



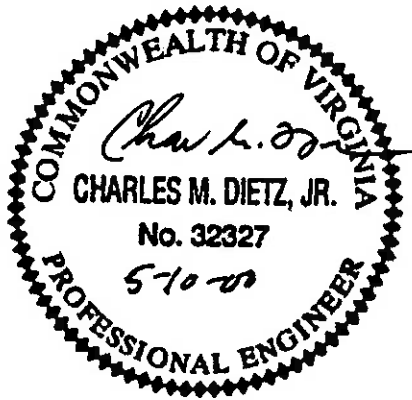
**Thompson  
+ Litton**

*Engineers  
Architects  
Planners*

**MASTER PLAN  
FOR  
WATER AND SEWER SYSTEM IMPROVEMENTS  
FOR THE  
CITY OF BEDFORD**

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FOR  
WATER AND SEWER SYSTEM IMPROVEMENTS  
FOR THE  
CITY OF BEDFORD**

**PREPARED FOR  
CITY OF BEDFORD, VIRGINIA**



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**THOMPSON + LITTON  
ENGINEERS • ARCHITECTS • PLANNERS  
RADFORD, VIRGINIA 24141**

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## INTRODUCTION

The City of Bedford is located in the central portion of Bedford County approximately 25 miles east of Roanoke, Virginia. It is located at the intersection of U.S. Route 460, U.S. Route 221, and State Route 122. The City and its environs lie within the Little Otter River and Goose Creek watersheds. A general location map is presented in Exhibit I.

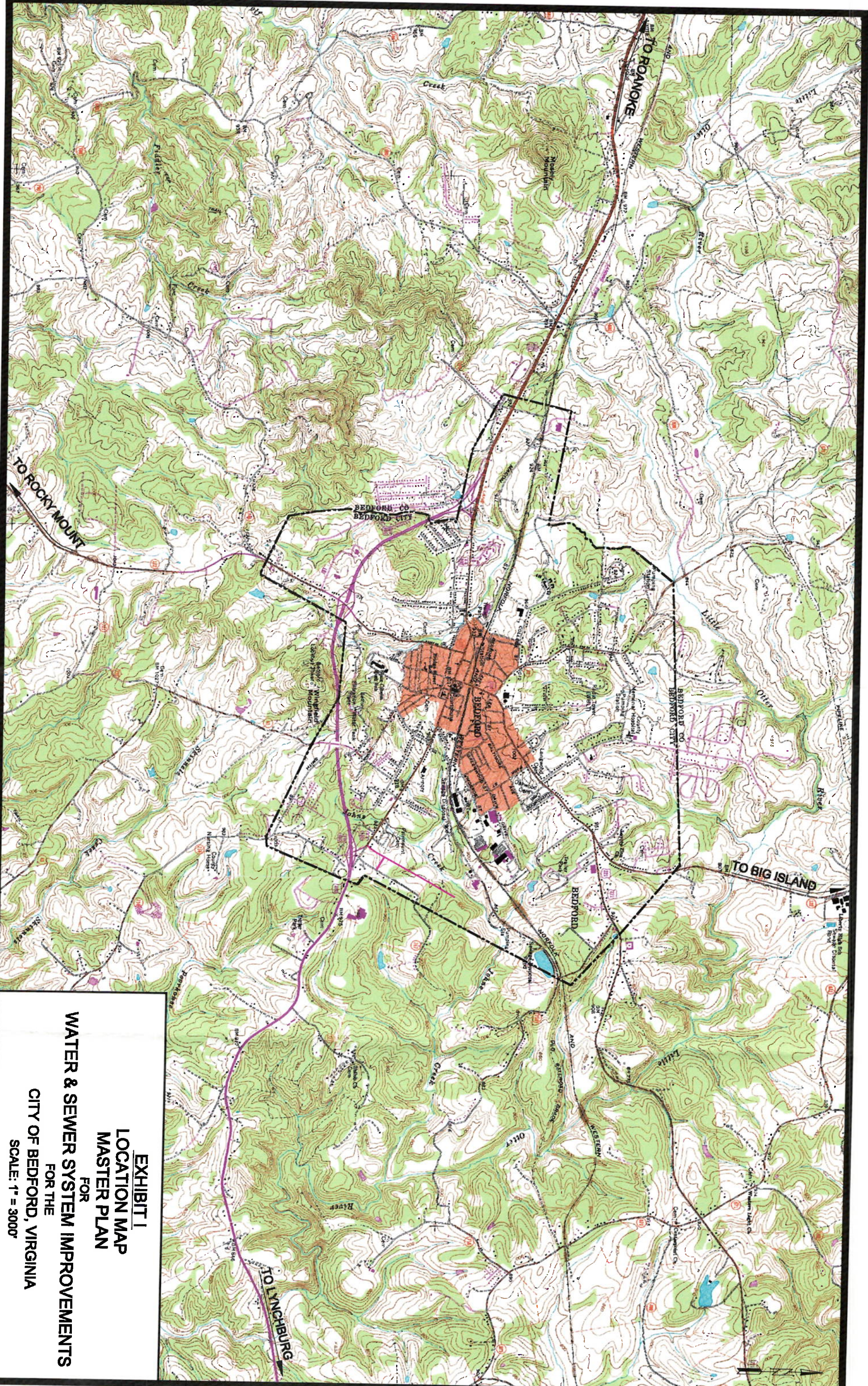
The City of Bedford and Bedford County have an agreement to develop and promote five Joint Economic Development Areas, which include one industrial park site within the City and four areas of the County immediately outside the City limits. As part of this agreement, "...the City and the County covenant and agree to begin... the formulation of a strategic long range plan for future water and sewer development in the City and the central area of Bedford County." Additionally, the City has recognized that this planning effort must also consider residential, commercial, and industrial development within the City limits.

Presently, the City operates and maintains both water and sewer systems that serve residential, commercial, and industrial areas within the City limits. The City also provides these services to several users outside the City limits adjacent to U.S. Route 460 and U.S. Route 221. Due to recent drought events and the resulting impacts on the City's reservoir and Big Otter River sources, the City has identified a need to develop supplemental water sources to increase the capacity/flexibility of the existing sources.

Recent studies and reports have indicated significant I/I problems with respect to the City's existing sewer system. This problem has resulted in the City entering into a consent agreement with the Virginia Department of Environmental Quality to reduce/eliminate I/I from

the system. The City has recognized that the overall development of a long-range water and sewer plan must consider this problem.

As a result of the aforementioned economic development opportunities and the resulting potential for growth within the City, Thompson + Litton was commissioned by the City of Bedford to prepare this Water and Sewer Master Plan.



**EXHIBIT I**  
**LOCATION MAP**  
**MASTER PLAN**  
**FOR**  
**WATER & SEWER SYSTEM IMPROVEMENTS**  
**FOR THE**  
**CITY OF BEDFORD, VIRGINIA**  
**SCALE: 1" = 3000'**

## GENERAL INFORMATION

### Purpose and Scope

The purpose of this Master Plan is to address the existing and future water and sewer system needs of the City of Bedford, Virginia with regard to economic development and growth within the City limits. Additionally, this Master Plan will evaluate two potential supplemental water sources for the City's existing reservoir. Preliminary project cost estimates are included in this report as a means of establishing financing requirements and to assess the economic feasibility of the proposed water and sewer improvements. The information contained herein will provide the basis for preliminary and final designs for the proposed system improvements.

### Service Area Descriptions

The primary areas that will be considered by this Master Plan include the City, the five Joint Economic Development Areas (JEDA), and the two City Economic Development Areas (CEDA). A service area map, which depicts the planning area, is presented in Exhibit II. The service areas illustrated in Exhibit II can be described as follows:

#### *City of Bedford*

The major developments within the City of Bedford include the central business district, commercial areas along U.S. Route 460 Business and U.S. Route 221, industrial areas along U.S. Route 221, and residential areas.

*460 East - Joint Economic Development Area*

The 460 East JEDA extends along both sides of U.S. Route 460 from the eastern City limits to the vicinity of the intersection of State Route 777 and consists of approximately 500 acres of land. The majority of the JEDA is relatively open and level with development consisting primarily of commercial and mobile home parks.

*460 West - Joint Economic Development Area*

The 460 West JEDA extends along both sides of U.S. Route 460 and the Norfolk Southern tracks westwards from the western City limits for approximately 2/3 of a mile and consists of approximately 300 acres. The majority of the JEDA is relatively level and/or gently sloping with development consisting primarily of commercial and some industrial type facilities.

*122 South - Joint Economic Development Area*

The 122 South JEDA extends along State Route 122 southwards from the southern City limits for approximately half a mile and consists of approximately 128 acres of land. The majority of the JEDA is relatively level and/or gently sloping with development consisting of small commercial facilities and single-family residences.

*Little Otter - Joint Economic Development Area/Regional Industrial Park (Alternatives I and II)*

The existing Little Otter Business Park JEDA (Alternative I) is located to the east of the City limits, primarily west of the Little Otter River between U.S. Route 221 and the Norfolk Southern tracks and consists of approximately 74 acres. Current development within the Park consists of two industrial service type businesses. Additionally, this service area includes the

proposed Little Otter Regional Industrial Park (Alternative II), consisting of approximately 486 acres of open and gently rolling topography situated adjacent to U.S. Route 221.

*Bedford City - Joint Economic Development Area*

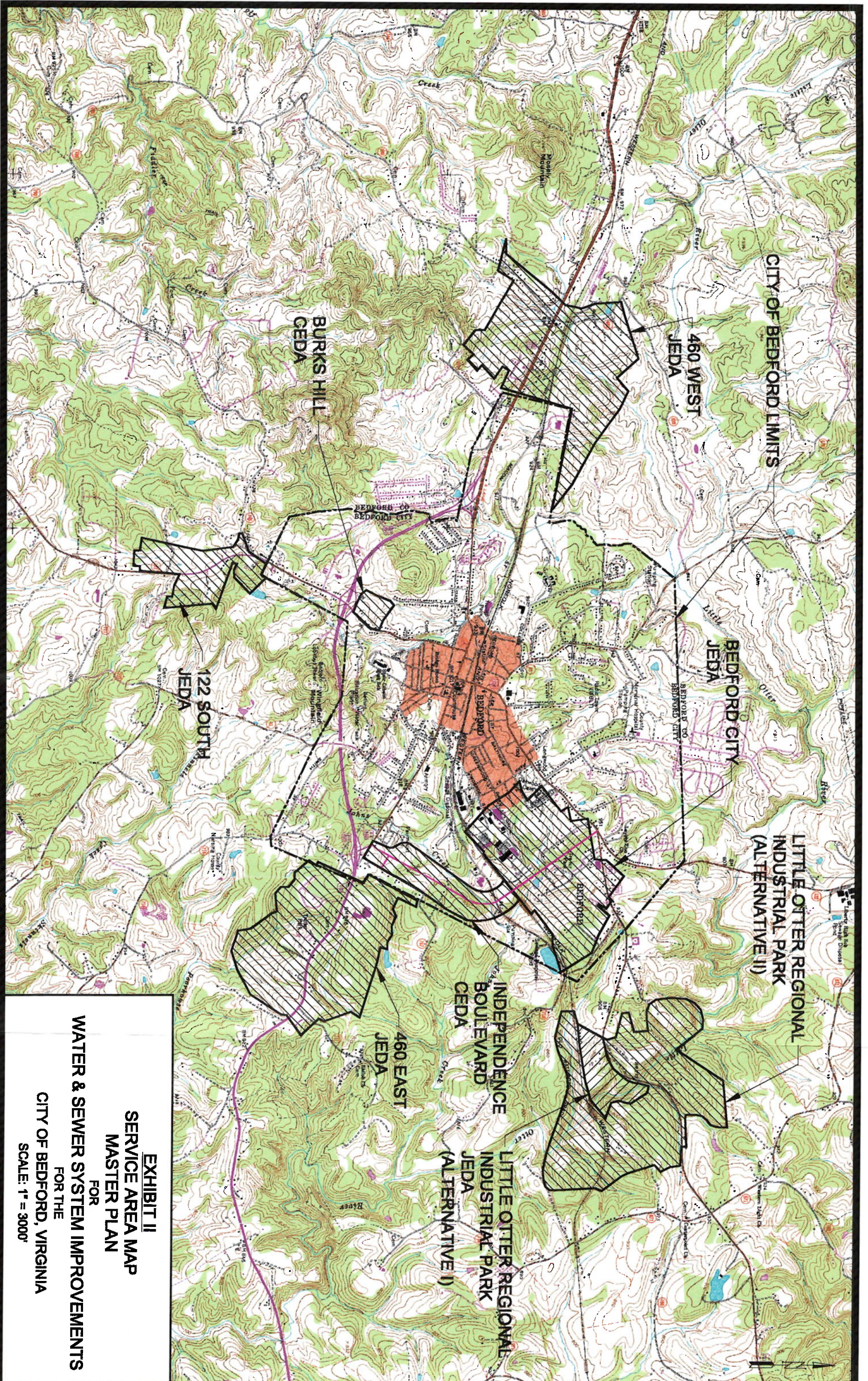
The Bedford City JEDA includes the property east of the center of town within the City limits between the Norfolk Southern tracks to the south and U.S. Route 221 to the north and consists of approximately 110 acres. The majority of development within the JEDA consists of industrial (Rubatex) and small industrial support service facilities.

*Burks Hill - City Economic Development Area*

The Burks Hill CEDA is located on the western side of State Route 122 near the U.S. Route 460 interchange. Current development within the CEDA consists of the D-Day Memorial, small commercial facilities, and a school. The majority of the CEDA consists of open land surrounding the memorial, the school, and residential properties.

*Independence Boulevard - City Economic Development Area*

The Independence Boulevard CEDA is located along the section of Independence Boulevard between U.S. Route 460 Business and State Route 718. Current development consists of the Dawn Drive Industrial Park, a business center, and several small industrial support service facilities. The majority of the CEDA consists of rolling topography with convenient access to both U.S. Route 460 and State Route 221.



**EXHIBIT II**  
**SERVICE AREA MAP**  
**MASTER PLAN**  
 FOR  
**WATER & SEWER SYSTEM IMPROVEMENTS**  
 FOR THE  
**CITY OF BEDFORD, VIRGINIA**  
 SCALE: 1" = 3000'

## Economic Development Review

The *Economic Development Review* presented in Appendix B considers the development potential of each of the five JEDA's and two CEDA's. Each Economic Development Area is evaluated according to the following criteria: existing development, site conditions, developable parcels, transportation access, existing water and sewer service, and potential utilities requirements for development. Based upon their relative development potentials, the Economic Development Areas are prioritized into three tiers, with the First Tier areas considered those under the most development pressure and the Third Tier areas being under the least development pressure. The three tier prioritization is as follows:

### *First Tier*

460 East JEDA  
Independence Boulevard CEDA  
Burks Hill CEDA

### *Second Tier*

460 West JEDA  
122 South JEDA

### *Third Tier*

Little Otter JEDA/Regional Industrial Park  
Bedford City JEDA

## Projected Water Demands and Wastewater Flows

Utilizing available planning information, previous studies, the *Economic Development Review*, and design criteria, 20-year projections for water demands and wastewater flows have

been developed for the service areas. The supporting design calculations and methodologies utilized for the development of the water demands and wastewater flows are included in Appendices A, B, C and D. These projections will be utilized to develop the proposed water and sewer system improvements considered herein.

Existing water demands for the City of Bedford were based on production records, metered sales records, and house counts from the City's aerial mapping and U.S.G.S. topographic quadrangles. The projected average water demands for the Joint Economic Development Areas and City Economic Development Areas were established in accordance with the Virginia Department of Health (VDH) regulations, the *Economic Development Review* presented in Appendix B, and the Preliminary Engineering Report *Two Potential Industrial Park Sites for Virginia's Region 2000*. Projected peak water demands were based on the following formula:

$$Q_{PEAK} \text{ (gpd)} = 2 \times Q_{AVE} \text{ (gpd)}$$

where

$Q_{AVE}$  = average daily water demand

$Q_{PEAK}$  = peak daily water demand

Based on the 20-year planning period, a growth rate of approximately 0.6% per year for the City, and the *Economic Development Review* projections, the total average and peak water demands for the service area will be approximately 1,878,300 gpd and 3,756,600 gpd, respectively, considering the Little Otter Joint Economic Development Area/Regional Industrial Park Alternative I scenario, and 2,243,300 gpd and 4,486,600 gpd considering the Little Otter

Joint Economic Development Area/Regional Industrial Park Alternative II scenario. The projected demands for each service area are presented in Table 1. Design calculations and information utilized in determining these demands are presented in Appendices B and C.

Existing wastewater flows for the City of Bedford sanitary sewer system were developed from flow data presented in the *Bedford Capacity Study*. The projected average wastewater flows for the JEDA's and CEDA's were established in accordance with the Virginia Department of Health (VDH) regulations, the *Economic Development Review* presented in Appendix B, and the Preliminary Engineering Report *Two Potential Industrial Park Sites for Virginia's Region 2000*. Projected peak wastewater flows were based on the following formula:

$$Q_{PEAK} \text{ (gpd)} = P \times Q_{AVE} \text{ (gpd)}$$

where

$Q_{AVE}$  = average daily wastewater flow

$Q_{PEAK}$  = peak daily wastewater flow

$P$  = peak factor = 2.5

(Note: Peak factors for the existing system varied by basin as presented in the *Bedford Capacity Study*.)

Based on the 20-year planning period, a growth rate of approximately 0.6% per year for the City, and the *Economic Development Review* projections, the total average and peak wastewater flows for the service area will be approximately 1,878,300 gpd and 3,756,600 gpd, respectively, considering the Little Otter Joint Economic Development Area/Regional Industrial Park Alternative I scenario and 2,243,300 gpd and 4,486,600 gpd considering the Little Otter

**TABLE 1**  
**MASTER PLAN**  
**FOR**  
**WATER AND SEWER SYSTEM IMPROVEMENTS**  
**FOR THE**  
**CITY OF BEDFORD**

**PROJECTED WATER DEMANDS**

ECONOMIC DEVELOPMENT AREA	EXISTING Q <sub>AVE</sub>	EXISTING Q <sub>PEAK</sub>	5-YEAR Q <sub>AVE</sub>	5-YEAR Q <sub>PEAK</sub>	10-YEAR Q <sub>AVE</sub>	10-YEAR Q <sub>PEAK</sub>	20-YEAR Q <sub>AVE</sub>	20-YEAR Q <sub>PEAK</sub>
CITY OF BEDFORD	1,254,300	2,508,600	1,292,500	2,585,000	1,331,900	2,663,800	1,414,200	2,828,400
460 EAST								
460 WEST			57,600	115,200	98,600	197,200	172,600	345,200
122 SOUTH			26,000	52,000	45,500	91,000	82,400	164,800
LITTLE OTTER JEDAREGIONAL INDUSTRIAL PARK ALTERNATIVE I			1,000	2,000	22,000	44,000	45,000	90,000
ALTERNATIVE II			14,500	29,000	29,000	58,000	84,500	169,000
BEDFORD CITY			77,100	154,200	154,300	308,600	449,500	899,000
BURKS HILL			1,000	2,000	2,000	4,000	19,600	39,200
INDEPENDENCE BLVD			8,500	17,000	33,000	66,000	43,000	86,000
TOTAL ALTERNATIVE I	1,254,300	2,508,600	1,405,600	2,811,200	1,571,000	3,142,000	1,878,300	3,756,600
TOTAL ALTERNATIVE II	1,254,300	2,508,600	1,468,200	2,936,400	1,696,300	3,392,600	2,243,300	4,486,600

Notes:

1. All flows are gallons per day (gpd).
2. Q<sub>AVE</sub> denotes average flow.
3. Q<sub>PEAK</sub> denotes peak flow (Q<sub>PEAK</sub> = 2.0 × Q<sub>AVE</sub>).

Joint Economic Development Area/Regional Industrial Park Alternative II scenario. The projected flows for each service area are presented in Table 2. Design calculations and information utilized in determining these flows are presented in Appendices B and D.

To account for future contributions to the sewer system from inflow and infiltration (I/I), it was assumed that any growth in these flows would be moderated by the City's efforts to remedy the I/I problems in the system. As presented in Table 2, it was assumed that 80% of the existing I/I was removed over the 20-year planning period, with 25% removed after the first five years and 50% after the first ten years. For the purpose of sizing and evaluating sewer system improvements, inflows and peak infiltration for the 20-year planning period were assumed to be at 50% of their existing levels.

TABLE 2

MASTER PLAN  
FOR  
WATER AND SEWER SYSTEM IMPROVEMENTS  
FOR THE  
CITY OF BEDFORD

PROJECTED WASTEWATER FLOWS

ECONOMIC DEVELOPMENT AREA	EXISTING		5-YEAR		10-YEAR		10-YEAR		20-YEAR	
	Q <sub>AVE</sub>	Q <sub>PEAK</sub>	Q <sub>AVE</sub>	Q <sub>PEAK</sub>	Q <sub>AVE</sub>	Q <sub>PEAK</sub>	Q <sub>AVE</sub>	Q <sub>PEAK</sub>	Q <sub>AVE</sub>	Q <sub>PEAK</sub>
CITY OF BEDFORD	1,123,400	1,899,700	1,157,600	1,957,600	1,192,900	2,017,200	1,266,600	2,141,900		
INFILTRATION	626,400	1,083,800	469,800	812,850	313,200	541,900	125,280	216,760		
INFLOW	-----	3,948,600	-----	2,961,450	-----	1,974,300	-----	789,720		
460 EAST	-----	-----	-----	-----	-----	-----	-----	-----		
460 WEST	-----	-----	57,600	144,000	98,600	246,500	172,600	431,500		
122 SOUTH	-----	-----	26,000	65,000	45,500	113,750	82,400	206,000		
LITTLE OTTER JEDA/REGIONAL INDUSTRIAL PARK	-----	-----	1,000	2,500	22,000	55,000	45,000	112,500		
ALTERNATIVE I	-----	-----	14,500	36,250	29,000	72,500	84,500	211,250		
ALTERNATIVE II	-----	-----	77,100	192,750	154,300	385,750	449,500	1,123,750		
BEDFORD CITY	-----	-----	1,000	2,500	2,000	5,000	19,600	49,000		
BURKS HILL	-----	-----	8,500	21,250	33,000	82,500	43,000	107,500		
INDEPENDENCE BLVD	-----	-----	4,500	11,250	9,000	22,500	17,000	42,500		
TOTAL ALTERNATIVE I	1,749,800	6,932,100	1,740,500	6,014,650	1,745,200	5,131,150	1,855,980	4,308,630		
TOTAL ALTERNATIVE II	1,749,800	6,932,100	1,803,100	6,171,150	1,870,500	5,444,400	2,220,980	5,221,130		

Notes:

1. All flows are gallons per day (gpd).
2. Q<sub>AVE</sub> denotes average flow.
3. Q<sub>PEAK</sub> denotes peak flow (For the Economic Development Areas, Q<sub>PEAK</sub> = 2.5 × Q<sub>AVE</sub>).
4. Infiltration and inflow were assumed to be reduced by 25% at 5 years, 50% at 10 years, and 80% at 20 years.

## EXISTING WATER SYSTEM FACILITIES

The City of Bedford presently owns and operates a water system that supplies all City users as well as some users located outside the City limits. The City system provides water supplied primarily from the Stoney Creek Reservoir through a distribution system consisting of approximately 471,000 linear feet of 12-, 10-, 8-, 6-, 4-, and 2-inch water lines. Additionally, the City can supplement its reservoir supply with water from the Big Otter River. The City's Water Treatment Plant (WTP) has a capacity of 3.0 mgd and currently operates at approximately 42% capacity or 1.25 mgd. The WTP is located off of State Route 43 approximately 2.7 miles to the northwest of the City limits. Additionally, the City's water system contains three water storage tanks with a combined capacity of approximately 3,500,000 gallons. Two of the water storage tanks are located within the City limits adjacent to Helm Street and the other water storage tank is located at the WTP site. An existing facilities map, which depicts the existing City of Bedford water distribution system, is presented in Exhibit III.

Existing water facilities located within or adjacent to the Joint Economic Development Areas and City Economic Development Areas consist of the following:

- |  |  |
|--|--|
| 460 East-                                    | 8- and 6-inch water lines extending approximately 2,850 linear feet east of the City limits along U.S. Route 460.              |
| 460 West-                                    | 8-inch water line located at the eastern boundary of the JEDA on U.S. Route 460.   |
| 122 South-                                   | 12-inch water line extending through the JEDA along State Route 122 approximately 14,300 linear feet south of the City limits. |
| Little Otter JEDA/Regional Industrial Park - |  |
|  | 10-inch water line extending to the JEDA along State Route 221 approximately 3,700 linear feet east of the City limits.        |
| Bedford City-                                | 12-, 10-, 8- and 6- water lines located within the JEDA.   |

Burks Hill-

10-, 8-, and 6- water lines located within the CEDA.

Independence Boulevard-

10-inch water line extending from East Main Street approximately 900 linear feet into the southern portion of the CEDA.

