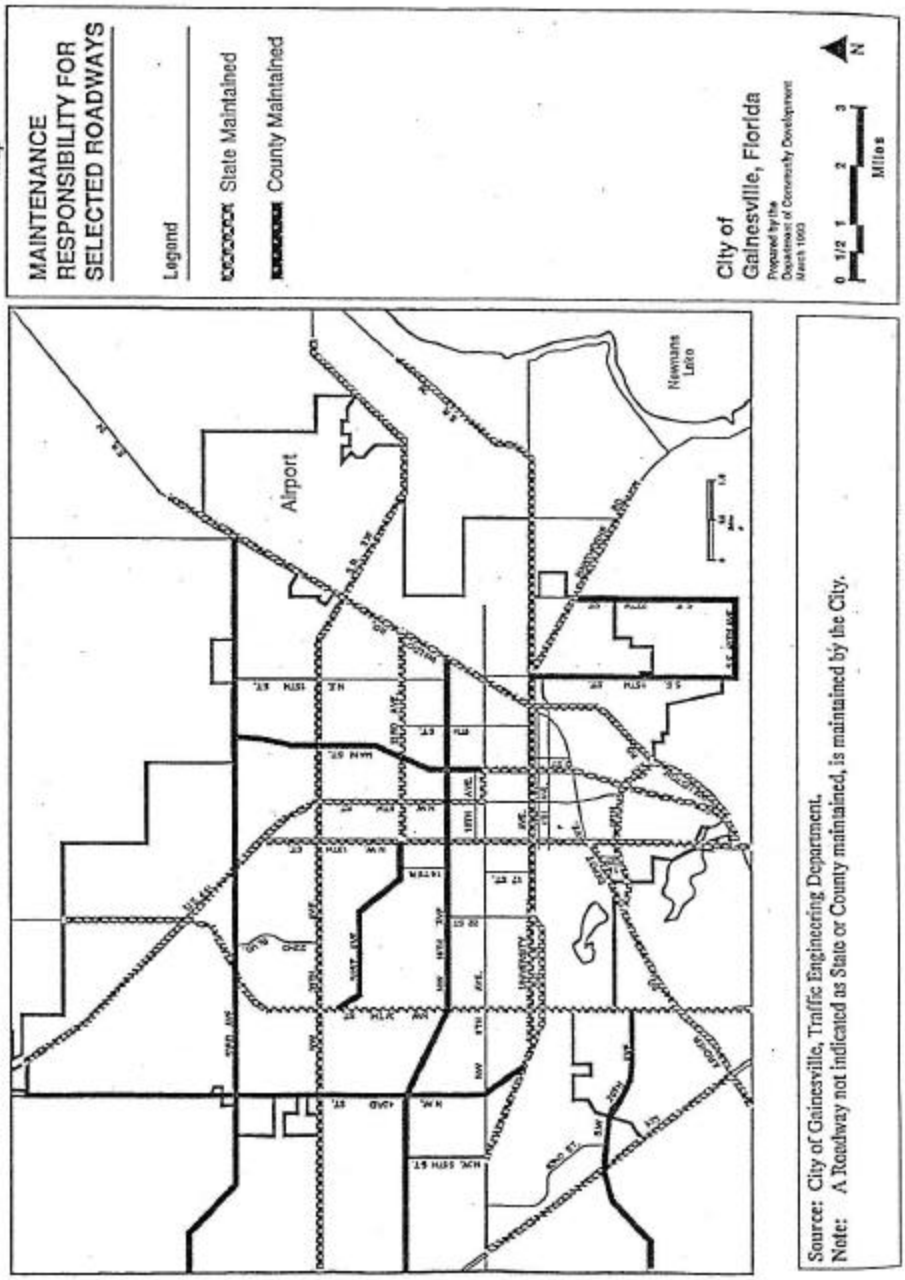
Map 6



Impact of Drainage Facilities Upon Natural Resources

All stormwater drainage in Gainesville flows into surface waters (creeks, lakes and wetlands) or depression basins. All surface waters in Gainesville, except for certain localized sites such as the Hogtown Creek in the vicinity of the Cabot/Koppers Superfund site, have been designated as "Class III" (suitable for recreation, propagation, and management of fish and wildlife) waters by the Florida Department of Environmental Regulation (DER) (Chapter 17-302, FAC).

Paynes Prairie State Preserve is the natural resource most affected by stormwater runoff. Sweetwater Branch, flowing into the prairie, serves the oldest parts of Gainesville, and therefore has the fewest stormwater treatment facilities. Much of the creek is channelized, which causes increased velocity during storm events. This leads to greater erosion and sedimentation, and increased nutrient loads in the prairie. The Stormwater Management Utility's work program (see section below on Stormwater Management Utility program) includes a study of each drainage basin in the system. Draft studies have been prepared for each stormwater basin except those annexed since 1991. The study of Sweetwater Branch is expected to provide alternative solutions to remediate the existing problems. Other solutions include enhancement of the City's street-sweeping program and improved maintenance capabilities since adoption of the Stormwater Management Utility.

IDENTIFICATION AND ASSESSMENT OF EXISTING PROGRAMS AND REGULATIONS

PROGRAM IDENTIFICATION AND ASSESSMENT

Stormwater Management Utility Program

Pursuant to Section 408.0893, Florida Statutes, a Stormwater Management Utility (SMU), was created by ordinance in 1988 to fund stormwater management services in the City of Gainesville. This utility provides a dedicated funding source for both operational and capital costs related to stormwater management. Fees are charged based on the amount of impervious surface that properties have. Non-residential properties are granted an on-site retention facility SMU fee credit if retention facilities are included in their site design. The fee applies to all public and private lands within the City which use or discharge into the City's stormwater management system. The Stormwater Management Utility is wholly owned by the City of Gainesville, and is only operative within its boundaries.

All revenues are used for stormwater management purposes. Currently, revenues are primarily spent on system maintenance and repairs. A small amount of the revenues are being used for assessing facility needs in one or two basins. The need for additional funding and associated long-term planning will be identified in the 5-year Stormwater Improvement Plan (SIP) for the utility.

Operation and Maintenance Program

An operation and maintenance program to maintain channels and structures is an integral part of the City's stormwater management program. The components of this program include mowing, street sweeping, open channel maintenance, and closed watercourse maintenance.

Mowing

The mowing associated with stormwater management achieves different ends with different facilities. Mowing in open channels maximizes the volume and speed of the water flowing through the channel, while mowing in detention/retention basins keeps the basins from being a public health or safety hazard for the neighborhood or area it serves. The City mows approximately 60 detention/retention basins two-to-three times a year and approximately 70 miles of open channels from twice a year to once every two years.

Street sweeping

Street sweeping has two purposes. The first is to remove litter that might clog drainage facilities, and the second is to remove sediments on the street and prevent them from being flushed into the natural systems.

Currently, downtown areas are scheduled for street sweeping twice per week, collector and arterial routes are swept every one to two weeks, and curbed residential streets every four to six weeks.

Open Channel Maintenance

There are approximately 70 miles of open channels in the City. Maintenance activities focus on keeping the capacity of the channel at its historical levels. This is achieved by removal of obstructions, mowing the vegetation and keeping the bottom of the channel level. These actions keep the channel clear so stormwater can flow with minimum resistance to its destination.

Storm Sewers (Closed Watercourses) and Culverts

This maintenance activity restores the flow capacity of inlets and underground piping. Age and exposure to physical impacts deteriorate these facilities. The Maintenance Division of the Public Works Department replaces those elements identified as critical through its inspection or trouble call processes. These are replaced or repaired as necessary.

REGULATION IDENTIFICATION AND ASSESSMENT

City Code General

The City has numerous regulatory requirements regarding stormwater management and flood control. The requirements were organized and incorporated into Chapter 30, the Land Development Code under Article VIII, Environmental Management. Also, the Public Works Design Manual was adopted by resolution in June of 1992. It includes guidelines for the design and operation of facilities that discourage the breeding of mosquitoes. Maintenance plans for stormwater management facilities are required as part of the development plan approval process. The plan must specify regular maintenance procedures for which the property owner is responsible. The City will periodically inspect stormwater control facilities and shall inspect these facilities upon complaint to determine that such facilities are operating and being maintained as designed.

City of Gainesville Ordinances

Chapter 30 Land Development Code
Article VIII Environmental Management
Division 3. Environmental Overlays
Subdivision II. Flood Control District

Purpose**:** To minimize public and private losses due to flooding.

Applies to: property subject to development plan approval by the City Plan Board and Development Review Board, platting, and all lands located within regulatory flood zones.

Rate Control

The Petitioner must provide calculations demonstrating that the rate of stormwater runoff from the property will be no greater for the design storm after the development than prior to development.

Flood Zone Development

Flood Channel Districts: Flood channels are the geographic area inundated as a result of a ten-year storm event. Construction of any permanent structures is prohibited in the flood channel with very limited exceptions.

Flood Plain Districts: Floodplains are the geographic areas inundated as a result of accumulation of runoff of surface waters from a 100-year storm event. The City will permit construction of structures meeting specific requirements in a floodplain. Structures may not reduce the storage capacity of a floodplain.

The ordinance is very specific about what activities are permitted or prohibited in the designated flood zones. It also includes stormwater management design criteria (City) and floodplain development criteria (City and Federal Emergency Management Agency) that typically provide for local retention, detention and treatment of stormwater generated as a result of development. These guidelines include the preparation of maintenance plans for the stormwater facilities and specify regular maintenance procedures to be followed by the owners.

Subdivision III. Surface Waters and Wetlands District

Purpose: To protect the significant natural communities associated with certain creek systems, regulated lakes and wetlands.

Applies to: All development of land, including single-family residences.

Requirements: No development is permitted within 35 feet of the centerline of any regulated creek, or within 35 feet of a regulated lake or wetland. Between 35 and 150 feet, there is a presumption that development is detrimental to the regulated creek unless demonstrated otherwise.

This section of the Land Development Code is very stringent regarding the need for sedimentation control measures during development. Development is defined as the disturbance of vegetation. This means that smaller projects including single-family home construction as well as larger projects, must be evaluated to determine impacts upon regulated surface water systems and wetlands.

Division 2. Landscape and Tree Management, Stormwater Management and Water/Wastewater Connection Policies
Subdivision II. Stormwater Management
Sec. 30-270(b)(2)f. Design standards for the subdivision of property.

Purpose: To ensure that adequate and necessary physical improvements of lasting quality and requiring minimum maintenance are installed; to prevent periodic or seasonal flooding.

Applies to: All subdivision of land within the City (except minor subdivisions and lot splits).

Requirements: A complete stormwater management system plan, in accordance with the flood control provisions of this article and with the design manual of the Public Works Department must be prepared. Specific requirements include:

1. A system of inlets and pipes must be provided to collect and direct stormwater during a ten-year 24-hour storm event. Public roads may be used to convey stormwater if unimpeded use of public roads during a ten-year 24-hour storm event is possible.

2. A route for stormwater runoff must be provided so as to prevent flooding and ensure access for emergency vehicles during a ten-year 24-hour storm event.

3. A detention/retention system must be provided which will permit a controlled outlet to receiving watercourses. The system shall be designed so that the rate of stormwater runoff is no greater after the development than before the land was developed, based on a 100-year critical duration storm event.

Current policies associated with the public acceptance of stormwater management basins for perpetual maintenance are based primarily on the City's ability to adequately, efficiently and economically complete periodic maintenance.

Article VII. Development Review Process
Division 1. Development Review Process
Sec. 30-160. Submittal Requirements

Purpose: To protect the character and maintain the stability of residential, commercial and industrial areas.

Applies to: Multi-family of five or more units or two or more buildings, office, most business and industrial sites.

Requirements:

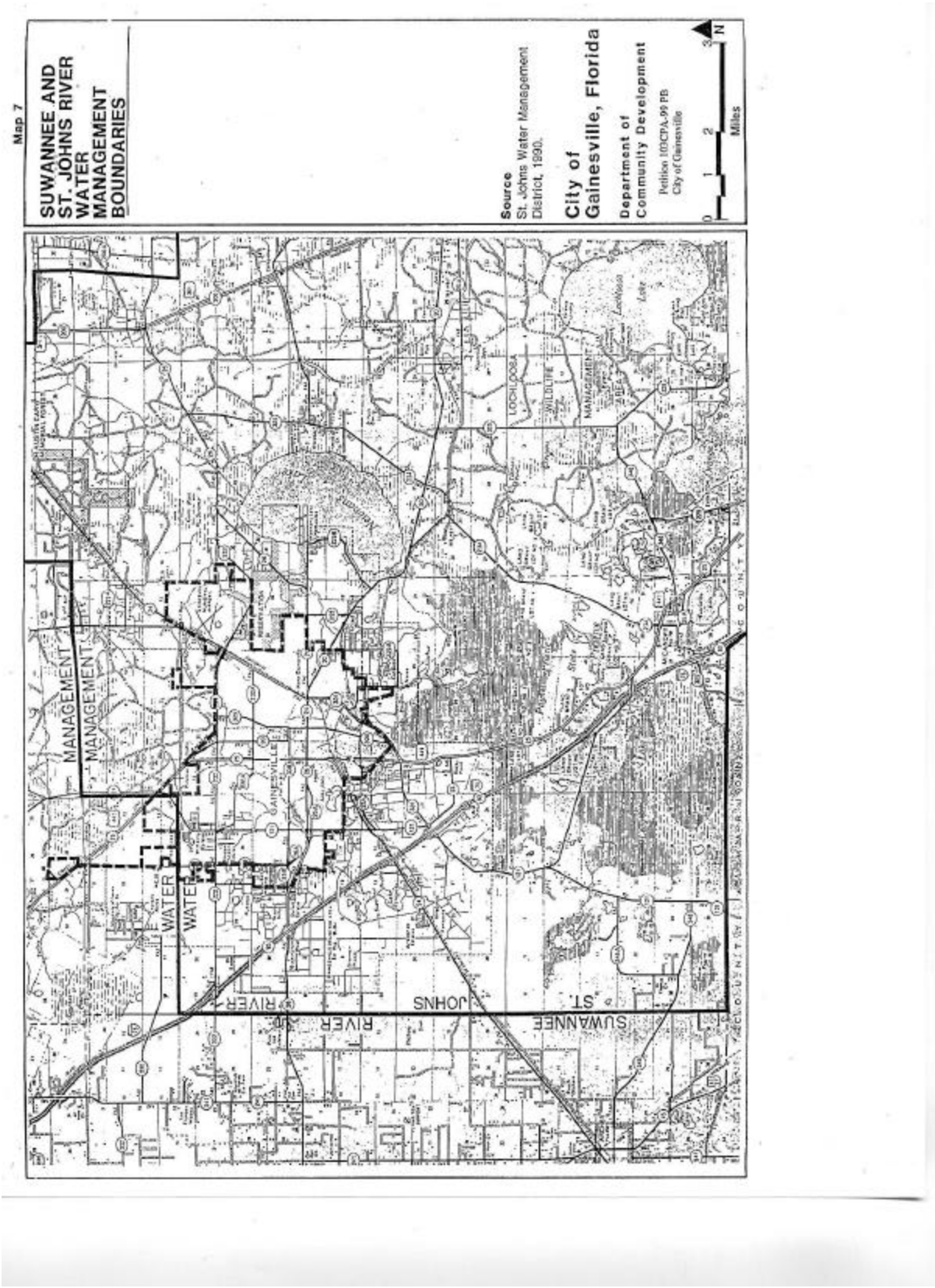
A preliminary stormwater management plan in accordance with Article VIII:

a. Show generalized soil types.
b. Graphically show existing topography in one-foot contours and direction of flow.
c. Graphically show any existing drainage control features, and all natural or manmade water bodies.
d. Note depth of the high water table.
e. Graphically show location, note area and dimensions of proposed drainage/retention basins and swales including proposed depth and elevation of basin bottom and shoulder, elevation of all control structures and all preliminary calculations.

f. Graphically show all easements.
g. Provide documentation if joint facility or master plan facility is to be utilized.
h. Graphically show proposed grading
i. Note proposed roof drainage control system.
j. Name, address and registration number of engineer or landscape architect who prepared preliminary stormwater management plan.
k. Sedimentation and erosion control plan: 1. During construction; and 2. Plan for erosion and sedimentation control over the life of the stormwater facilities.
l. List any permits required by the county, the applicable water management district, and any state agency.

A final stormwater management plan, in accordance with Article VIII, signed and sealed by a professional engineer registered in the State of Florida:

a. Data, method of analysis and explanation of assumptions for final stormwater management plan and stormwater management utility summary sheet.
b. Results of soil borings, if determined necessary by public works department.
c. Typical sections and details of all stormwater management control facilities; construction specifications, complete construction notes.
d. Grading and paving plan, including complete notes and construction specifications.
e. Final sedimentation and erosion control plan: 1. During construction; and 2. Plan for erosion and sedimentation control over the life of the stormwater facilities.
f. Status report on any permits required by the county, the applicable water management district and any state agency.
g. Maintenance plan for stormwater management facilities specifying regular maintenance procedures for which the property owner shall be responsible.


Map 7
SUWANNEE AND ST. JOHNS RIVER WATER MANAGEMENT BOUNDARIES
Source
St. Johns Water Management District, 1990.
City of Gainesville, Florida
Department of Community Development
Petition 103CPA-99 PB
City of Gainesville
0
1
2
3
Miles
N
MANAGEMENT
WATER
RIVER
JOHNS
ST.
SUWANNEE
GAINESVILLE
LOCHLOOSA
WILDLIFE
MANAGEMENT
AREA

Water Management District Regulations

Nearly all of the City is under the jurisdiction of the St. Johns River Water Management District (see map 7). A small portion of the City, in the vicinity of the Northwood subdivision near the northwest city limits, is in the Santa Fe River Basin under the management of the Suwannee River Water Management District.

St. Johns River Water Management District

The SJRWMD has implemented three sets of rules to regulate systems which manage and store surface waters:

40C-4, F.A.C., Management and Storage of Surface Waters
40C-40, F.A.C., General Surface Water Permits
40C-41, F.A.C., Surface Water Management Basin Criteria

The Rule relating to the regulation of stormwater discharge is 40C-42, F.A.C.

Suwannee River Water Management District

SRWMD has implemented the following rules governing surface water management systems:

40B-4.2010, F.A.C., General Surfacewater Management Permits
40B-4.2020, F.A.C., Content of Surfacewater Management Permit Applications
40B-4.2030, F.A.C., Conditions for Issuance of Surfacewater Management Permits
40B-4.2035, F.A.C., Minimum Operation and Maintenance Entity Requirements
40B-4.2040, F.A.C., Minimum Operation and Maintenance Standards.

Florida Department of Environmental Regulation

Permits are required from the Florida Department of Environmental Regulation for certain dredge and fill activities relating to State waters, unless the activity is permitted by the St. Johns River or Suwannee River water management districts.

NEEDS ANALYSIS

DESIGN CAPACITY AND DEMAND

Stormwater management is unique among utility services in that the demand for service is not based directly on population projections. Instead, it is estimated on the basis of historical storm events and the amount of impervious surface added during development. Minimum levels of service for stormwater quantity and quality are dictated by state mandates. Because these mandates are intended to restrict post-development rates of stormwater discharge to pre-development rates for the design storm, further development during the planning period should not reduce the capacity of the City's existing system to handle the design storm. Current deficiencies will require additional study and revenues to correct. They are not anticipated to be completely remedied during the 2000-2010 planning period.

Water Quantity

The City, with County participation, updated its Master Flood Control Planning Maps in 1990. These maps identify flood zone limits and rates of runoff for 10-, 25- and 100-year 24-hour storm events for the primary stormwater management systems in the City. The Flood Study Update[1] incorporated creek and open channel cross sections, as well as structure and land use data in its analysis. It also addressed major creek watersheds and 150 depression basins. The Flood Study Update found that floodplain limits and stormwater discharge rates had increased over those determined in an earlier study. The most significant reason for this increase was the soils information used. The earlier study, completed by Sverdrup and Parcel in 1974, had very limited soil information, as was noted in that study. The Flood Study Update incorporated data from the 1985 Soil Survey of Alachua County by the Soil Conservation Service. The major disparity in the soils data was that the earlier data assumed much more absorptive sandy soils than actually exist in basins draining through Gainesville. Hence, the runoff models predicted more stormwater than in the 1974 study. Increased flood zone elevations were consequently established.

Capacity

The City of Gainesville's stormwater management system is dependent on the natural creek network for a positive outfall (see geographic service area of each basin in Map 2). The City's Flood Study Update predicts the hypothetical impact of the 10-year and 100-year flood events on those

[1] Flood Study Update refers to a series of reports prepared by CH2M Hill which resulted in the Master Flood Control Planning Maps adopted in 1990.

systems. This information, when presented on the Master Flood Control Planning Maps define the extent of the 10-year and 100-year events. This information is useful for two purposes: 1) preserving basin capacity and 2) identifying potential threats to human life and property.

Preserving capacity for each basin is accomplished by evaluating the impact of development proposals on the flood channel (defined by the 10-year event) and flood plain (defined by the 100-year event) portions of the property. The criterion of no development within the flood channel preserves the flow capacity of the basin. The additional criterion of maintaining all flood storage within the flood plain preserves all storage capacity within a basin.

The capacity of each basin was determined by identifying the existing flood channel and floodplain elevations and the 10-year projected elevations at specific stations along each creek. (The flow and elevations both existing and future are given by creek basin in Appendix B.) As can be seen by reviewing the projected elevations (data shown in Appendix B) only minimal changes from the existing condition are expected. The system is adequate for the five-year and ten-year planning period. The study assumed full development of existing platted lots and minor increases in impervious area (200 square feet) on existing developed lots. The changes in projected flood channel elevations and floodplain elevations are minimal due in large part to the fact that the City is 83% built-out (Future Land Use Element, Data and Analysis 1991-2001 Comprehensive Plan), and therefore most lots already contain significant impervious surface area.

Additionally, major redevelopment of existing developed areas that were developed prior to current stormwater management regulations results in improvement to basin capacity. This improvement occurs because the new development must provide on-site storage of a portion of the stormwater, except in cases of redevelopment in the downtown area where an alternative means of stormwater treatment is allowed. With on-site storage an incremental amount of flow is taken out of flow and the basin capacity is not decreased.

Of the ten drainage basins in the City, only the Hogtown basin has existing capacity problems. A remedy developed to offset development impacts was implemented by a policy initiative in 1988. This policy limits the volume as well as the rate of runoff for the 100-year critical duration storm event. In the Hogtown basin no increase in volume from the pre-development condition is permitted to be released prior to 72 hours after the design storm event. Flooding in the basin has not been observed to have increased. This is due to the fact that the majority of basin has already been developed and more stringent development requirements have been implemented. A study conducted by CH2M Hill determined the most effective and feasible location for a regional stormwater basin within this basin. A regional basin is expected to greatly alleviate existing flooding problems. In addition to this study, work was completed to improve a berm located between the Sugarfoot Prairie and the Anglewood Subdivision to reduce the overflow of floodwater from the prairie into the neighborhood.

Water Quality

Regulatory requirements relating to water quality were not implemented in the Gainesville area until 1981. Development prior to that time generally did not incorporate water quality treatment features in the design of stormwater management facilities. There are known contributors of pollutant loading into the City's stormwater system such as the Cabot-Carbon/Koppers Superfund Site (see the 2000-2010 Solid Waste Data and Analysis Report). Since a majority of the City's drainage system eventually discharges to the Floridan aquifer, it would be reasonable to conclude that the current systems should not receive additional pollutant loadings. Any reduction in such pollutant loading would benefit the creek ecosystems and the public health, safety and welfare.

LEVEL OF SERVICE (LOS) METHODOLOGY AND STANDARD

Design Storm

A design storm is a model rainfall event that can be used as a yardstick to quantify runoff rates and volumes and is one of the most important factors in stormwater master planning. The design storm concept is developed using historical data from previous rain storms. The parameters that define a particular design storm include frequency and duration. The selection of a storm event for application in stormwater management facility design must balance the subsequent cost to develop against the resulting increase in flood hazard within a community.

Design Storm Frequency

The City of Gainesville uses the 100-year critical duration storm for the design of stormwater management facilities to ensure that the flood zone elevations defined by the Flood Study Update are not adversely impacted.

Level of Service Standard

The Flood Study Update defines the level of service standard required to maintain floodplain storage and conveyance capacities. Development occurring in the City has been designed so that the post-development rate of discharge for the site cannot exceed the pre-development rate. However, the proposed adoption of the 100-year critical duration storm event as the design storm allows the City to be more consistent with the no net increase in the 100-year floodplain criteria. Minimum first floor elevation standards are also recommended. Only sites that are subject to creek regulation and the water management districts are designed to incorporate additional water quality requirements. These standards require treatment of the first one-half inch of runoff. The level of service standard for stormwater quality should be treatment of the first inch of runoff due to the stream-to-sink characteristics of most of the basins as is now reflected in Policy 1.1.1. Developments completed prior to 1974 do not meet current standards for water quantity and those completed prior to 1981 do not meet current standards for water quality.

NEEDS ASSESSMENT

Hogtown Creek

From a water quality standpoint, the Creek appears to be within acceptable standards for urban surface waters except at the upstream end of the main branch, near N. Main Street. At that location, pollutants from the Cabot-Carbon/Koppers Superfund site (see the Conservation, Open Space and Groundwater Recharge Data and Analysis Report) leach into the Creek. This effect appears to diminish within approximately two miles downstream.

Since 1981, the State, under provisions of Florida Administrative Code Chapter 17-25, has required that all new development treat its "first flush" of runoff for water quality. Therefore, further degradation of water quality has not been as likely since 1981.

Temporary flooding is experienced in many areas within the Hogtown Creek Basin. Flooding occurs when the inlet capacity of Haile Sink is exceeded and/or the available storage for stormwater is filled with transient flows.

Tumblin Creek

The upper basin collects stormwater primarily from residential and commercial development. The watershed becomes predominantly residential as it continues southward. The majority of development within this basin occurred prior to the implementation of any stormwater quality and quantity regulation. Although there is minimal localized flooding along this creek, erosion is a concern due to high water flow rates.

Sweetwater Branch

The area drained by Sweetwater Branch is highly urbanized and most of the development within it occurred prior to the implementation of stormwater quality and quantity regulations. Sweetwater discharges into Alachua Sink via an open channel. Water quality with respect to sediment, debris and pollutants is consequently much more critical for this creek, since only minimal wetland treatment occurs in its open channel.

Calf Pond, Lake Forest and Little Hatchet

Development within these basins occurred prior to stormwater quality and quantity regulations. Flooding is localized and minimal.

Depression Basins

Each depression basin within the City has its own unique drainage characteristics. Most development around the depression basins occurred prior to stormwater quantity and quality

regulations. Increased sediment loadings during and after construction are suspected as a reason some of the basins do not perform as they once did.

GENERAL PERFORMANCE OF EXISTING FACILITIES

Virtually all of Gainesville is served by some form of drainage system. Replacement of aging and inadequate systems is a greater concern than construction of any new systems (Swearingen, 1987, p. 4). Every area of the City has needs for improved stormwater management facilities, however most of Gainesville's critical drainage system improvement needs are in the older areas of the City, i.e., those areas developed more than twenty years ago, prior to requirements for on-site retention (Swearingen, 1987, p.5).

The cumulative effect of past practices is that existing stormwater management facilities do not have adequate capacity to accommodate the 100-year critical duration storm city-wide and are not capable of providing significant water quality treatment.

System function also may be impaired due to inadequate maintenance. For instance, the capacity of stormwater systems can be reduced by leaves and yard debris introduced through roadway drainage systems. The Stormwater Management Utility has made it possible for the City to increase its street-sweeping activities to address this concern. Increased maintenance levels for open channels have also been realized, which in turn, increases system capacity.

The performance of stormwater management facilities is typically assessed in relation to water quantity and quality problems that result from the failure or inadequacy of individual components. The Public Works Department has conducted a preliminary survey of the City's stormwater management systems and has identified existing stormwater management deficiencies (listed in Appendix C.). These deficiencies include both maintenance and capital needs. As a result many can be addressed through the maintenance programs of the Stormwater Management Utility. Capital items have been prioritized. Level of Service Capital Improvements are shown for funding in the 5-Year Schedule of Capital Improvements. The non-Level of Service Capital Improvements that have been prioritized for action between 1999-2003 will be funded if funds become available (see the Capital Improvements Data and Analysis Report Level 2 Capital Improvement Needs).

Projected Capital Improvements

1. Northeast Boulevard/Duck Pond Improvements. Located between NE 10th Avenue and NE 5th Avenue. Estimated cost $400,000;

   The purpose of this proposal is to rebuild the Duck Pond into a free-flowing stream by removing the concrete banks around the stream, allowing it to become free flowing, while planting nutrient removing vegetation along the banks. A system of alternating ponds/wetlands and stream segments would be created to improve water

management, while improvements on the boulevard, including traffic control devices, would also be part of the project.

2. Brownfield Project. Located south of Depot Avenue. Estimated cost $2,000,000;

   This project would involve using a brownfield site for a master stormwater basin for the downtown area. This would allow further redevelopment and revitalization of the downtown area at higher densities and intensities. This will encourage compact development and allow a more urban-type development and design pattern. It would reduce redevelopment costs at individual sites, increase intensity of use on each parcel, and provide a possible recreational amenity in the area.

3. Sweetwater Branch-Paynes Prairie Outfall Facilities. Located on Sweetwater Branch at Paynes Prairie. Estimated cost $2,000,000;

   This is a proposal to build a treatment system to improve the quality of water flowing onto Paynes Prairie from Sweetwater Branch creek. Water from the creek flows across the prairie into Alachua Sink and the Floridan Aquifer. Trash from the creek dumps out onto the north side of the prairie and the creek flow is also blamed for the loss of open marsh to dense vegetation. A treatment system would include a retention pond to catch the litter and sediment and a constructed marsh to remove nutrients.

4. Hogtown Creek Sediment Project. Located at N.W. 34th Street and Hogtown Creek. Estimated construction cost $750,000.

   Construct sedimentation control facilities to reduce the amount of sediment that collects at this location. This will help to reduce the incidences of flooding in the area.

PROBLEMS AND OPPORTUNITIES

Basin-Wide Planning

The data in the Flood Study Update provide a foundation for the development of a comprehensive city-wide stormwater management program. In order to implement such a program, the City will need to complete master stormwater basin plans for each stream basin. The basin-wide management approach will provide the necessary data base for optimizing the planning, design and implementation of stormwater management facilities. These studies will identify areas that could be used for regional stormwater management facilities for water quantity or quality purposes, or both. In addition, a high priority task for the Stormwater Management Element is development of baseline data and an inventory of stormwater facilities in the annexed areas of the City. Since annexation, existing problems have been addressed by special studies.

The basin-wide studies should proceed in phases. As the basin-wide studies and plans are completed, proposed improvements and implementation techniques should be scheduled to begin. The Stormwater Management Utility is the funding source for these engineering studies. Plans are currently being developed.

Regulations

Preservation and protection of existing drainage features has been implemented through regulation. The City's current stormwater management regulations mandate that the City will maintain the existing level of wetland acreage and their function. The City will need to evaluate the wetland protection strategies to determine if 'no net loss of wetlands' remains an appropriate strategy or whether a format for evaluation of wetlands can be developed that would allow greater flexibility in wetland mitigation.

The City also may want to review the water quality standards of the water management districts which regulate the City to determine if one set of criteria would be more applicable to stream-to-sink systems. The application of water quality standards to existing developed sites being modified would be another consideration.

Proposed Amendments to Stormwater Management Element Policies:

1. The LOS standard needs to be amended to adopt the 100-year, critical duration design storm;

2. The Master Flood Control Planning Maps need to be updated to include all annexed areas;

3. The City should complete an inventory of all city-maintained retention/detention basins;

4. The City should complete an inventory of all channels and culverts in the annexed area;

5. The City should evaluate and update roadway drainage data; and

6. The City should finalize the master stormwater basin plans which are now only completed in draft form, and prepare stormwater basin plans for those basins that were annexed.

7. The City should prepare a 5-year Stormwater Improvement Plan (SIP). Associated with this planning document the City should develop a prioritization

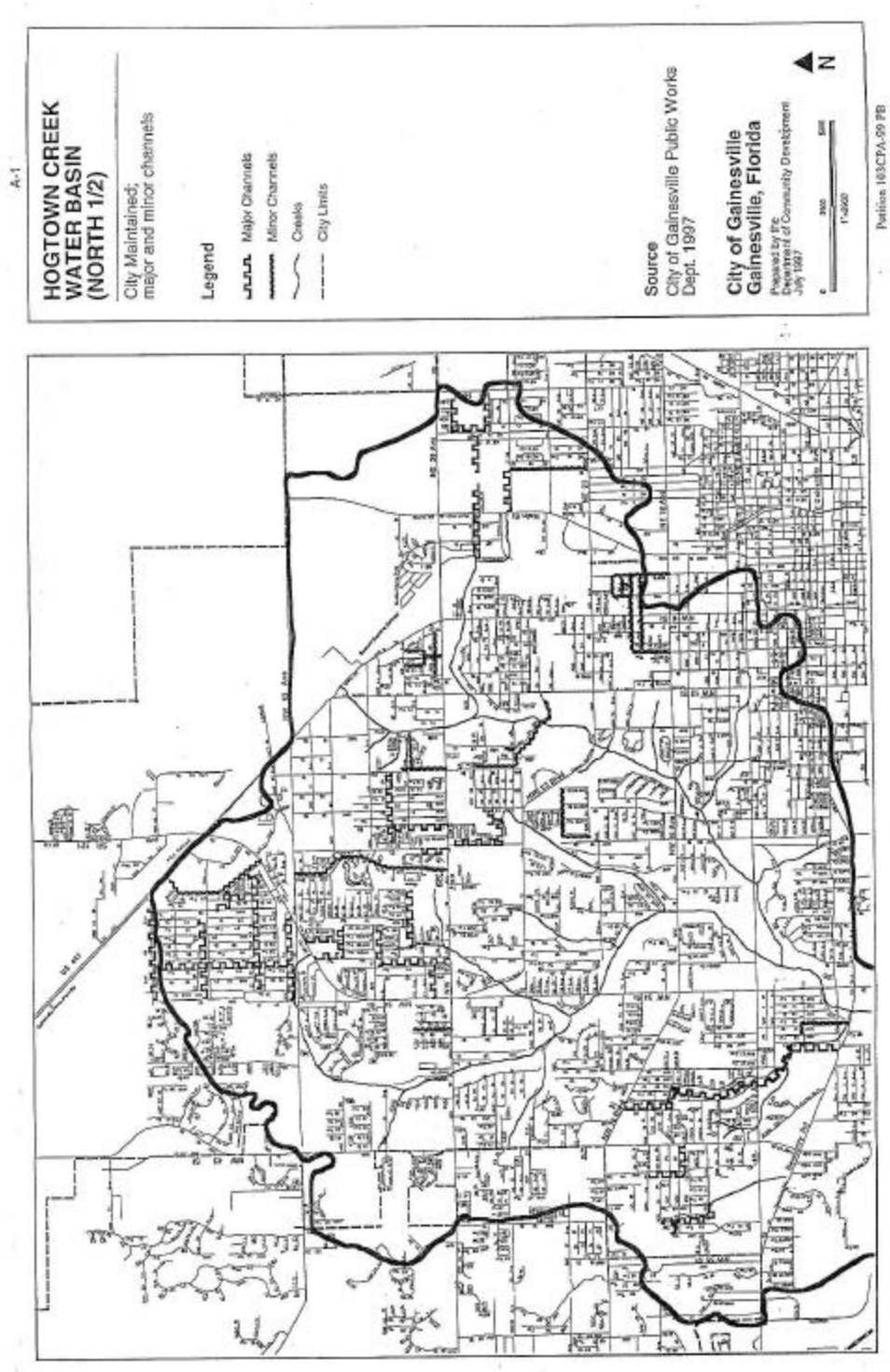
methodology that will rank projects on the Stormwater Improvement Needs list for inclusion in the SIP.

8. The City should adopt a policy regarding stormwater management that would allow for the redevelopment of the downtown core and Central City area, which currently lacks adequate stormwater management facilities.

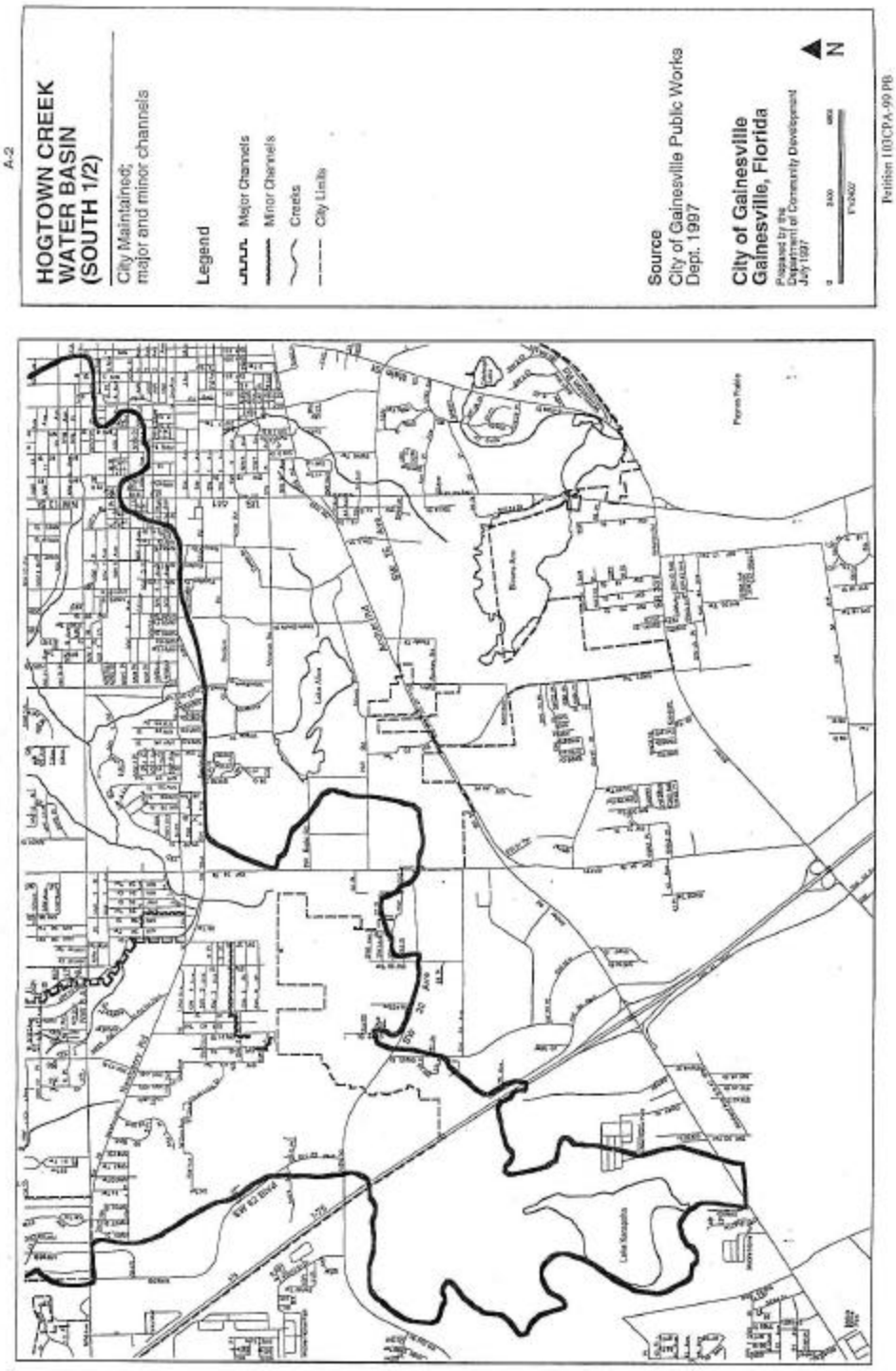
Appendix A

Map Series

Channels and Creeks—Map Series A
Culvert Crossings—Map Series B
Semi-paved Roadways—Map Series C


A-1
HOGTOWN CREEK
WATER BASIN
(NORTH 1/2)
City Maintained;
major and minor channels
Legend
Major Channels
Minor Channels
Creeks
City Limits
Source
City of Gainesville Public Works
Dept. 1997
City of Gainesville
Gainesville, Florida
Prepared by the
Department of Community Development
July 1997
N
Petition 103CPA-99 PB
City of Gainesville

A-2


HOGTOWN CREEK
WATER BASIN
(SOUTH 1/2)
City Maintained;
major and minor channels
Legend
Major Channels
Minor Channels
Creeks
City Limits
Source
City of Gainesville Public Works
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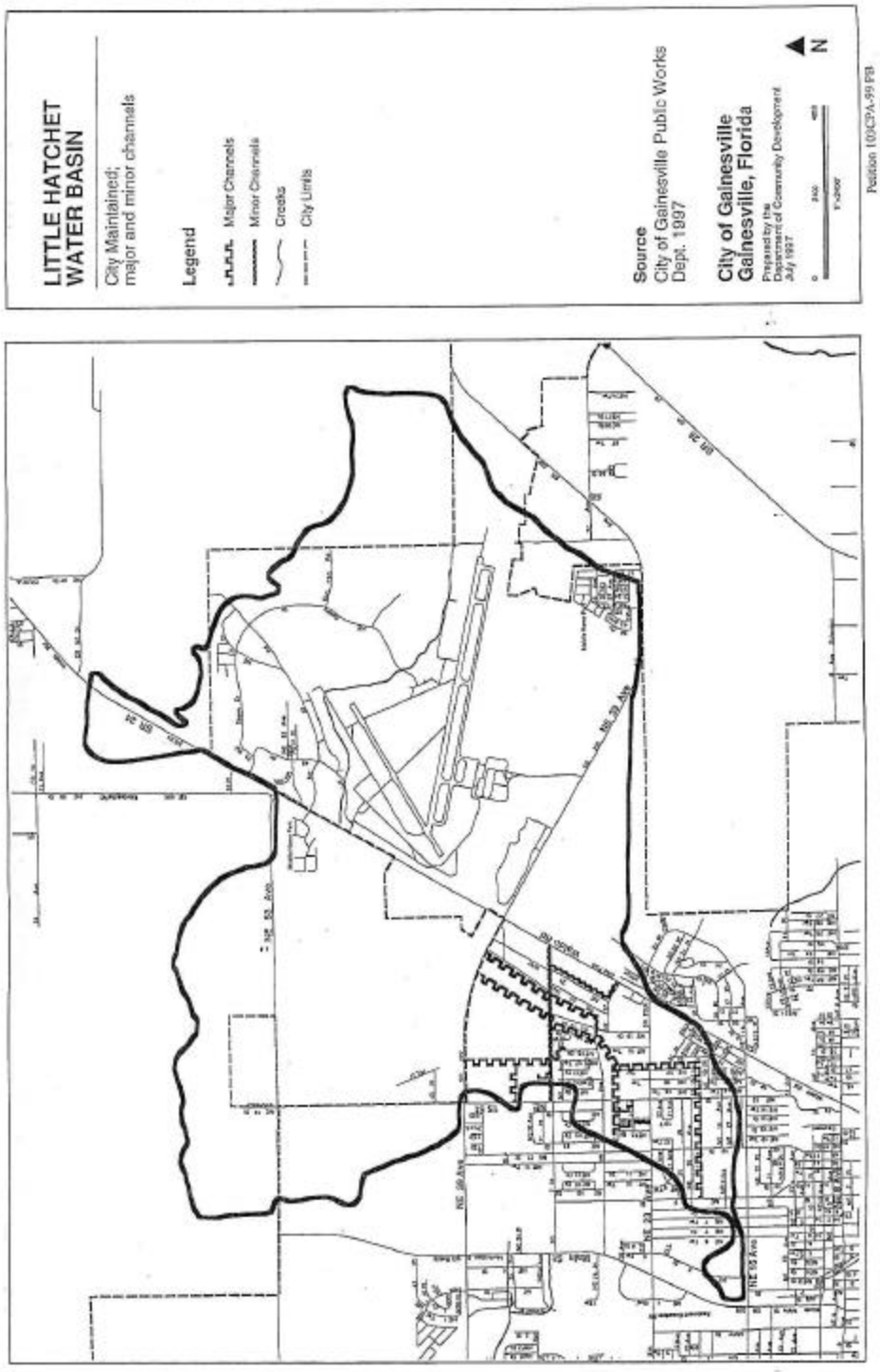
City of Gainesville
Gainesville, Florida
Prepared by the
Department of Community Development
July 1997
N
Petition 103CPA-99 PB
City of Gainesville

A-3


LITTLE HATCHET
WATER BASIN
City Maintained;
major and minor channels
Legend
Major Channels
Minor Channels
Creeks
City Limits
Source
City of Gainesville Public Works
Dept. 1997
City of Gainesville
Gainesville, Florida
Prepared by the
Department of Community Development
July 1997
N
Petition 103CPA-99 PB
City of Gainesville

A-4


TUMBLIN CREEK
WATER BASIN
City Maintained;
major and minor channels
Legend
Major Channels
Minor Channels
Creeks
City Limits
Source
City of Gainesville Public Works
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Gainesville, Florida
Prepared by the
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July 1997
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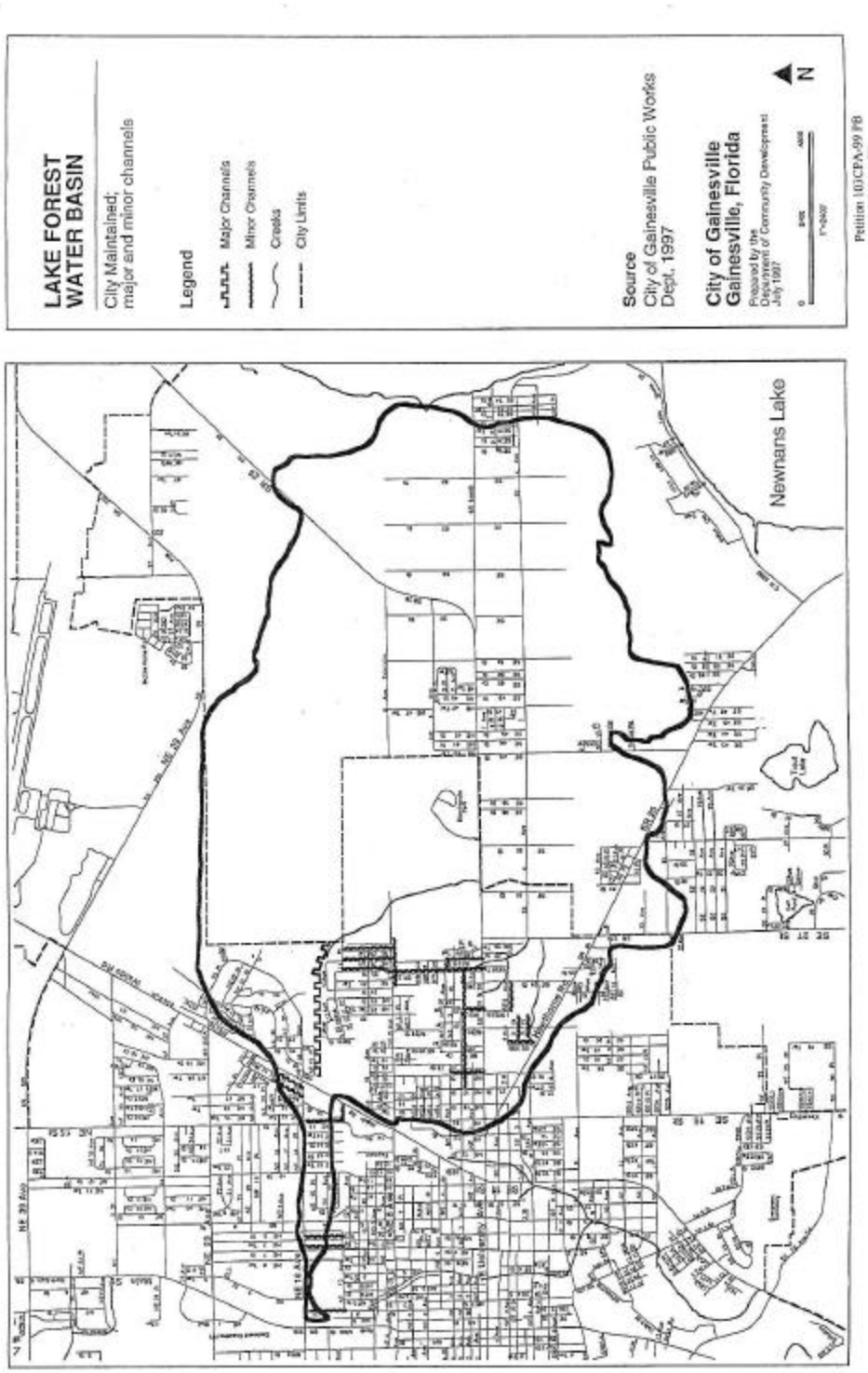
City of Gainesville


A-5
LAKE FOREST
WATER BASIN
City Maintained:
major and minor channels
Legend
Major Channels
Minor Channels
Creeks
City Limits
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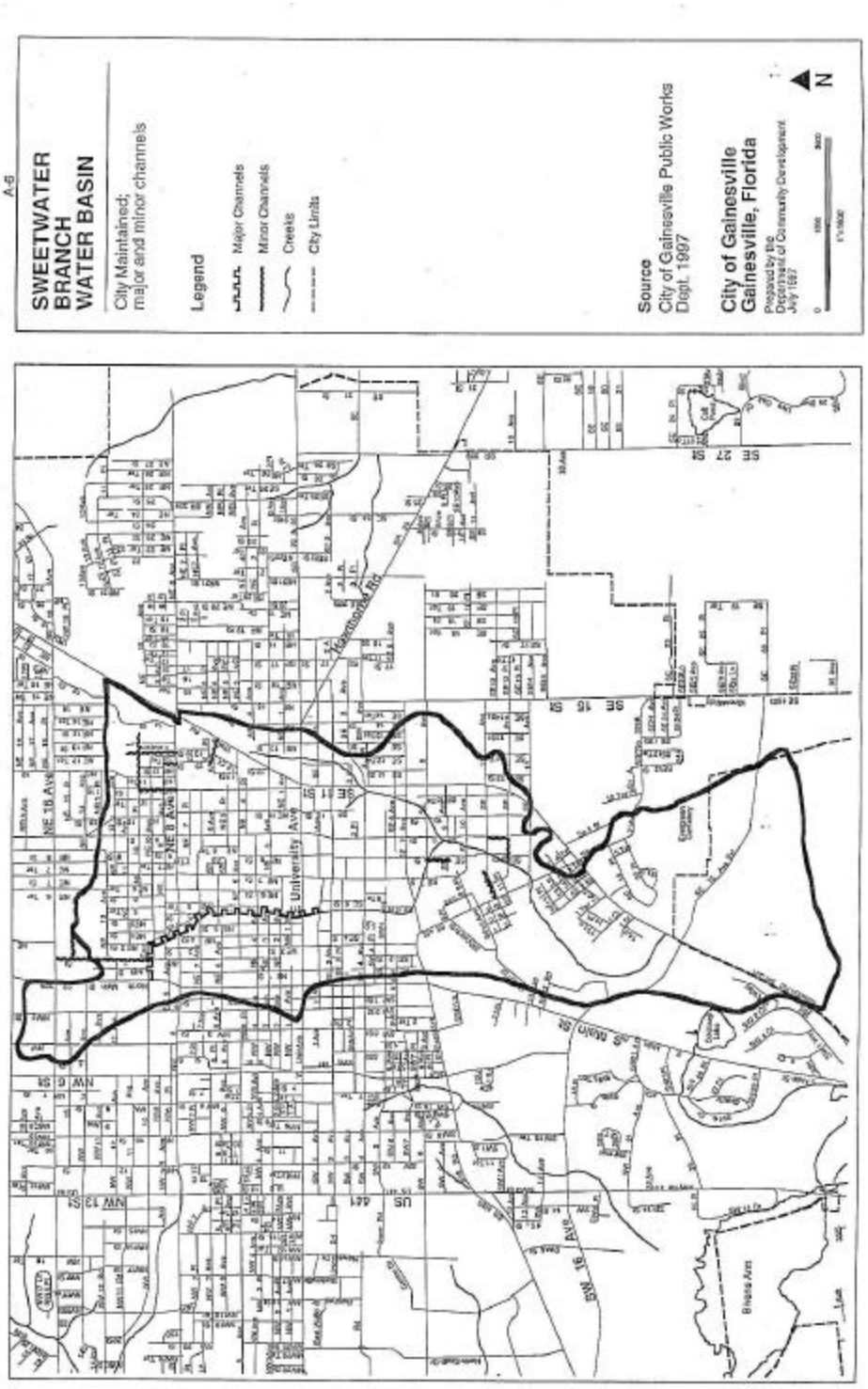
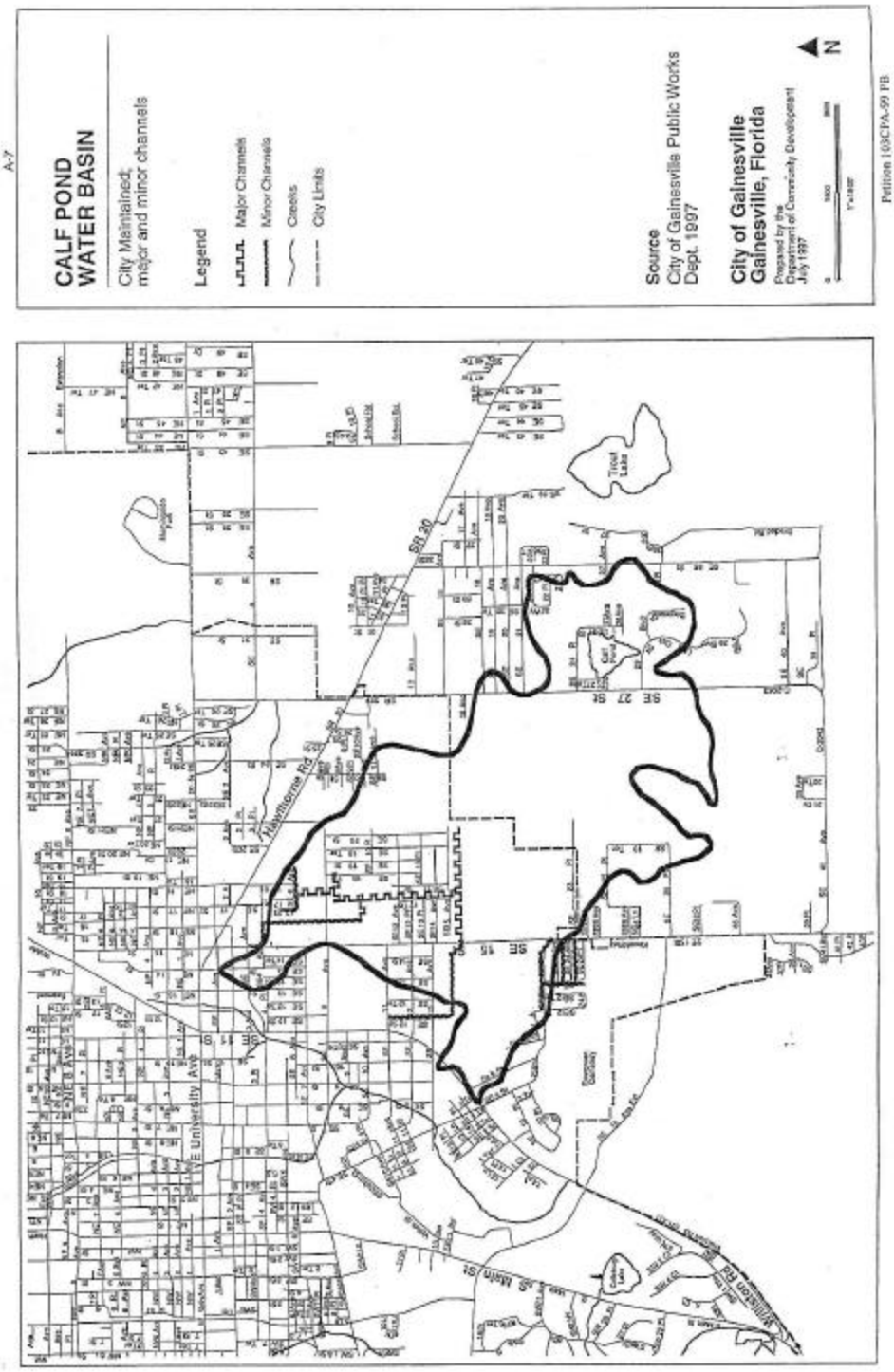
City of Gainesville Public Works
Dept. 1997
City of Gainesville
Gainesville, Florida
Prepared by the
Department of Community Development
July 1997
N
Petition 103CPA-99 PB
City of Gainesville
Newnans Lake


A-6
SWEETWATER BRANCH WATER BASIN
City Maintained; major and minor channels
Legend
Major Channels
Minor Channels
Creeks
City Limits
Source
City of Gainesville Public Works Dept. 1997
City of Gainesville
Gainesville, Florida
Prepared by the Department of Community Development July 1997
N
Petition 103CPA-99 PB
City of Gainesville
Hogtown Creek
University Ave
NE 16 Ave
NE 8 Ave
NW 13 St
US 441
SW 16 Ave
SE 16 St
SE 27 St
Main St
Sweetwater Branch


A-7
CALF POND
WATER BASIN
City Maintained;
major and minor channels
Legend
Major Channels
Minor Channels
Creeks
City Limits
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Dept. 1997
City of Gainesville
Gainesville, Florida
Prepared by the
Department of Community Development
July 1997
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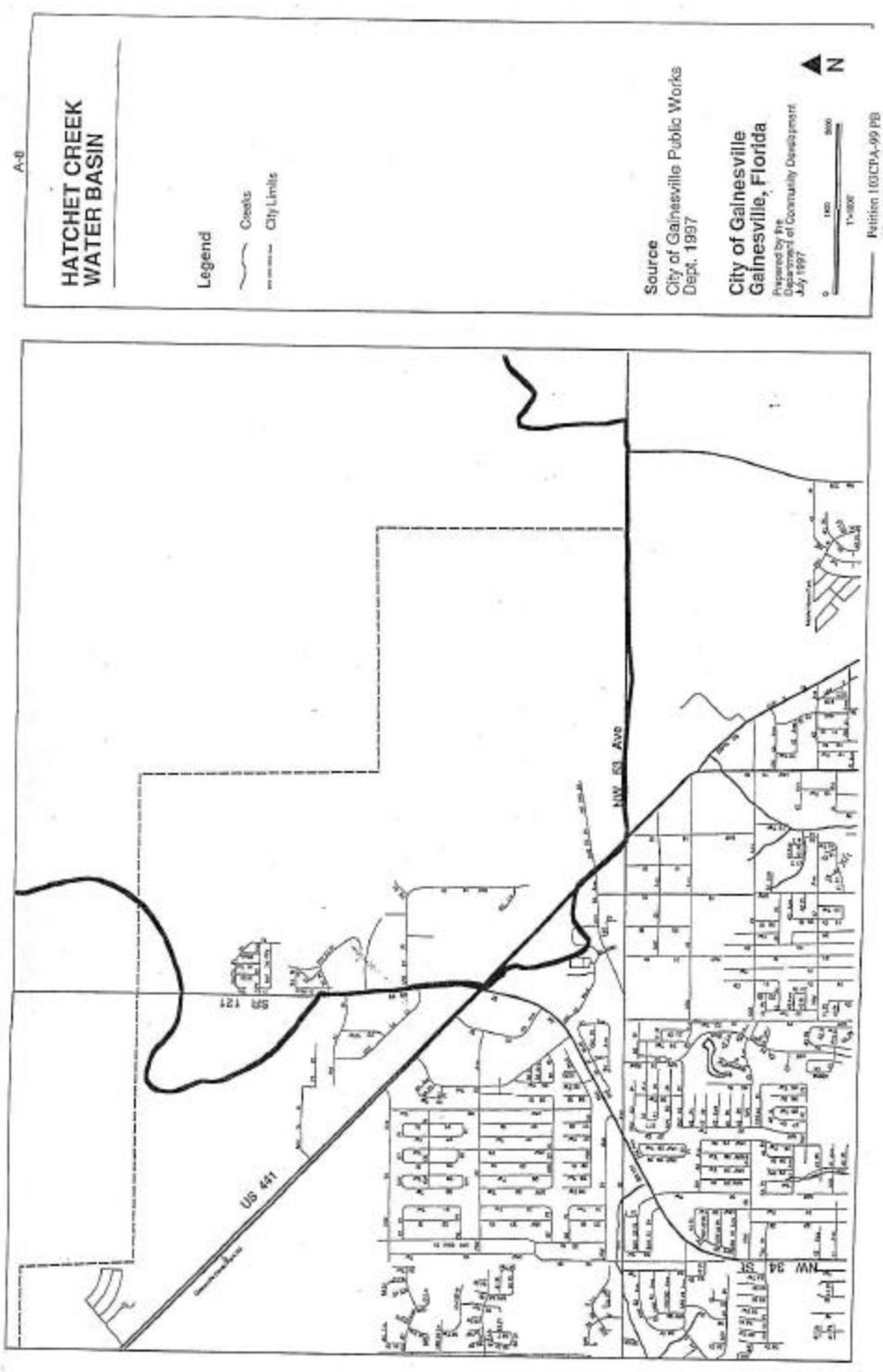
City of Gainesville
SR 20
Hawthorne Rd
SE 27 St
SE 15
S Main St
E University Ave
Trout Lake


A-8
HATCHET CREEK
WATER BASIN
Legend
Creeks
City Limits
Source
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City of Gainesville
Gainesville, Florida
Prepared by the
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July 1997
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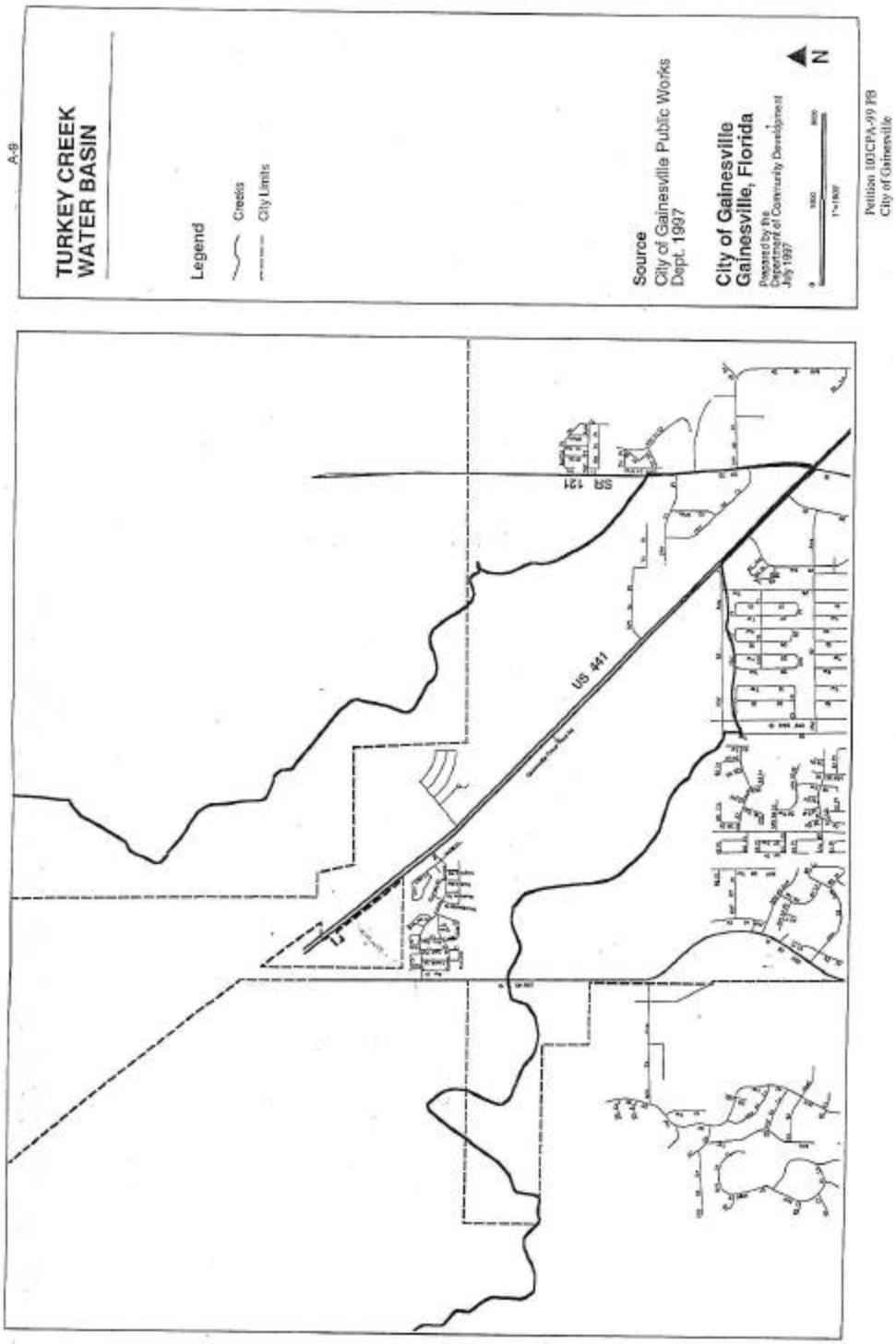
SR 121
SR 26


A-8
TURKEY CREEK
WATER BASIN
Legend
Creeks
City Limits
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Gainesville, Florida
Prepared by the
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July 1997
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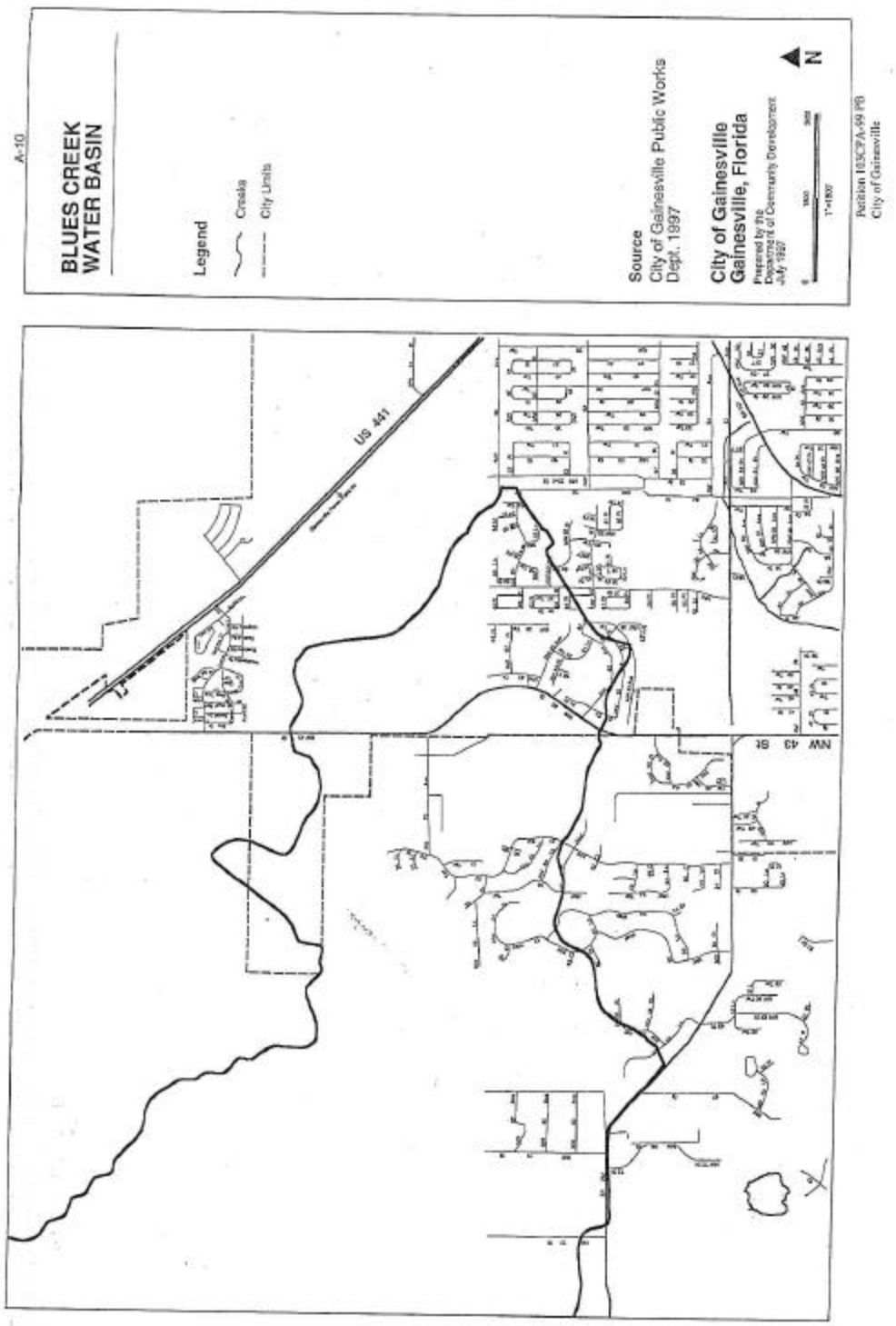
City of Gainesville
SR 121
US 441


A-10
BLUES CREEK
WATER BASIN
Legend
Creeks
City Limits
Source
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Dept. 1997
City of Gainesville
Gainesville, Florida
Prepared by the
Department of Community Development
July 1997
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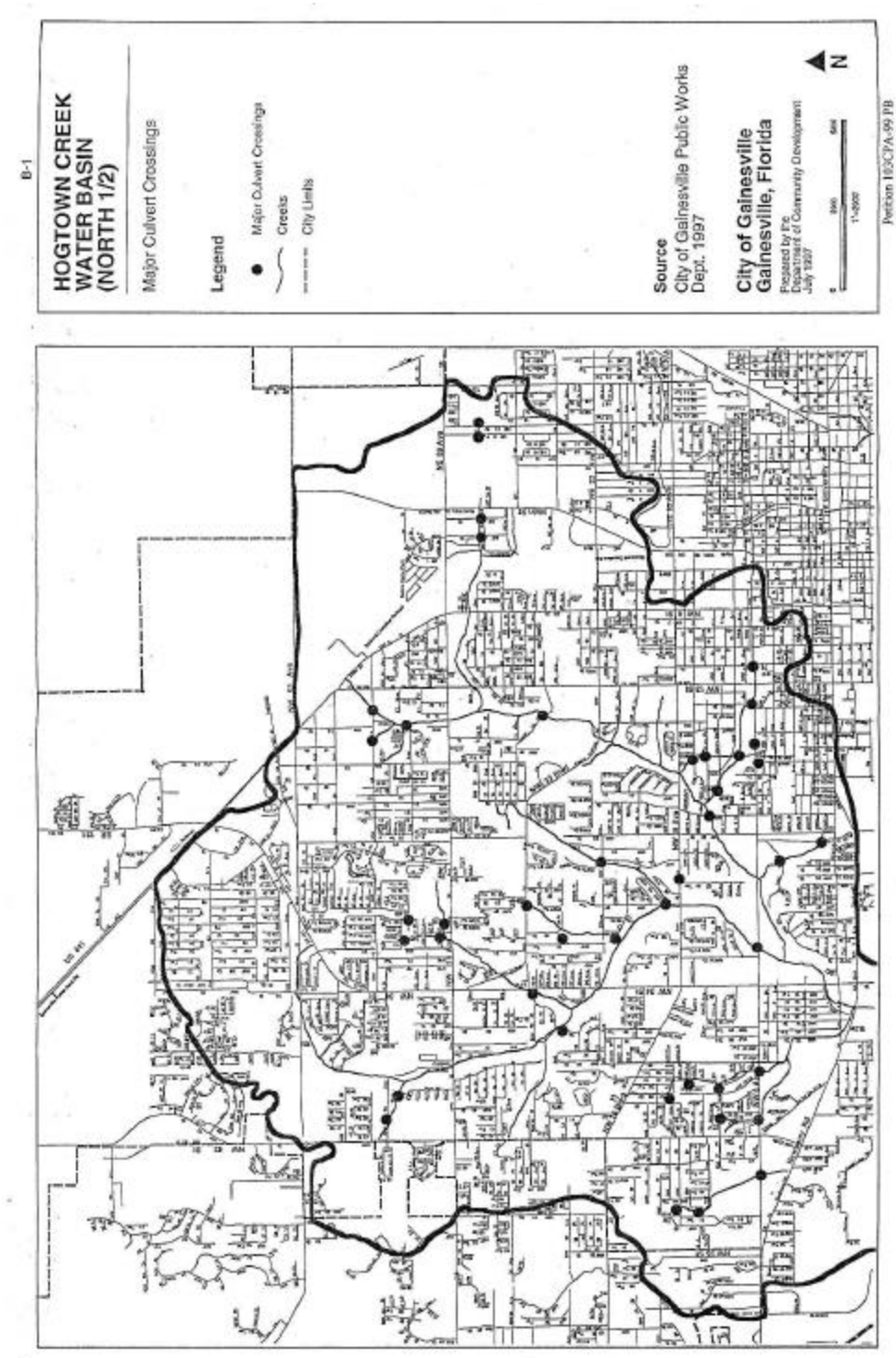
City of Gainesville
US 441
NW 43 St


B-1
HOGTOWN CREEK
WATER BASIN
(NORTH 1/2)
Major Culvert Crossings
Legend
Major Culvert Crossings
Creeks
City Limits
Source
City of Gainesville Public Works
Dept. 1997
City of Gainesville
Gainesville, Florida
Prepared by the
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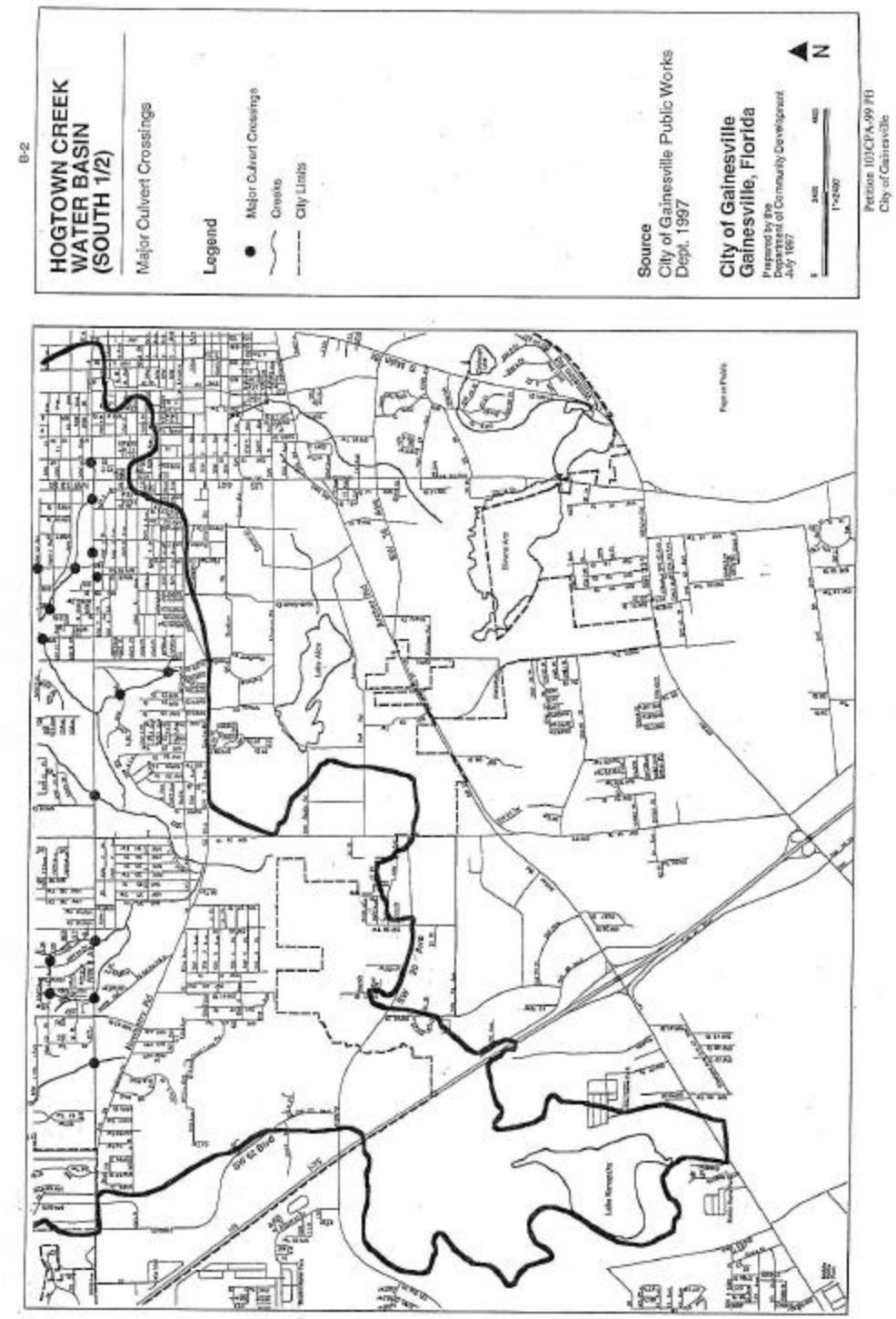
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HOGTOWN CREEK
WATER BASIN
(SOUTH 1/2)
Major Culvert Crossings
Legend
Major Culvert Crossings
Creeks
City Limits
Source
City of Gainesville Public Works
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City of Gainesville
Gainesville, Florida
Prepared by the
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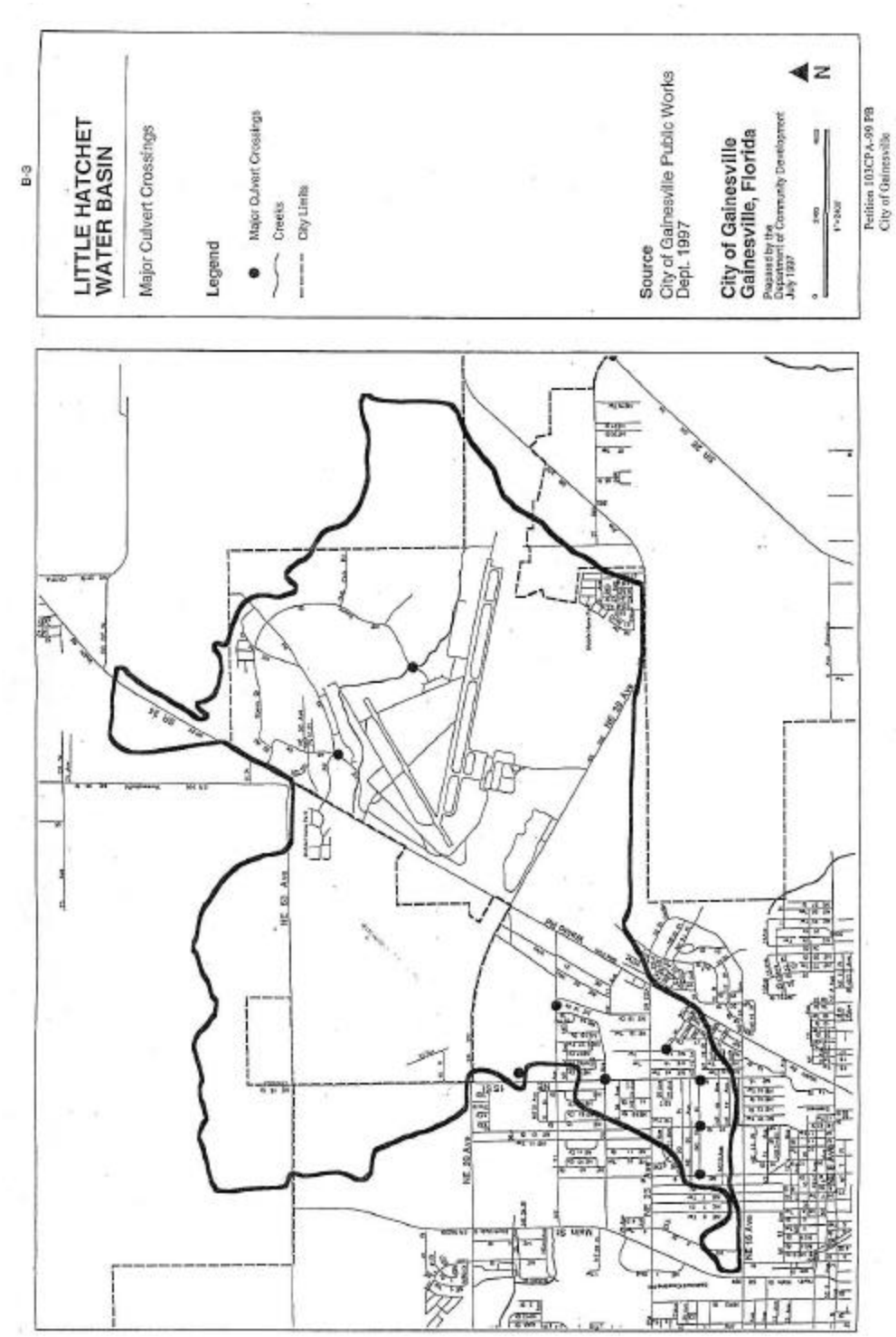
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Major Culvert Crossings
Legend
Major Culvert Crossings
Creeks
City Limits
Source
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City of Gainesville
Gainesville, Florida
Prepared by the Department of Community Development July 1997
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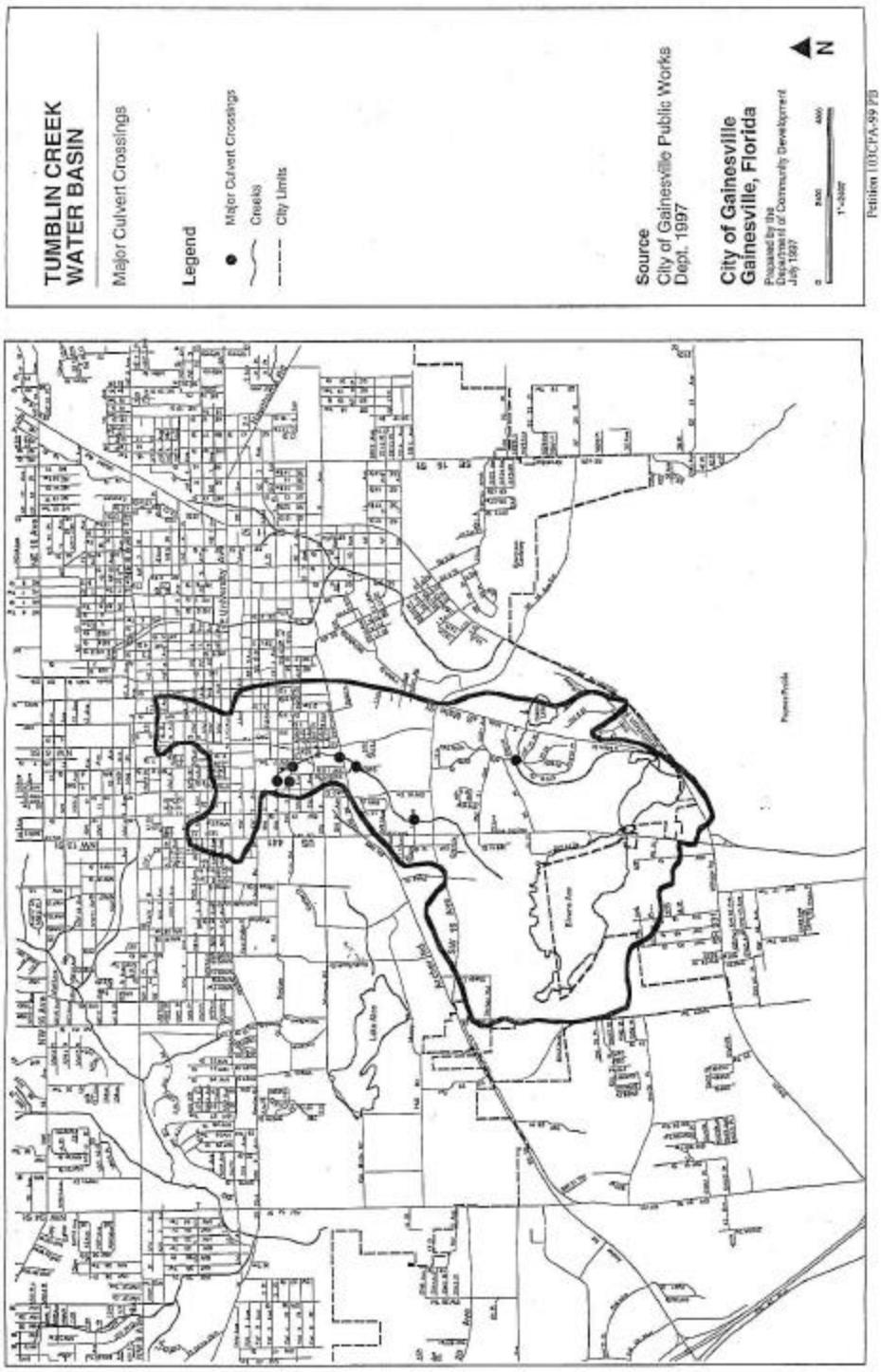
Petition 103CPA-99 PB
City of Gainesville

B-4


TUMBLIN CREEK
WATER BASIN
Major Culvert Crossings
Legend
Major Culvert Crossings
Creeks
City Limits
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Prepared by the
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July 1997
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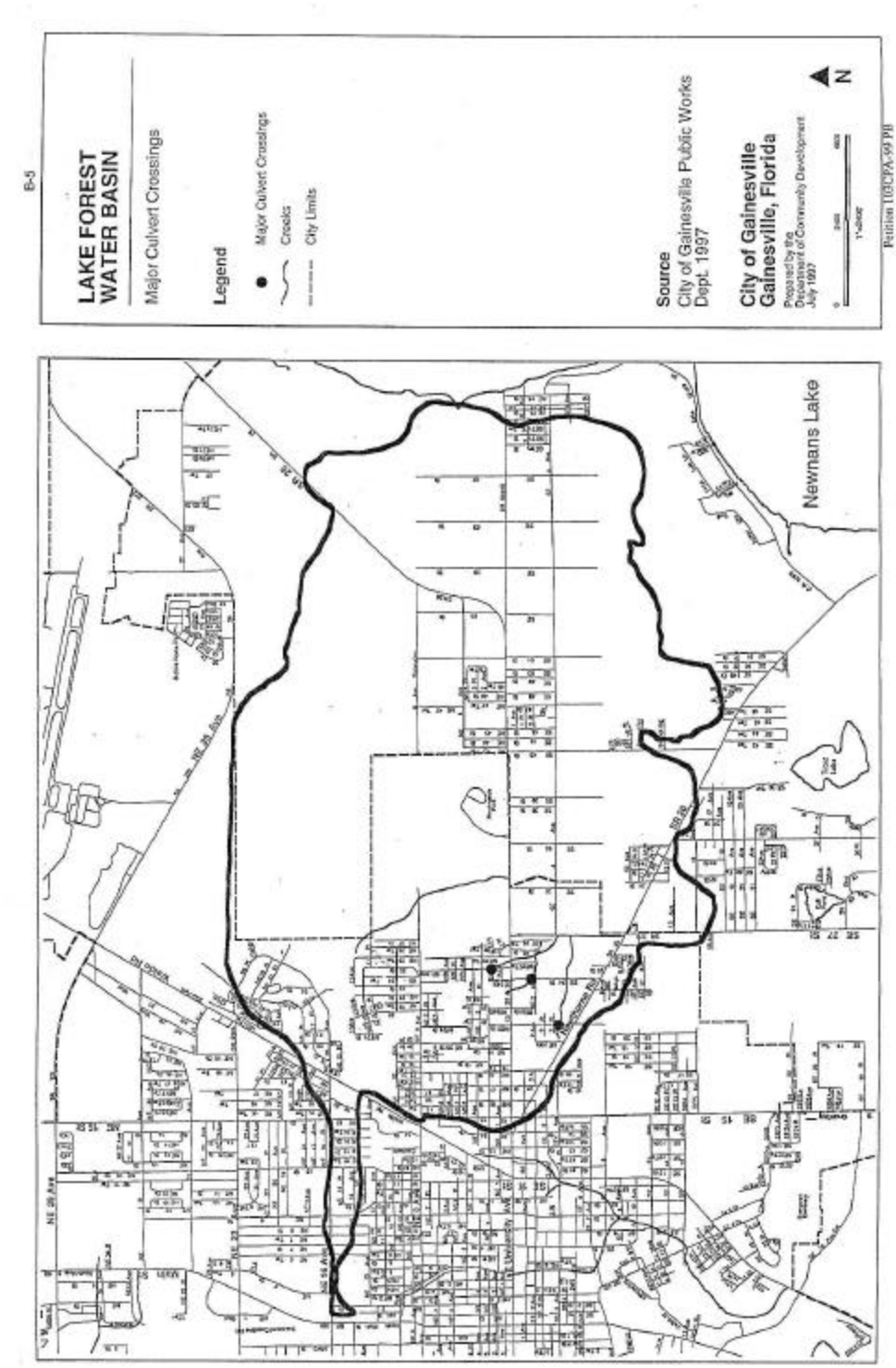
Petition 103CPA-99 PB
City of Gainesville


B-5
LAKE FOREST
WATER BASIN
Major Culvert Crossings
Legend
Major Culvert Crossings
Creeks
City Limits
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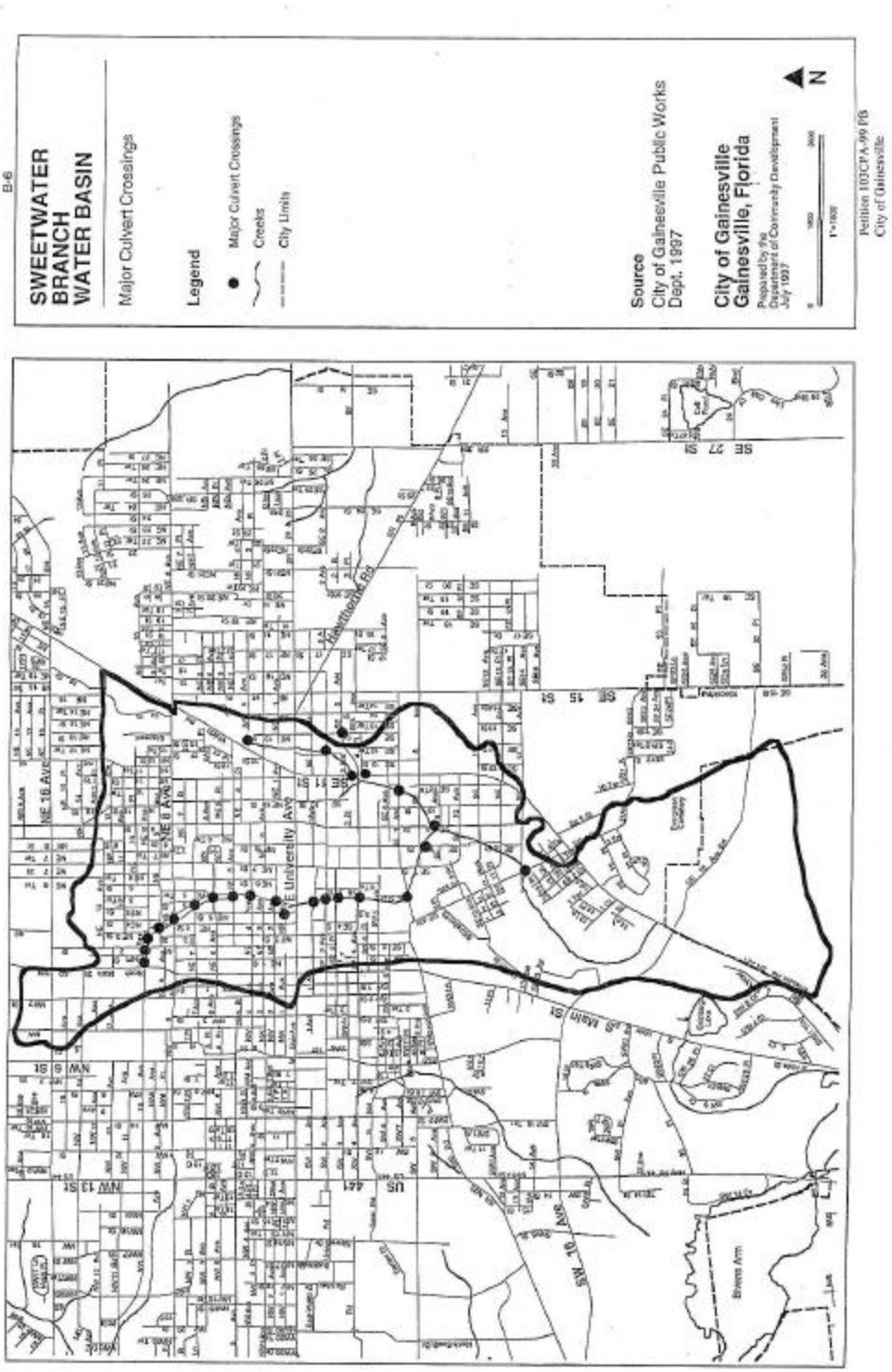
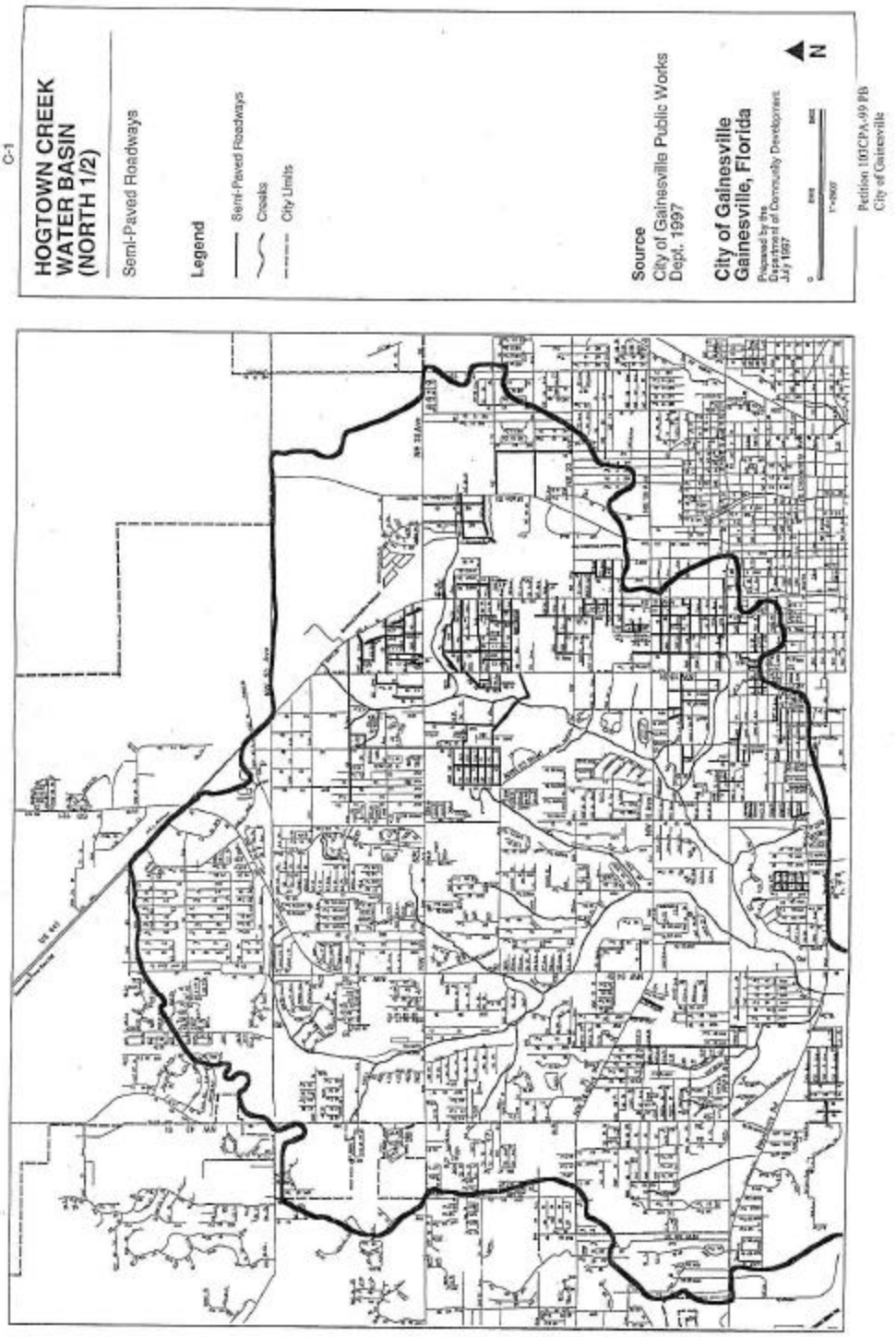
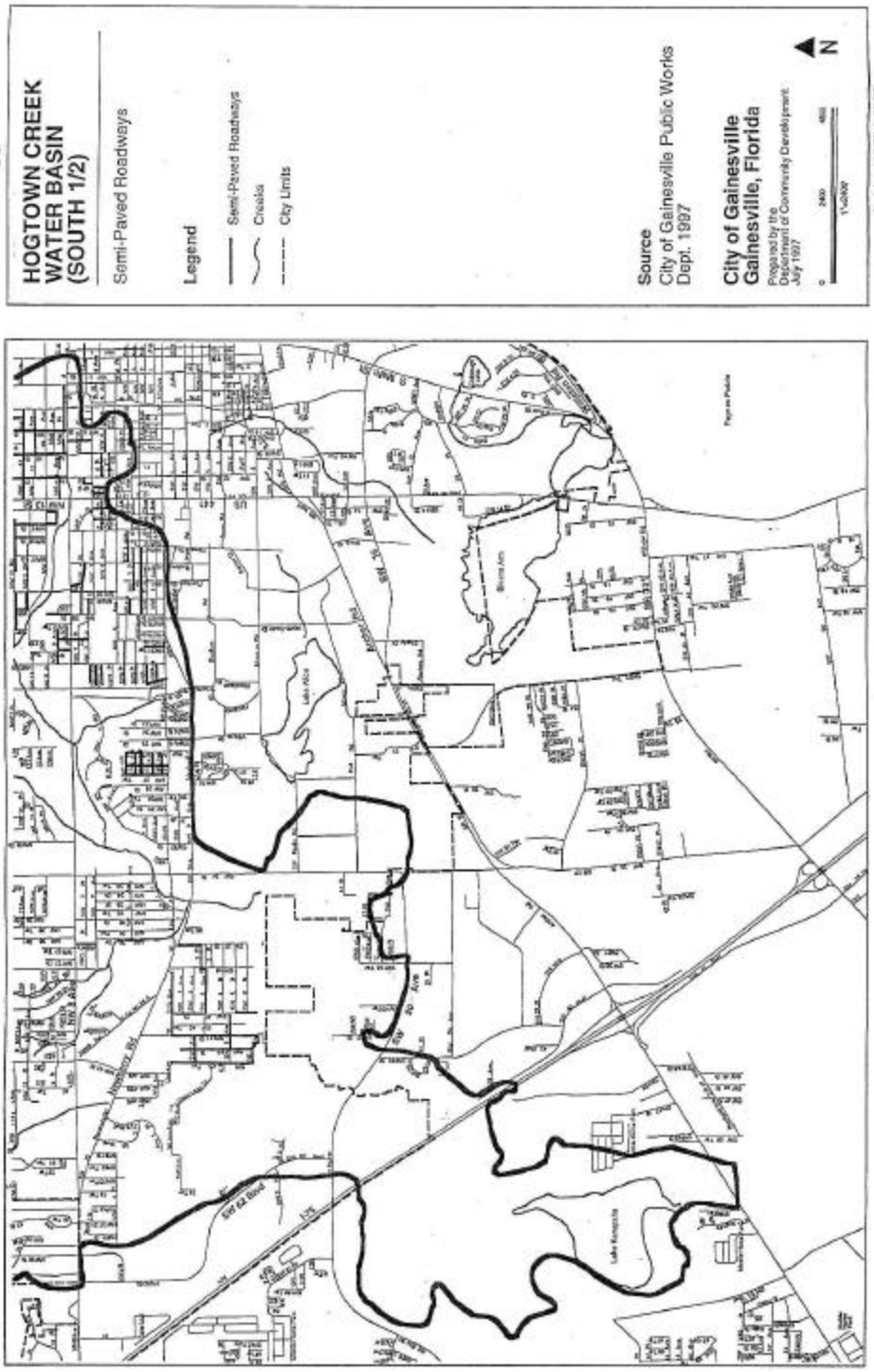
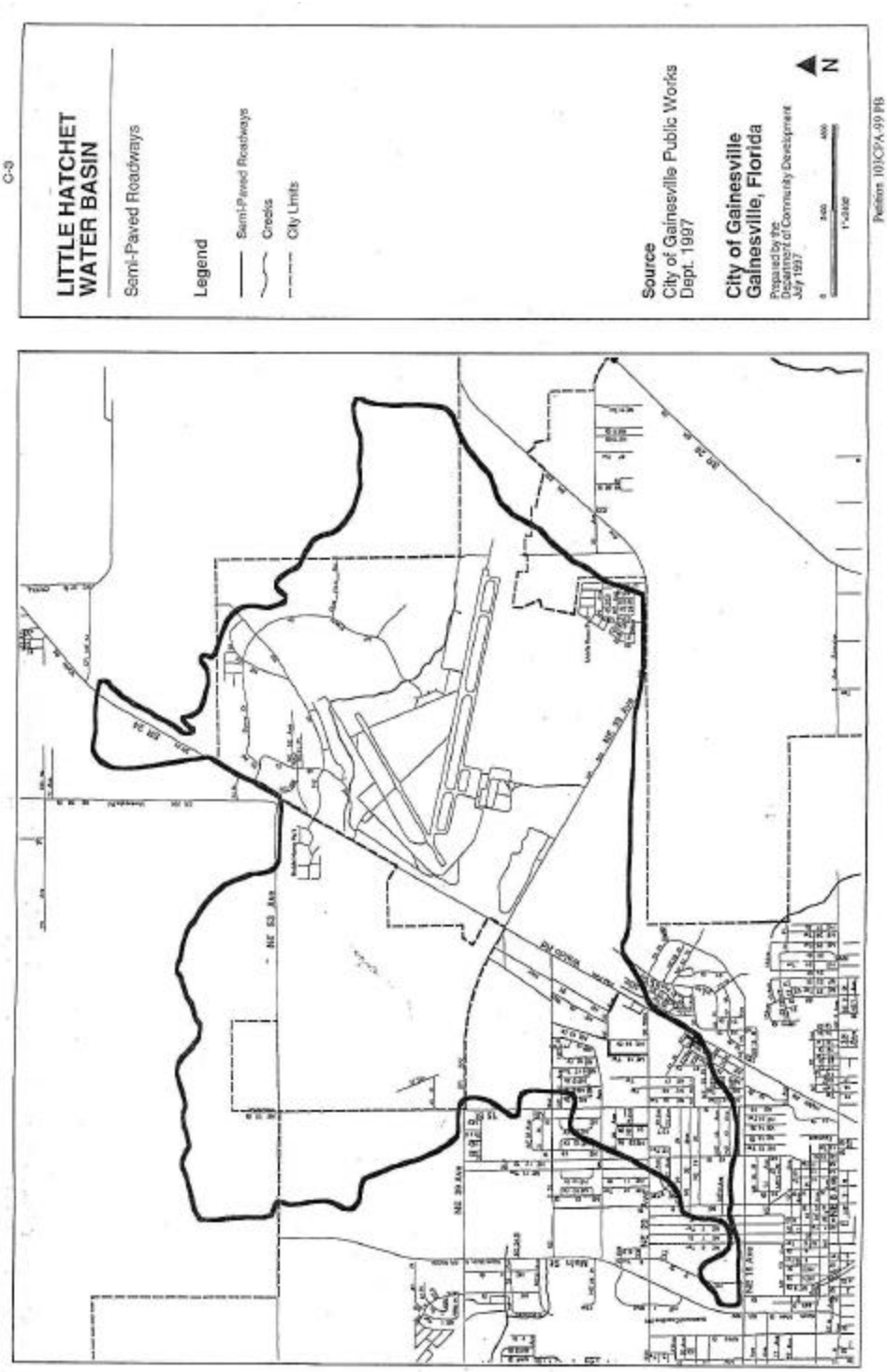
City of Gainesville
Newnans Lake

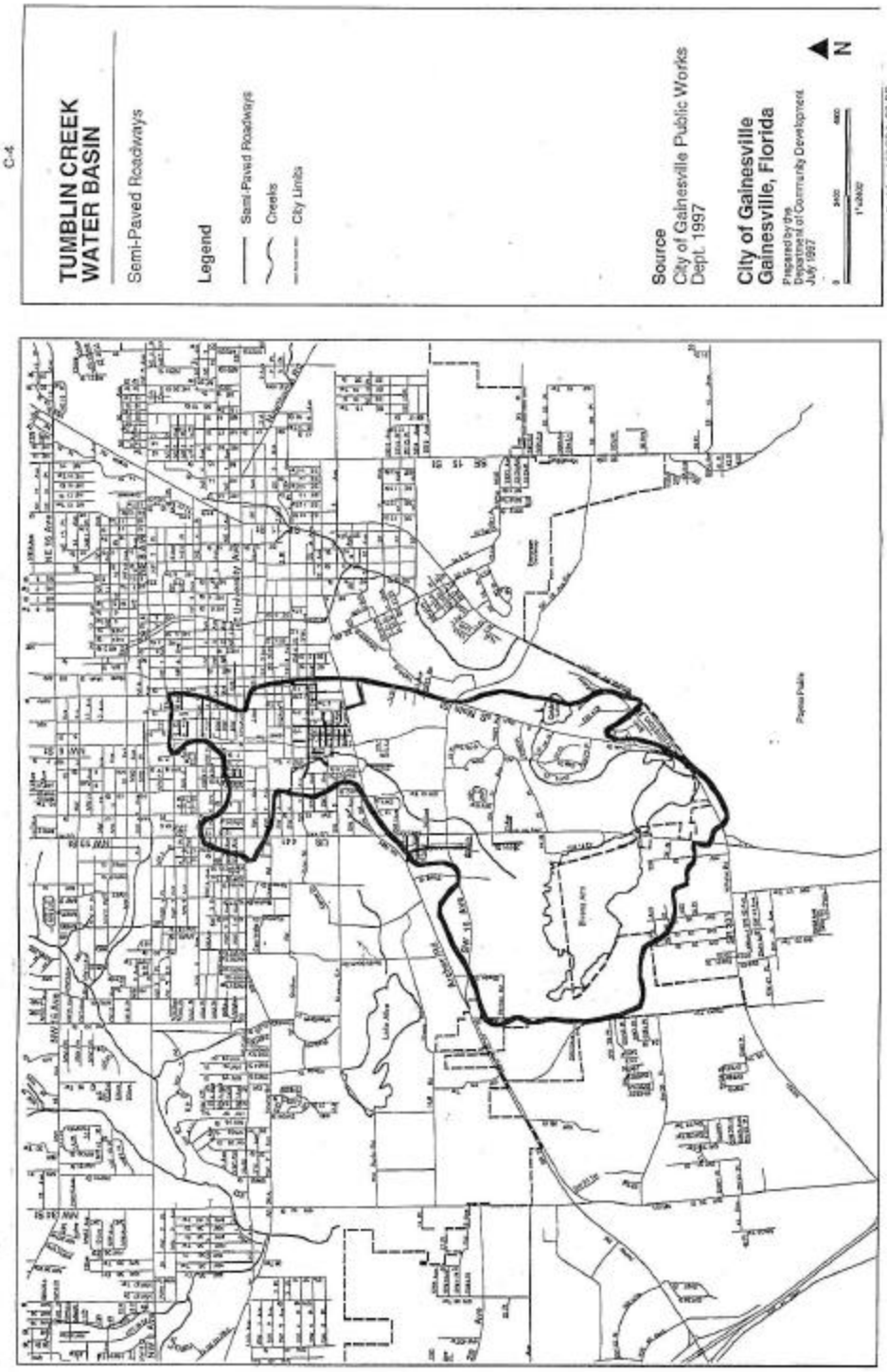

B-6
SWEETWATER BRANCH WATER BASIN
Major Culvert Crossings
Legend
Major Culvert Crossings
Creeks
City Limits
Source
City of Gainesville Public Works Dept. 1997
City of Gainesville
Gainesville, Florida
Prepared by the Department of Community Development July 1997
N
Petition 103CPA-99 PB
City of Gainesville
Haisten Blvd
NE 16 Ave
NE 8 Ave
NE University Ave
SE 15 St
SE 27 St
NW 6 St
NW 13 St
US 441
SW 10 Ave
Main St
Bivens Arm

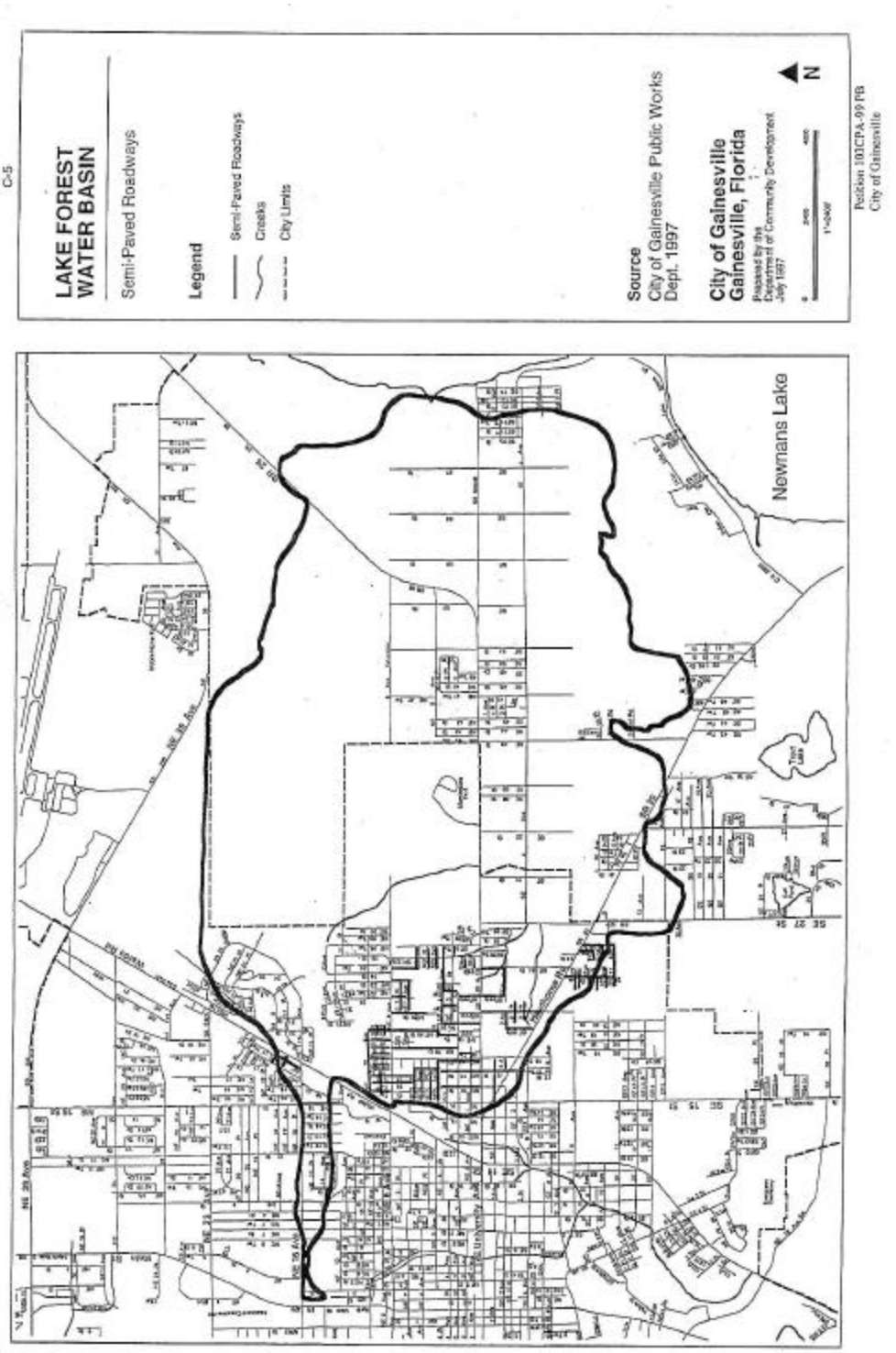

C-1
HOGTOWN CREEK
WATER BASIN
(NORTH 1/2)
Semi-Paved Roadways
Legend
Semi-Paved Roadways
Creeks
City Limits
Source
City of Gainesville Public Works
Dept. 1997
City of Gainesville
Gainesville, Florida
Prepared by the
Department of Community Development
July 1997
N
Petition 103CPA-99 PB
City of Gainesville

C-2

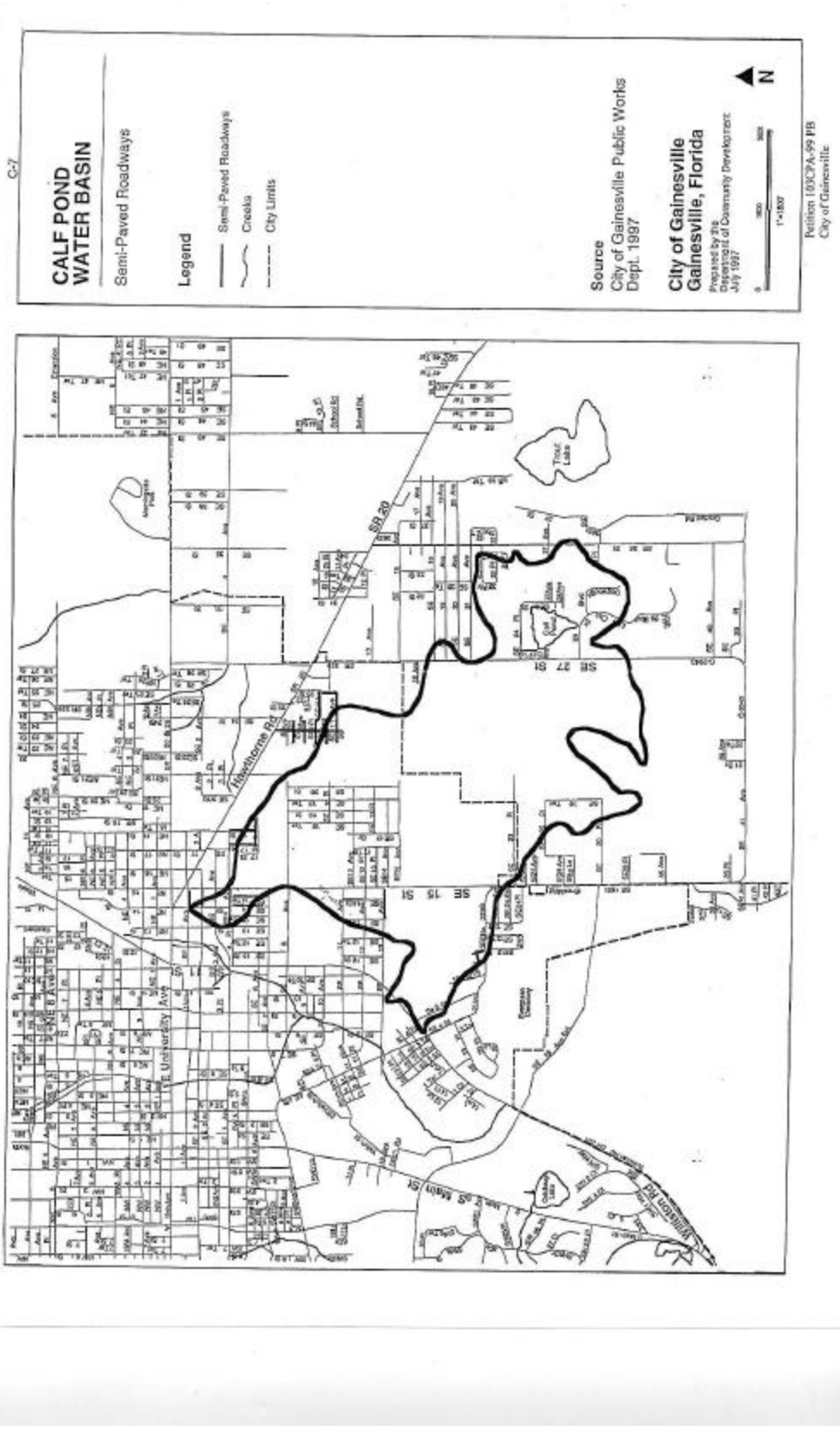

HOGTOWN CREEK
WATER BASIN
(SOUTH 1/2)
Semi-Paved Roadways
Legend
Semi-Paved Roadways
Creeks
City Limits
Source
City of Gainesville Public Works
Dept. 1997
City of Gainesville
Gainesville, Florida
Prepared by the
Department of Community Development
July 1997
N
Petition 103CPA-99 PB
City of Gainesville


C-3
LITTLE HATCHET WATER BASIN
Semi-Paved Roadways
Legend
Semi-Paved Roadways
Creeks
City Limits
Source
City of Gainesville Public Works Dept. 1997
City of Gainesville, Florida
Prepared by the Department of Community Development July 1997
N
Petition 103CPA-99 PB
City of Gainesville


C-4
TUMBLIN CREEK
WATER BASIN
Semi-Paved Roadways
Legend
Semi-Paved Roadways
Creeks
City Limits
Source
City of Gainesville Public Works
Dept. 1997
City of Gainesville
Gainesville, Florida
Prepared by the
Department of Community Development
July 1997
N
Petition 103CPA-99 PB
City of Gainesville


C-5
LAKE FOREST
WATER BASIN
Semi-Paved Roadways
Legend
Semi-Paved Roadways
Creeks
City Limits
Source
City of Gainesville Public Works
Dept. 1997
City of Gainesville
Gainesville, Florida
Prepared by the
Department of Community Development
July 1997
N
Petition 103CPA-99 PB
City of Gainesville
Newnans Lake

Map C-6 Sweetwater Branch Water Basin
Semi-Paved Roadways—C of G Public Works Dept. 1997


C-7
CALF POND
WATER BASIN
Semi-Paved Roadways
Legend
Semi-Paved Roadways
Creeks
City Limits
Source
City of Gainesville Public Works
Dept. 1997
City of Gainesville
Gainesville, Florida
Prepared by the
Department of Community Development
July 1997
N
Petition 103CPA-99 PB
City of Gainesville
SR 20
Newberry Rd
SE 27 St
SE 15 St
S Main St
NE 8 Ave
NE University Ave

Appendix B

Peak Flows and Elevations

Tables B-1 – B-7
Figures B-1 – B-3

Appendix B includes tables and figures excerpted from the 1990 Flood Elevation Update prepared by CH2M Hill. For further information please refer to the full study which is on file with the Public Works Department, City of Gainesville.

For a copy of the tables and figures for this Appendix B, go to the Dept. of Community Development (334-5022). It is at the end of the data & analysis for the Stormwater Management Element, Petition 103CPA-99 PB.