UNC
INSTITUTE FOR
THE ENVIRONMENT

CAMDEN COUNTY GREEN INDUSTRIAL PARK FEASIBILITY STUDY

THE UNIVERSITY of NORTH CAROLINA at CHAPEL HILL

2008

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List of Acronyms

EDC – Economic Development Corporation
EIA – Economic Impact Analysis
EIP – Eco-industrial Park
GIP – Green Industrial Park
IE – Institute for the Environment
LEED – Leadership in Energy and Environmental Design
LQ – Location Quotient
MW – Megawatt (1000 watts)
NAICS – North American Industrial Classification System
NCDENR – North Carolina Department of Environment and Natural Resources
NCNE – North Carolina Northeast (Commission)
TRI – Toxic Release Inventory

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Executive Summary

In the spring of 2008, the Golden LEAF Foundation sponsored a study by the University of North Carolina at Chapel Hill to examine the feasibility of developing a "green" industrial park in Camden County, North Carolina. The project was conducted by UNC teams from the Institute for the Environment (IE), Center for Competitive Economies in the Kenan-Flagler Business School, and the Environmental Finance Center in the School of Government. The project focused on three areas: (1) business opportunities and regional development, (2) environmental impacts, and (3) governance and finance. In addition, a community engagement team from IE assessed the interests and concerns of a range of stakeholders, and a landscape design team prepared conceptual images of a future green industrial park.

The business team analyzed industry clusters for the Hampton Roads metropolitan region and estimated the likely tax revenues generated and potential number of jobs created by the development of a green industrial park. The environmental team assessed the potential environmental impacts of a green industrial park, described how those impacts could be mitigated through siting, design, and operation, and offered guidelines for the development of such a park. Finally, the governance and finance team assessed options available to pay for and manage or operate a green industrial park.

For the analysis, the proposed green industrial park was divided into three phases (Figure 6.2). Phase I includes features such as new water and sewer lines, increased wastewater treatment capacity, renewable energy facilities, a wetland water management system, stormwater management facilities and mixed-use development. Phase II includes additional industrial and residential development, expansion of the wastewater and water treatment facilities and acquisition of additional land. Finally, Phase III includes the construction of a new wastewater treatment facility, additional mixed-use development, wetland construction, and large scale renewable energy facilities.

Findings and Conclusions

Is a green industrial park feasible for Camden County? It depends. Several issues would have to be addressed, including the lack of infrastructure, competition from existing industrial parks in the region, and potential environmental impacts. The key findings and conclusions for the feasibility study are summarized below.

Business Opportunities and Regional Development

The business team identified 625 emerging growth companies in six industry clusters: (1) aluminum products, (2) basic health services, (3) metalworking and fabricated metal products, (4) information services, (5) business services, and (6) non-residential building products. Companies in these clusters would be logical targets for recruitment by the county. If built, a green industrial park could generate roughly $285,000 in property taxes during the first five years of operation and approximately 260 jobs over the first three years. Other findings:

- Interviews with a small sample of firms in the six industry clusters suggests that there is some interest in a green industrial park in Camden County, particularly among firms seeking to lower their costs for energy and water use and waste disposal, but distance to Norfolk and the lack of infrastructure remain obstacles.
- To be competitive, an industrial park in Camden County will have to differentiate itself from the existing industrial parks lying closer to core of the southern Hampton Roads region. Green development is one way to differentiate.

Environmental Quality

Camden County's low population density and lack of major industries has kept its air and water relatively clean, but an industrial park could affect the environment in several ways. Impervious surfaces, vehicle traffic, water and energy use, solid wastes, and emissions from facilities within an industrial park would all impact local environmental quality. The level of impact would depend on the size, location, design and operation of such a park. Reducing the environmental impact would require increased investment at the outset, but the added costs would be offset by future savings in energy and environmental management. Other findings:

- Managing stormwater and wastewater and restoring sensitive areas (e.g., wetlands) appear to be the main environmental challenges for a green industrial park. Loss of wildlife habitat may also be a concern.
- Environmental impacts could be mitigated through innovative site and building design and through the use of innovative technologies such as green roofs, water harvesting, and wastewater recycling. In addition, the creation of jobs in Camden County could reduce out-commuting and thus offset some of the environmental impacts, such as air pollution from vehicles.
- New facilities should be designed and operated to minimize energy and water use, reduce/recycle wastes, use renewable energy, minimize impervious surfaces, manage stormwater on-site, and restore wetlands.

Governance and Finance

Camden County's ability to issue more debt in the short- and medium-term is limited. Cost estimates for Phase I alone ranged from $40 to $60 million. Given the size of the county's revenue base, funding the infrastructure and development of a major industrial park would require assembling a financing package that relies heavily on external funding sources. No single existing grant program would likely cover the multi-million dollar investment shortfall needed for a project of this magnitude to advance. Other findings:

- The county must secure financing from multiple grants and external partnerships. Possible sources include the Clean Water Management Trust Fund, 21st Century designation from the Golden LEAF Foundation, North Carolina Rural Center, and county bonds.
- There is a gap between identified sources of funding and needs. Of the $40-60 million costs estimated for Phase I, approximately $35-55 million would need to come from external public and private sources.
- Any decisions regarding which governance and financing option(s) to pursue must be made in the context of the county's long-term strategies and goals for development and should grow out of a broader strategy for leveraging assets to broaden the tax base and create jobs and economic opportunities for its residents.

Community Engagement

The community engagement team solicited input from a diverse array of stakeholders, including business, government, and community-based organizations. The team interviewed over 50 local leaders and residents and conducted two local workshops. These activities helped define participants' perceptions of key local assets and challenges as well as their information needs. In addition, the team interviewed 50 businesses in the region to assess their interest in a green industrial park. In addition:

- Stakeholders identified various assets (available land, transportation corridors, etc.) and challenges (lack of infrastructure, lack of nearby retail, etc.) associated with building a green industrial park, as well as the types of businesses that might be promising candidates to recruit.
- Stakeholders also emphasized that economic benefit to the whole county should be the primary concern for an industrial park, followed by the reduction of any impacts on wildlife, stormwater runoff, or light, noise, or chemical pollution.

1. Introduction

In the spring and summer of 2008, the Golden LEAF Foundation funded a study to examine the feasibility of developing a green industrial park in Camden County, North Carolina. In this final report of the feasibility study, the term "green industrial park" (described in more detail below) refers to an assemblage of land created for the purpose of locating business, office, light manufacturing, warehousing, wholesaling flex space, or research activities that incorporates a number of environmental features. Such features—often referred to as green—typically minimize water and energy use, reduce stormwater runoff, and minimize or recycle waste products. In addition, some green industrial parks have attracted firms that produce green products (such as solar panels, wind turbines, and energy- or water-saving devices). Thus, an industrial park may be green in its design and operation or it may be green in the types of industries that operate there, or both.

This project was administered by the Institute for the Environment (IE) of the University of North Carolina at Chapel Hill (UNC). Research was conducted by UNC teams focused in three areas—business opportunities, environmental quality, and governance/finance. The Center for Competitive Economies in the Kenan-Flagler Business School's Kenan Institute of Private Enterprise analyzed local and regional economic climate as well as business opportunities in the region; IE's Center for Sustainable Community Design assessed the potential environmental impacts of a proposed green industrial park and ways to mitigate those impacts through green design and operations; and the Environmental Finance Center in the School of Government examined governance and finance options for the proposed park. In addition, a community engagement team from IE's Environmental Resource Program facilitated discussions that identified the interests and concerns of a range of potential stakeholders regarding potential development in Camden County. Finally, a team of landscape architects created conceptual images of what a green industrial park in Camden County might look like.

1a. What is a Green Industrial Park?

Business parks come in many shapes and sizes and go by different names. In general, they are assemblages of land created for the purpose of locating business, office, light manufacturing, warehousing, wholesaling flex space, and/or research activities in campus-like settings. They are also called office parks, industrial parks, or if they are oriented toward research laboratories and similar technological activities, research parks. Newer business parks consist of a mix of offices, shops and services, with higher densities and walkable town centers.

More recently, such parks have incorporated a number of green features that minimize water and energy use, reduce stormwater runoff, or recycle waste products. Other parks have attracted firms that produce green products such as solar panels, wind turbines, energy-saving light fixtures, or water saving devices. In general, industrial parks can be green in their design, operation, type of firms or products, or a mix of all three.

A green design and operations approach to industrial parks focuses on the buildings housing the businesses in the park, the infrastructure supporting those buildings (e.g., water and sewer), as well as the design of the park itself (i.e., its size and layout). For example, a park could be sited and designed to avoid sensitive areas, such as wetlands or wildlife habitat, and it might be made more compact than traditional industrial parks in order to minimize impervious surfaces (roofs, parking lots, etc.) and hence, stormwater runoff. A park could also be located close to residential or commercial areas to facilitate walking, the use of public transportation, or to minimize commuting distances. A more compact design would also reduce the costs of infrastructure. This type of park might attract firms that have embraced the principles of green design. That is, firms may opt to locate their green building in a green industrial park, rather than in a traditional industrial park.

Across the country, major companies including International Business Machines Corporation (IBM), Ford Motor Company, Gap Incorporated, Bank of America Corporation, Target Corporation, and Wal-Mart Stores Incorporated, are using green, high performance building practices in the planning and design of their headquarters and offices. Smaller companies are going green as well. For example, JohnsonDiversey Incorporated, a leading producer of environmentally responsible cleaning products, built its new distribution center to be as responsible as its products. The center, located in Sturtevant, Wisconsin, is energy and water efficient in its operations and constructed of recycled building materials. (See Case Study 1, pg. 38). Similarly, the Jean Vollum Natural Capital Center in Portland, Oregon, features such green amenities as a green roof, daylighting, and recycled materials, and was awarded Gold LEED certification (see Case Study 2, pg. 42). Green buildings can lower operating costs, particularly for energy and water use, and create a healthier working environment. In 2004, ProLogis—one of the world's largest developers, owners, and managers of warehouse/distribution facilities—completed a green, 458,000-square-foot, LEED-certified distribution center in Alsip, Illinois for Anixter International, an international wire and cable manufacturer. The building's green features have cut energy use by nearly 25 percent.

A 2007 study by the CoStar Group—a commercial real estate information company—asserted that green development will become almost a necessity as tenants, lenders, residents, and even investors push for sustainability. In addition, the study found that green buildings outperform their non-green peer assets in key areas such as occupancy, sale price and rental rates, sometimes by wide margins.[1] According to Kevin Doyle, president of Green Economy, a Boston-based firm that promotes an environmentally healthy workforce, the green industry in the United States in 2005 was valued at about $265 billion employing 1.6 million people. Green businesses have been growing at a rate of about 5 percent annu-

1 http://www.kennedyusa.com/PDFs/CoStar%20Study%20finds%20Energy%20Star%20LEED%20Bldgs%20Outperform%20Peers.pdf

2 Wingfield, Brian. "For Job Market, Green Means Growth." Forbes.com July 3,2007. http://www.forbes.com/2007/07/02/environment-economy-jobs-biz_cx_bw_0703green_greenjobs.html

Characteristics of Eco-Industrial Parks

- Single by-product exchange or network of exchange
- Clusters of recycling businesses, environmental technology companies or companies making green products
- Environmental theme (e.g., solar powered park)
- An industrial park with "green" infrastructure
- Mixed-use development (e.g., a mix of industrial, office and retail uses)

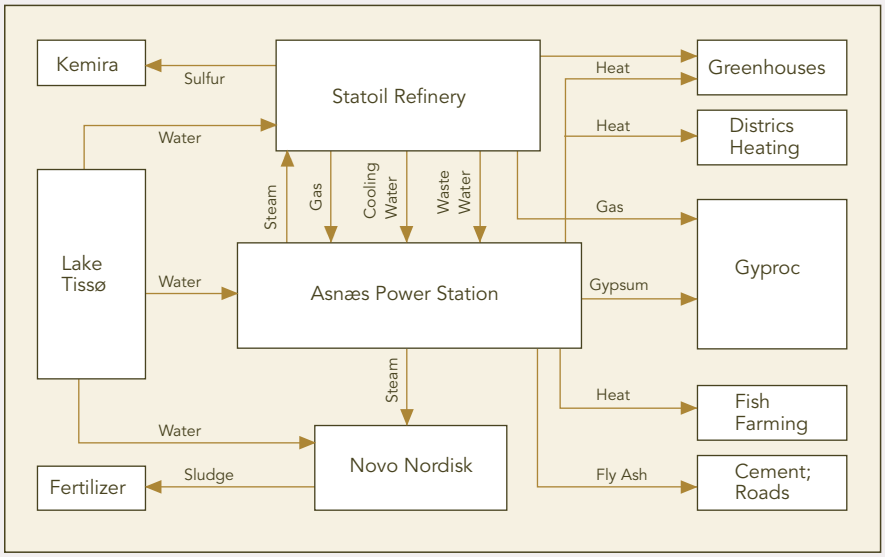
ally during the last three years, Doyle says, whether it is from existing companies revamping their operations, such as Xerox Corporation and Herman Miller Incorporated, or from new companies with a business model that emphasizes environmental performance.[2]

An eco-industrial park (EIP) is similar to a green industrial park, but it includes a collection of complementary firms or industries that are networked to reduce energy and material use. The main distinction is that an EIP involves a level of coordination or cooperation among industries—an industrial symbiosis in which energy and materials produced by one industry are consumed as inputs by another. The industries and processes are seen as interacting systems rather than isolated components in a system of linear flows. The idea is to create a network of companies that collaborate through resource recovery and waste-sharing systems producing a symbiotic relationship to improve their environmental and economic performance within a region.

EIPs employ the concepts of industrial ecology, in which industrial systems operate in a similar fashion as natural ecological systems. Under this arrangement, companies locate in proximity to one another to take advantage of resource exchange, waste and energy streams, and knowledge exchange. By cooperating with each other in an industrial ecosystem, businesses can improve their combined environmental performance by measures that could increase profit margins and potentially advance economic development.

The development of EIPs is a relatively new practice. One of the first examples is in Kalundborg, Denmark, where a web of energy and waste exchanges has developed between the local city administration, a power plant, a refinery, a fish farm, a pharmaceuticals plant and a wallboard manufacturer (Figure 1.1). Kalundborg, however, was an unplanned EIP that developed over more than 20 years into what it is today.

Figure 1.1
Schematic of material and energy exchanges at Kalundborg, Denmark



While the concept of an EIP sounds promising, the practice has proved challenging. Recruiting companies to participate and creating effective exchange systems has proved problematic. Some of the barriers to building an EIP include:

- Technical—exchanges among industries can be either infeasible or not understood, or necessary information is not available at the right time,
- Financial—exchanges may be economically unsound or too risky,
- Organizational—exchanges may not fit a company's corporate structure, and
- Legal—concerns over liability may prevent even proven exchange processes.

In the United States, EIPs were promoted by the President's Council on Sustainable Development under the Clinton administration. This program established four pilot projects, one of which was the Cape Charles Park. (See Case Study 3, pg. 45). This park was in operation for over 10 years, outlasting the three other pilot projects. Its demise as an EIP was mostly due to its location in a remote, rural area that made it difficult to recruit and retain companies.

Organization of the Report

The rest of this feasibility report is divided into six parts.

- Section 2 examines the economic conditions and business opportunities in Camden County, including the types of industries that might be attracted there.
- Section 3 describes the potential environmental impacts of a green industrial park, explains how those impacts could be mitigated and offers guidelines for the development of such a park.
- Section 4 describes the options for financing green development in Camden County.
- Section 5 describes the community engagement activities of the study team.
- Section 6 provides drawings that convey a vision for future green development in Camden County, based on research findings and community input.
- Section 7 summarizes the conclusions of this analysis.

Figure 1.2 presents a map of Camden County, NC, including an indication of the geographic area in which the study primarily focused.

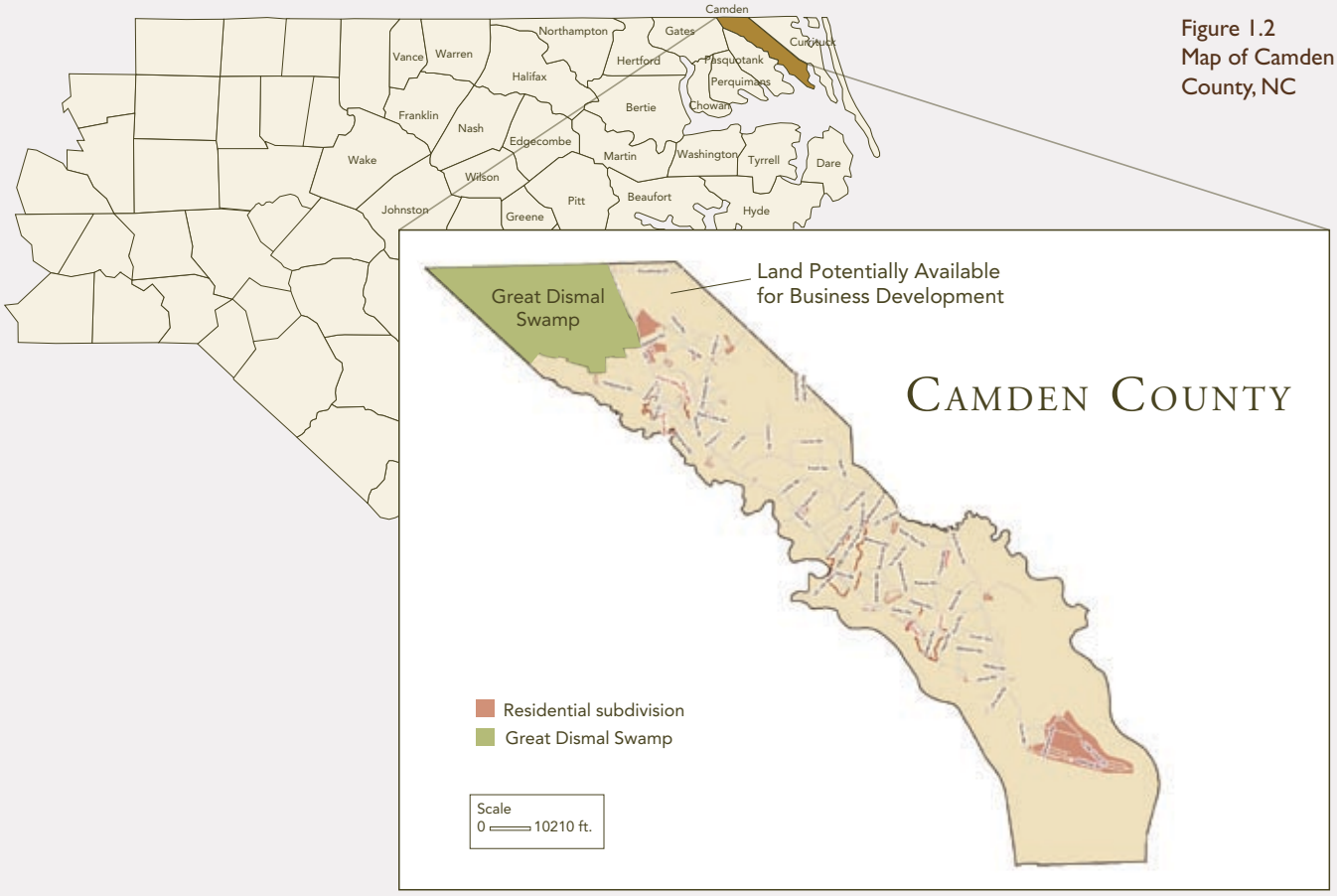


Figure 1.2
Map of Camden County, NC

2. Opportunities for Business Development

This section presents the results of our demographic and economic scan of Camden County, North Carolina and an industry cluster analysis. The cluster analysis identifies industry groups that the research region demonstrates as having current and emerging competitive advantages, including industry clusters that Camden County may find attractive due to synergies with the adjacent Hampton Roads economy.

2A. Camden County Demographic and Economic Scan

This demographic and economic scan for Camden County is a comprehensive overview of both temporal and current socioeconomic data that provides background information essential to understanding the local and regional economy including an overview of data important to broadly defined economic development planning. However, it cannot capture every indicator or level of detail for all data sections. The demographic and economic scan includes the following sections: population; education; labor force, employment and income; business climate (sites and infrastructure); and quality of life indicators. General observations and notes on the measures provided are included within the economic scan.

Population

Camden County has experienced a steady population increase since the mid-1980s. Between 1990 and 2000, the county population grew by 16.6%. The current decade already outpaces the previous. one: Between 2000 and 2006, the growth rate reached 35% (Figure 2.1) and exceeds that of the state as a whole, as well as all of its neighboring comparable counties. As of July 2006, Camden County's population reached 9,298. By 2030, The North Carolina State Data Center projects population growth will reach 16,241, or growth of an estimated 2,898 persons per decade.

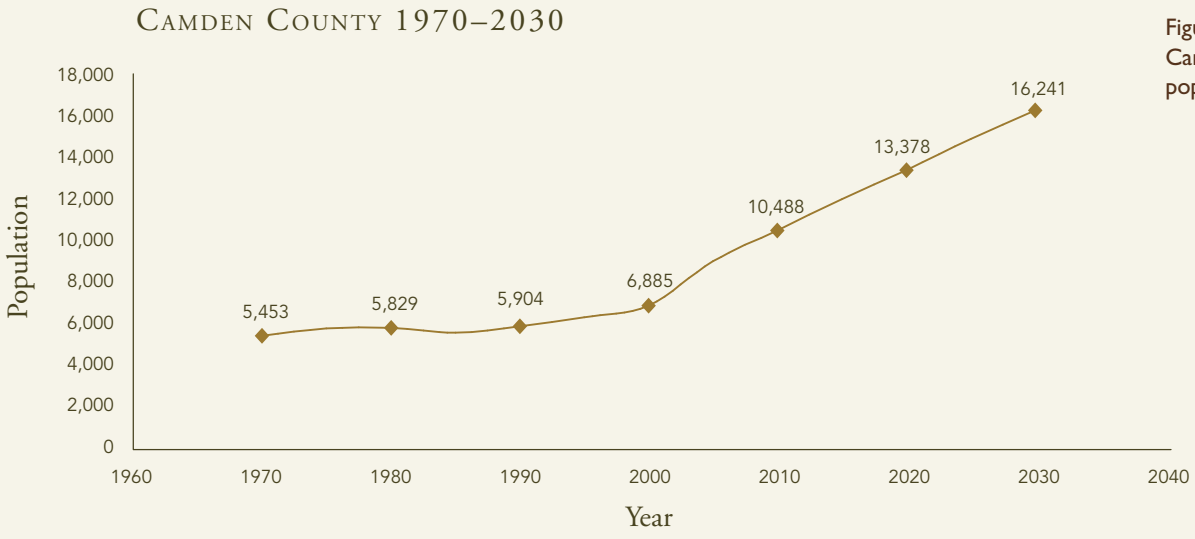


Figure 2.1
Camden County population growth

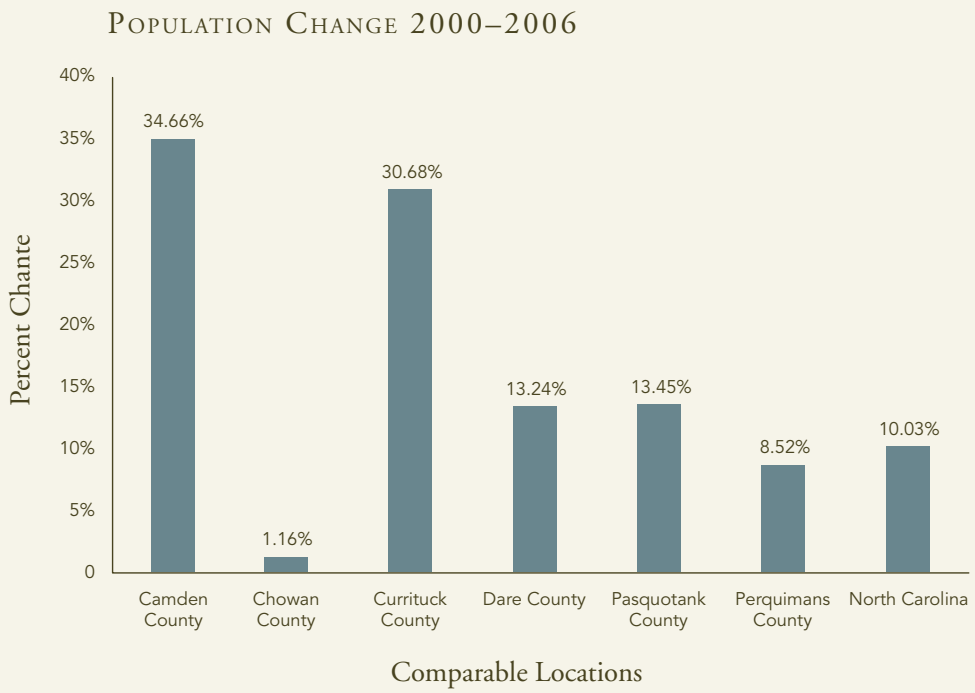


Figure 2.2
Population change in Camden and surrounding counties

Although Camden is one of North Carolina's smaller counties, in terms of population, it is experiencing significant growth compared to counties throughout the state. Camden is the tenth fastest growing county in North Carolina, with a growth rate of 57% from 1990 to 2006. This significantly exceeds the state growth rate of 21.3% (Figure 2.3). Camden County has a relatively low population density per square mile relative to surrounding counties and the state average, although this density is increasing at a steady pace. According to the North Carolina State Data Center, Camden County's land area is 240 square miles and the county had a population density of 28.61 persons per square mile in 2000. By 2005, population density estimates rose to 37.48 persons per square mile. Using conservative population estimates, the Data Center projects that Camden County's population density will increase to 67.48 persons per square mile by 2030.

Figure 2.3
Population growth in Camden County compared to surrounding counties

Population and Growth

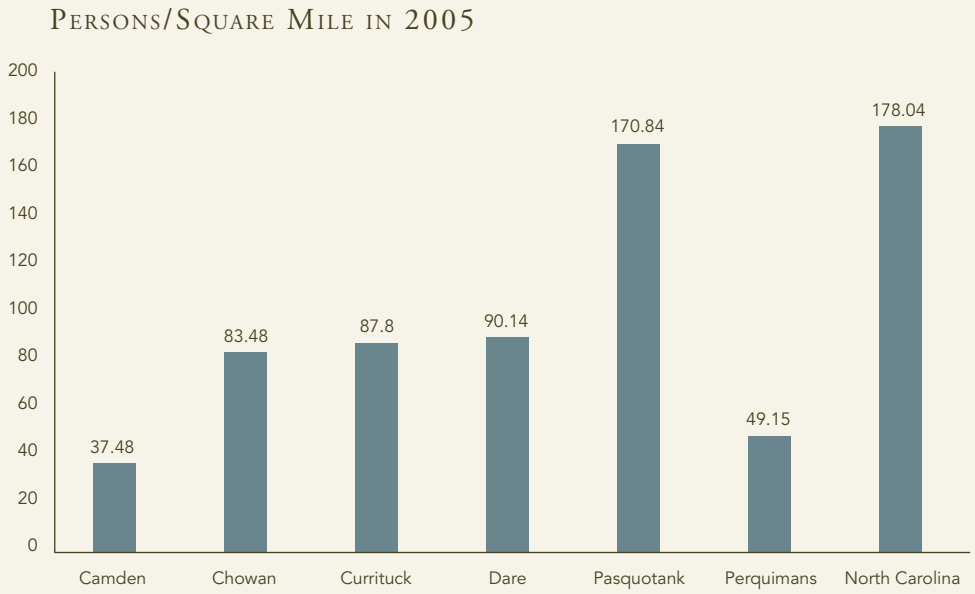
Population July 2006

	State Rank	Population
Pasquotank	60	39,968
Dare	67	34,730
Currituck	77	23,580
Chowan	88	14,677
Perquimans	92	12,464
Camden	**97**	**9,298**

Population Change 1990–2006

	State Rank	% Population Change
Currituck	6	73.0%
Camden	**10**	**57.0%**
Dare	16	49.2%
Pasquotank	40	26.5%
Perquimans	59	18.1%
Chowan	84	8.8%
North Carolina	–	21.3%

Figure 2.4
Population density in Camden and surrounding counties



Education

Although the proportion of Camden's residents who received high school diplomas is on par with the state average, a significantly smaller percentage of county residents pursued higher degrees. The 2000 U.S. Census found that in Camden County, 82.1% of those twenty-five and over are high school graduates—thirteenth highest in the state—which compares favorably to North Carolina's average of 78.1%. When comparing residents with at least a bachelor's degree, 16.2% of Camden residents have an advanced degree—thirty first in the state—compared to 22.5% across the state.

Figure 2.5
Educational attainment for Camden County compared to surrounding counties

Educational Attainment

High School Diploma or More

	State Rank	% Pop. 25+
Dare	2	88.6%
Camden	**13**	**82.1%**
Currituck	29	77.6%
Pasquotank	32	76.8%
Chowan	50	73.1%
Perquimans	56	71.9%
North Carolina	–	78.1%

Bachelor's Degree or More

	State Rank	% Pop. 25+
Dare	9	27.7%
Chowan	29	16.4%
Pasquotank	29	16.4%
Camden	**31**	**16.2%**
Currituck	49	13.3%
Perquimans	61	12.3%
North Carolina	–	22.5%

Source: US Census 2000 and Indiana Business Research Center

According to the North Carolina Department of Commerce, the county currently ranks thirty-eighth in the state for average SAT scores, suggesting significant potential for an increase in the county's future educational attainment levels. Compared to surround-

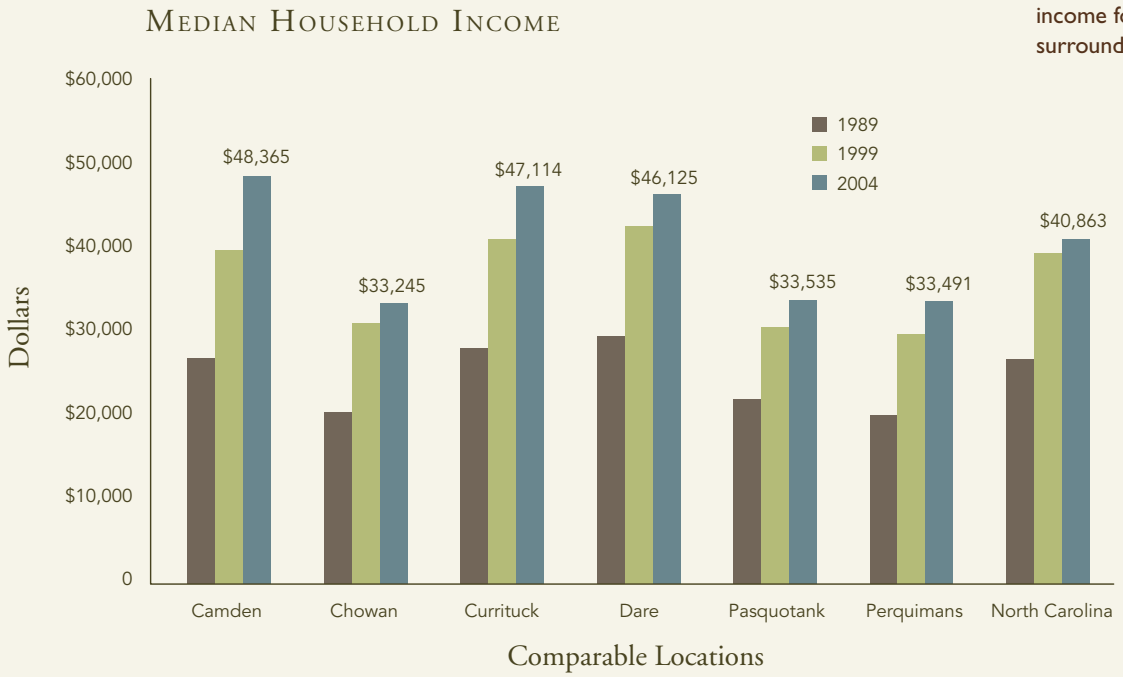
ing counties, Camden has a slightly higher college degree attainment ranking. However, Camden's current proportion of college-educated residents could affect the county's ability to attract knowledge-based industries with higher wage employment opportunities.

Labor Force, Employment and Income

Household Income

In 2004, the North Carolina Department of Commerce found that Camden County ranked fifth in the state for the highest median household income. Median household income in Camden exceeded not only the state average, but also the median income level in all of its peer counties. Most of the employment income of Camden County residents is attributable to higher wage employment outside the county and/or outside the state.

Figure 2.6
Median household income for Camden and surrounding counties



Unemployment and Poverty

In the past few years, Camden County has experienced unemployment and poverty rates that fall below the state average. In 2006, Camden ranked seventy-forth out of 100 counties in the state for unemployment, placing it in the top 25% of counties with the lowest unemployment. Camden's unemployment is slightly below that of the state with unemployment rates at 4.3% and 4.8% respectively for 2006.

As of 2004, the county also had the second lowest poverty rate in the state at 8.7%. In 2004 the state poverty rate was 13.8%. Figure 2.7 below shows how Camden County compares with nearby counties and the state for 2004 and 2006.

Very low unemployment and poverty rates would suggest that Camden County is experiencing a relatively tight labor market. However, unemployment rates may be low because they apply to the available workforce and do not take into account people who are underemployed or are no longer seeking work. Furthermore, the rates do not

consider the type of work available and do not reflect the quality of employment taken by the workforce. Unemployment is also calculated on the residential location of workers and a majority of Camden County workers is employed outside the County.

Figure 2.7
Unemployment and poverty rates for Camden County compared to surrounding counties

Unemployment and Poverty

Unemployment Rate (2006)

	State Rank	% Pop Unemployed
Perquimans	48	5.2%
Chowan	52	5.0%
Pasquotank	52	5.0%
Dare	66	4.5%
Camden	**74**	**4.3%**
Currituck	99	3.5%
North Carolina	–	4.8%

Poverty Rate (2004)

	State Rank	% Pop in Poverty
Chowan	25	16.9%
Pasquotank	27	16.8%
Perquimans	35	16.0%
Currituck	96	9.6%
Camden	**99**	**8.7%**
Dare	100	7.8%
North Carolina	–	13.8%

Source: US Census 2000 and Indiana Business Research Center

Wealth: Income and Wage Discrepancy

As demonstrated above, 2004 data show that Camden County has a high median household income level when compared to other counties in North Carolina. However, in 2005 Camden's per capita personal income was $27,167—thirty-ninth in per capita personal income in the state—which represents a -$5,067 variance from the North Carolina average per capita personal income of $32,234. A discrepancy between income and wages exists as the county had the fifth highest weekly wage in the state at $797 per week. It is unclear why such a discrepancy exists, but it may relate to a larger average household size in Camden County. This weekly average wage substantially exceeds that of the neighboring counties. Furthermore, Camden County exceeded the state average weekly wage by $53.

Figure 2.8
Per capita income and weekly wage for Camden and surrounding counties

Personal Wealth and Wages

Per Capita Personal Income (2005)

	State Rank	Per Capita
Dare	10	$33,463
Currituck	20	$29,982
Chowan	29	$28,456
Camden	**39**	**$27,167**
Perquimans	52	$25,996
Pasquotank	74	$24,013
North Carolina	–	$32,234

Average Weekly Wage (2006)

	State Rank	Weekly Wage
Camden	**5**	**$797**
Pasquotank	36	$604
Chowan	54	$577
Dare	60	$567
Currituck	65	$559
Perquimans	93	$507
North Carolina	–	$744

Source: North Carolina Department of Commerce

Low wages cause many Camden County residents to look outside the county for employment opportunities. Not unlike many of the neighboring counties, a significant number of Camden's residents commute out of the county and the state for work. Over 76.3% of workers commute to jobs outside of the county, compared to only 26.4% on average in the state. Neighboring counties experience similar percentages of commuting workers due to their close proximity to jobs in Virginia.[1]

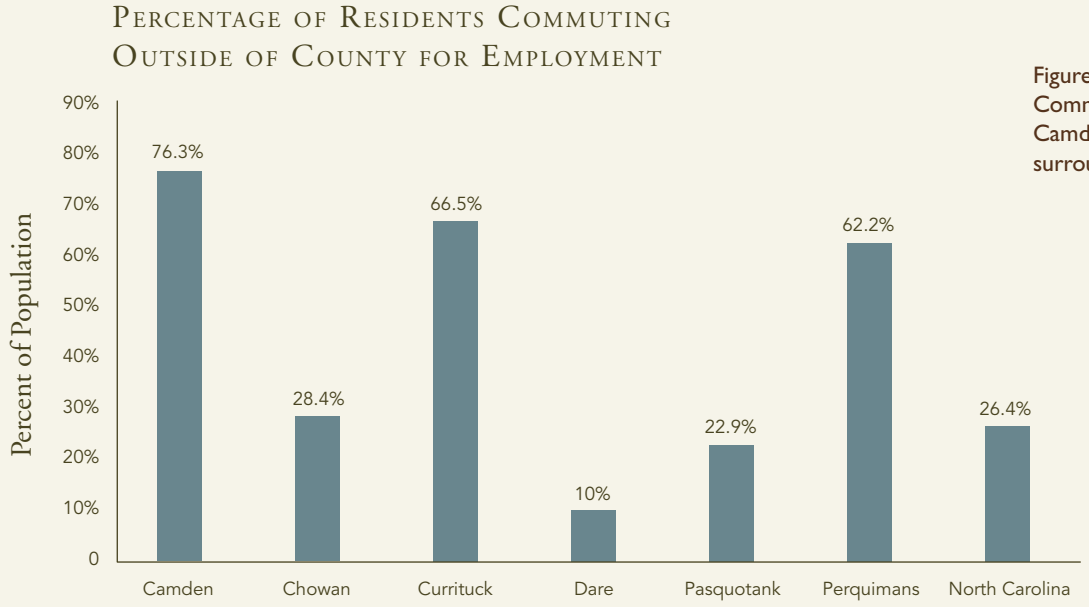


Figure 2.9
Commuting rates for Camden County and surrounding counties

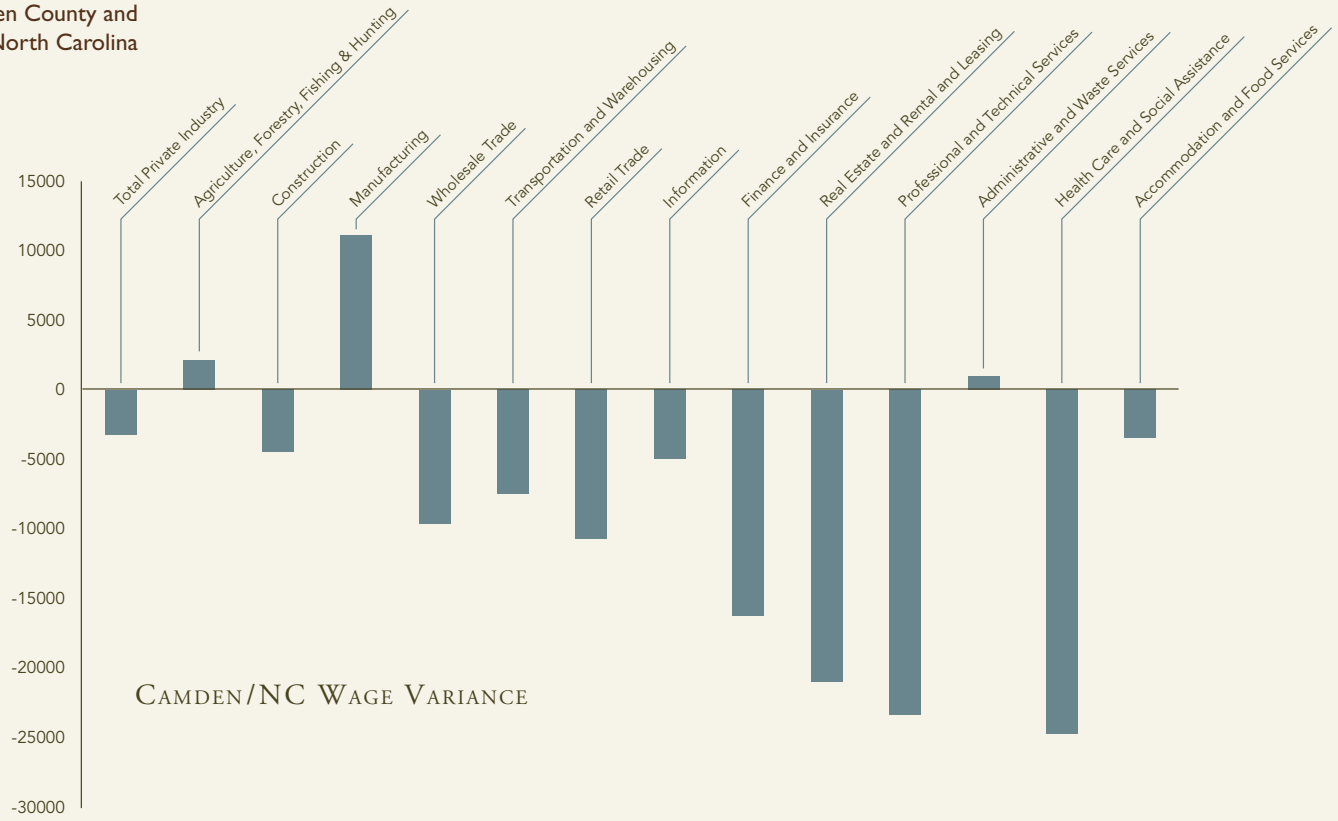
Figure 2.10
Personal income – Camden County vs. surrounding counties

1 Figure 2.8 highlights a data anomaly in accounting for Camden County's income. Per capita income is lower than the state average and ranks thirty-ninth in the state, while median household income was much higher, ranking fifth in the state in 2004 and eight in the state in 2005, respectively. The Bureau of Economic Analysis considers per capita personal income to be a more comprehensive measure of income. It is possible that Camden County does not score as well as other counties when utilizing this more comprehensive measure versus rankings based on median household income. It is also possible that Camden County's small population base, relative to other counties, may skew mean data calculations like per capita income in such a manner that comparisons to more populous counties are difficult. A complete description of income definitions may be found on the BEA's website at http://www.bea.gov/regional/ docs/spi2002/household_ income.cfm.

Analysis of industry wage patterns shows that Camden County experiences a significant wage variance between average industry wages for the county and the state. This supports the finding that personal income in Camden County is lower than the state average. The chart below shows wage variance between Camden County and North Carolina for each major industry sector.

The only industries which represent a positive wage variance are agriculture, forestry, fishing and hunting, as well as administrative and waste services. Manufacturing jobs in Camden offer significantly higher than state average wages. It is challenging to draw inferences from Camden's employment data, given the small sample and high worker commute rate. For example, the manufacturing wage is higher than the state average, but manufacturing only represents a workforce of seventy-seven people, most of whom are employed by two small manufacturing firms.

Figure 2.11
Wage variance between Camden County and North Carolina



Employment in the county is concentrated in the retail services industry, which has shown significant growth over the last decade, nearly doubling in size between 1995 and 2007. Manufacturing has shown positive growth over this time period as well, with employment up from nineteen to seventy-seven. While the number of jobs in professional services has tripled, construction, accommodations, and food services have declined.

Private Sector Employment 1995, 2007

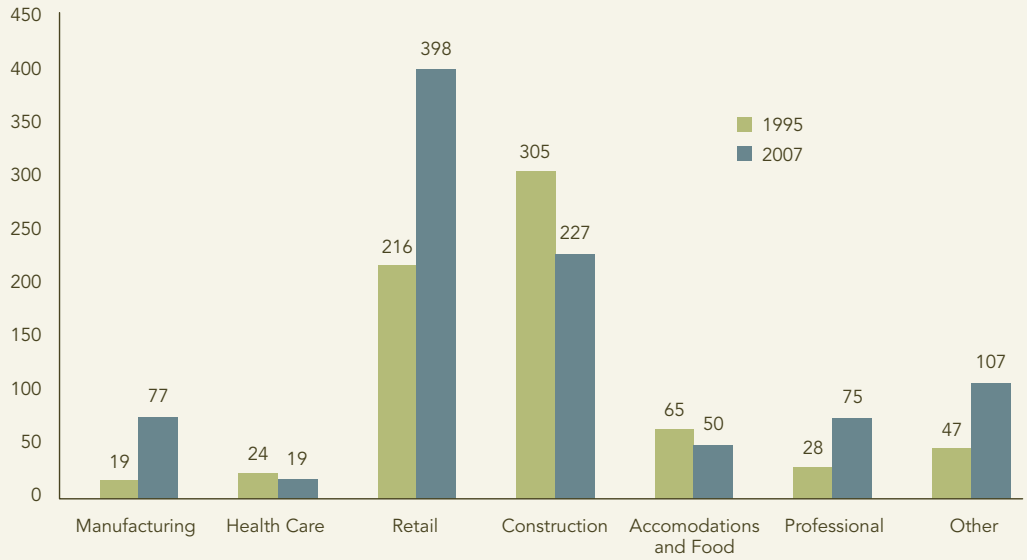


Figure 2.12
Private sector employment in Camden County, 1995 and 2007

Current employment figures for Camden County indicate that the highest concentrations of employment are in retail, construction, administrative, and waste management. Forestry and agriculture constitute another significant portion of employment.

Camden Employment

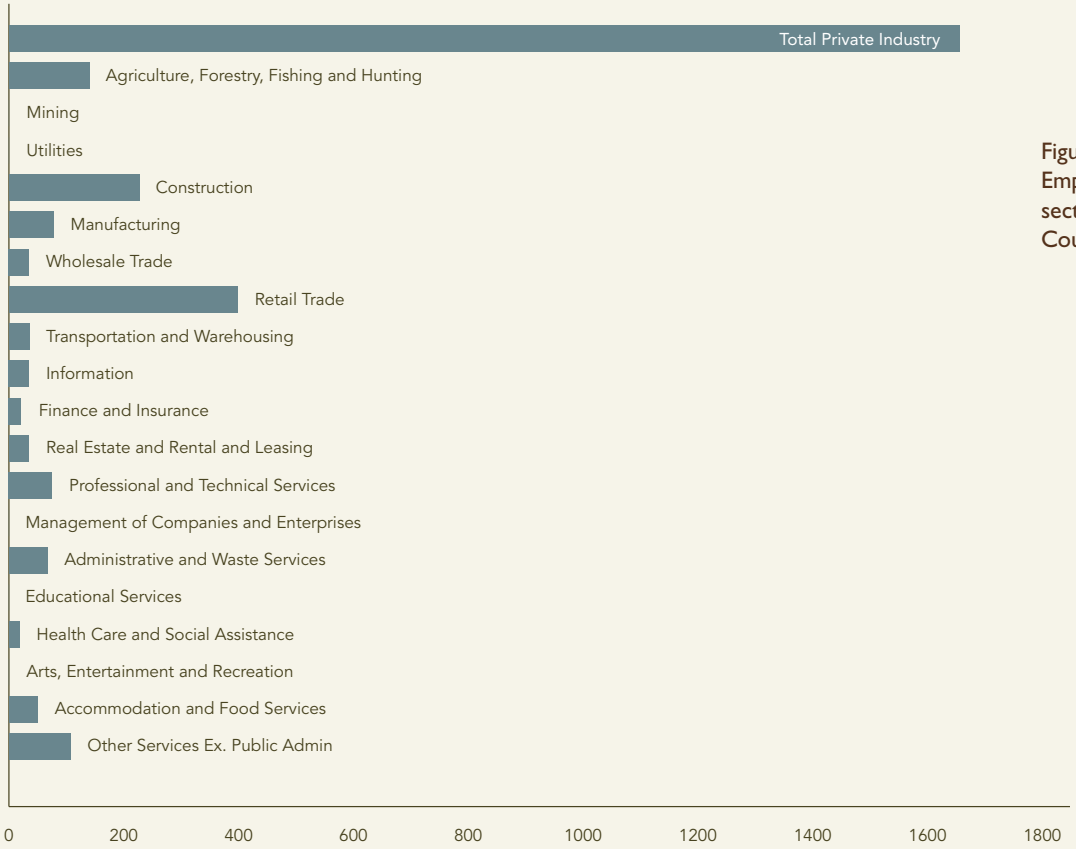


Figure 2.13
Employment, by sector, in Camden County - 2007

Figure 2.14 indicates the predicted growth rates of various industries in Camden County, as measured by annualized growth rate projections. While natural resource and mining will experience negative growth, sectors such as professional services, financial activities, and leisure and hospitality show above 2.75% growth. Education and health services had declined in wages and job availability in the past, but are expected to have significant growth over the next several years.

Figure 2.14
Growth rate of various industries in Camden County

Camden County's Resident Labor Resources

For counties like Camden, with high commute rates, place of employment data will underestimate the true labor force. In order to capture industry sectors for which the county already has a skilled labor force in place, but that currently are commuting elsewhere, it is necessary to compare the two sources of data.[2]

Figure 2.15 presents the difference between place-of-residence data gathered by the U.S. Census for 2000 ("jobs of residents") and place of employment data ("in-county jobs") gathered by the North Carolina Employment Security Commission. As the table illustrates, Camden County has larger excess labor supplies in manufacturing, retail trade, transportation, healthcare, services, and public administration. This suggests that the county has the relevant labor pool to support companies in these industries.

2 Workforce data is collected by place of residence and by place of employment. Place-of-residence data is gathered by the Decennial Census and inventories the industries and occupations of persons living in the county. Place of employment data inventories employment and wage data for businesses physically located in an area, and is gathered each quarter from businesses in fulfillment of their federal unemployment insurance reporting requirements by the U.S. Bureau of Labor Statistics' Census of Employment and Wages. Theoretically, place-of-residence and place–of-employment data would be identical if all residents of a jurisdiction worked where they lived. However, since commuting between jurisdictions is a common occurrence, place-of-residence and place-of-employment data often will differ.

NAICS	NAICS Description	Jobs of Residents (located anywhere)	In-County Jobs	Labor Difference
11	Agriculture	116	106	10
21	Mining	0	0	-
22	**Utilities**	**56**	**11**	**45**
23	Construction	265	295	(30)
31-33	Manufacturing	317	20	297
42	Wholesale Trade	8	54	(46)
44-45	Retail Trade	443	281	162
48-49	Transportation	182	27	155
51	Information	25	31	(6)
52	Finance	97	18	79
53	Real Estate	52	32	20
54	Science/Tech	104	66	38
55	Management of companies and enterprises	0	0	-
56	Administration	136	52	84
61	Education	337	244	93
62	Healthcare	332	110	222
71	Arts	20	1	19
72	Hospitality	74	62	12
81	Misc. Services	163	57	106
92	Public Admin	372	110	262
	TOTAL	**3,099**	**1,577**	**1,522**

Figure 2.15
Place of residence vs. place of employment

Retail Sales and Fiscal Impact of Retail

Camden County's low population density coupled with a high commuter rate has limited the potential for retail development in the county. The lack of retail options forces many residents to not only work, but also shop, outside the county. Shopping outside the county results in a leakage of retail sales dollars and accompanying local-option sales tax revenue. In North Carolina, the 2.5% local-option sales tax revenue is returned to counties on both a point of delivery and per capita basis. In fiscal year 2006-2007, Camden County received approximately $777,000 in local-option retail sales tax revenue from point of delivery of sales (i.e., sales made in Camden County). In total, the per capita retail sales for Camden County is less than the state average. When we control for income levels, the county loses approximately 61% of its retail sales to other counties.[3] This means that approximately sixty-one cents of every dollar spent by Camden County residents on retail is spent outside the county. This retail sales loss represents $1.2 mil-

3 Retail sales leakage is measured as the inverse of an area's retail pull factor. Retail pull factors are a measure of the amount of retail sales a local area is capturing relative to a larger base area. A pull factor of 1 is average, while anything less than 1 represents a leakage and anything greater than 1 represents retail sales capture from outside the area. For this analysis, we utilize Camden as the study area and North Carolina as the base area. We control for Camden's per capita income, which is lower than the state average. Fiscal year 2006-07 taxable sales data and county sales tax revenue disbursements from the NC Dept. of Revenue were used in this analysis. Pull factor and retail sales leakages are good approximations for the retail performance within a county. Llyod (1995) provides a good description of calculating retail pull factors at http://www.joe.org/joe/1995april/iw2.html

Figure 2.16
Camden County
retail sales loss

Retail Category	Leakage Rate
Apparel	80%
Automotive	77%
Food	82%
Furniture	96%
General merchandise	73%
Lumber and building material	51%
Unclassified	35%
Total	**61%**

lion in annual sales tax revenue. As Figure 2.16 demonstrates, the retail sales loss rate is highest in apparel, automotive, food, and furniture.

Due to the concentration of shopping centers and regional malls in urban areas, it is unrealistic for rural counties such as Camden County to capture 100 percent of residents' retail sales dollars. However, increasing the presence of retail development would provide a fiscal benefit to the county.

Business Climate

This section provides a brief overview of business sites and infrastructure present in Camden County. A more in-depth analysis of the current status of these components of the business climate is needed to help county leaders attract new employment opportunities and diverse industry investment.

Business Sites

An integral part of industry development is fostering a good business climate. Packaging and pre-approving high quality building sites can help local economic developers market development-ready opportunities to clients. In North Carolina, the Department of Commerce established the Certified Sites Program to develop a statewide inventory of sites that meet specific business development criteria. The department's goal is to enhance the state's competitive edge by creating "full-service, fully tested ready-to-develop business sites for clients.

Through the ncsitesearch.com website, potential clients can view site profiles, which include site location, size, zoning designation, current use, transportation access, and utility service. For Camden County, there are no listed sites that are officially certified by the Department of Commerce. In fact, there is only one site in the county listed in the database: a forty-two-acre parcel that was previously used for wood products, although it does not currently list a zoning designation for the site. Located on a fourteen-foot deep spur of the Dismal Swamp Canal it is considered a barge site. The site is just off of U.S. Highway 17 and is equipped with all major utility services, with the exception of natural gas. In addition, there are no available buildings listed in this database to attract new industry.

To maximize the county's future potential for industrial and commercial development, Camden County's leaders may want to undertake a comprehensive business-site inventory to better understand the region's development opportunities. By packaging and promoting prime development sites, Camden County can foster a business climate that

attracts the type of development the county leaders are looking for. A further discussion of existing industrial parks occurs in the industry cluster analysis on page 34.

Infrastructure

Again, a comprehensive inventory of the county's infrastructure will add greatly to the county's strategic economic development plan. The one business site listed with the Department of Commerce has electric, water, septic, and telecommunications infrastructure in place, but is lacking natural gas service. It seems likely that any potential business sites in the county have variable states of infrastructure development. Water and sewer systems tend to be the infrastructure systems most in need of current update or development, owing to their long-term lifespan and the lack of public investment in these systems in rural areas. However, with the rising importance of technology sectors, investment in telecom infrastructure will be of the utmost importance to counties like Camden that may be interested in attracting and cultivating knowledge-based industries.

Transportation infrastructure is another aspect of infrastructure development that cannot be neglected by counties pursuing economic development. In Camden County, Highways 158, 34, and 17 are the primary arteries, connecting the county north to Norfolk, Virginia and east to Currituck County and the Outer Banks. Although there are both positive and negative consequences to increasing connectivity within the county as well as to the surrounding counties, building new and improving existing transportation infrastructure is often in the best interest of counties undertaking comprehensive economic development strategies. Counties may couple land-use plans, design guidelines and zoning with curb cut and access restrictions to mitigate traffic congestion and minimize sprawling development along the newly improved transportation corridors. Such strategies can minimize negative environmental consequences associated with improved highway networks.

Quality of Life

Quality of life indicators may include any type of asset that enhances the living conditions of residents within Camden County. In particular, access to medical services, day care facilities, green spaces, and community amenities are important quality-of-life indicators for Camden County.

Medical Services and Child Care

Camden County has a slightly below average set of ratios for population to medical professionals, considering the size of the county. Camden County has one physician for every 9,298 residents, one registered nurse for every 530 residents, and no dentists.

Figure 2.17
Density of medical professionals in Camden County compared to surrounding counties

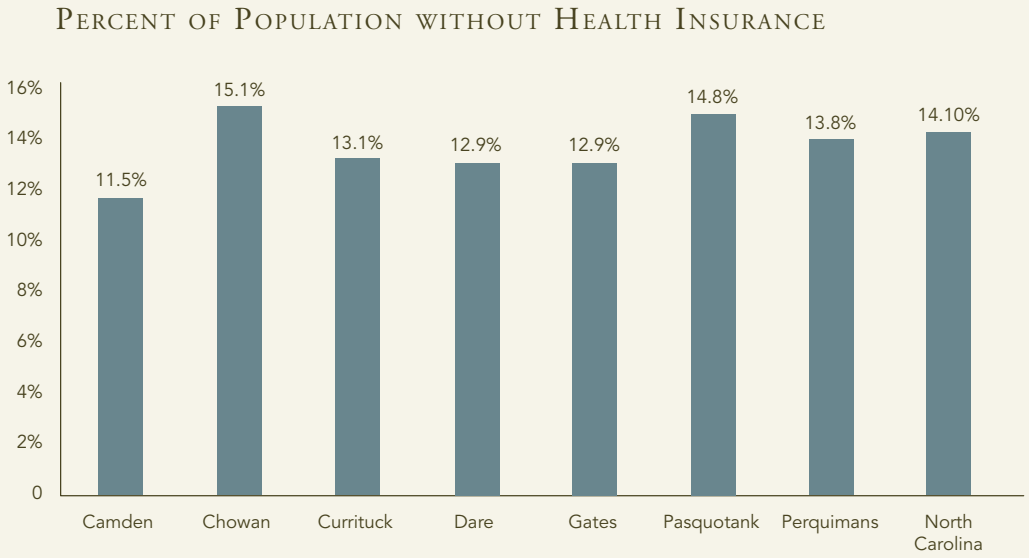
Medical Professionals per County (2005)

Population/Physician Ratio		Population/RN Ratio		Population/Dentist Ratio	
Camden	**9,298**	**Camden**	**530**	**Camden**	–
Chowan	524	Chowan	98	Chowan	3,618
Currituck	3,930	Currituck	354	Currituck	4,597
Dare	681	Dare	155	Dare	1,740
Pasquotank	396	Pasquotank	86	Pasquotank	3,240
Perquimans	6,232	Perquimans	467	Perquimans	6,077

Source: North Carolina Department of Commerce

The county also has a lower percentage of residents without health insurance compared to neighboring counties and the state.

Figure 2.18
Populations lacking health insurance in Camden and surrounding counties



Considering Camden County's growing population, child care facilities may become an increasingly important. Currently, the county has only five licensed facilities, with a combined capacity to care for 244 children. In 2005, 521 preschool aged children (0 to four years old) resided in Camden County. As the county grows, child care represents both a burgeoning employment opportunity, as well as a potential stumbling block to consistent, stable growth.

Figure 2.19
Child care facilities in Camden and surrounding counties

Child Care Facilities

Licensed Facilities		Capacity	
Camden	**5**	**Camden**	**244**
Chowan	18	Chowan	949
Currituck	20	Currituck	623
Dare	39	Dare	1,544
Pasquotank	64	Pasquotank	2,162
Perquimans	8	Perquimans	214

Source: North Carolina Department of Commerce

Green Space and Community Amenities

In addition to medical professionals and child care facilities, green space and community amenities are often important quality-of-life indicators that attract new residents and supplement economic development strategies.

Camden County offers four county parks and recreational areas, along with easy access to the Dismal Swamp Canal State Park and the Great Dismal Swamp, one joint community library, and four county schools. Furthermore, the county offers close proximity to Norfolk International Airport, a major hub within an hour of the county line, as well as

Camden County Amenities

Type	Amenities
Schools	Grandy Primary School
	Camden Middle School
	Camden High School
	CamTech High School
Parks	Community Park
	Senior Walking Trail
	Dismal Swamp Canal
	Shiloh Landing Boat Launch
Library	East Albemarle Regional Library
Medical Services	Albemarle Hospital
	Chesapeake General Hospital
Airports	Norfolk International Airport

Figure 2.20
Camden County amenities

close access to two hospitals. For a small county, Camden County offers a good selection of community amenities, as well as access to personal services.

2b. Economic And Demographic Scan Conclusion

This economic scan indicates that Camden County possesses many of the same opportunities and challenges of other rural North Carolina counties. Camden County has a small geography and small population, but is rapidly developing into a lower cost bedroom community for the south Hampton Roads region. The county lacks the commercial development options and job opportunities for its citizens, but does possess an available workforce and demand for retail development to begin to make improvements in commercial development and other job creation areas. The economic scan suggests the county should:

- Designate commercial areas for professional services, financial activities, and leisure and hospitality, which are all expected to show above 2.75% growth. Education and health services have declined in wages and job availability in the past, but are expected to undergo significant growth over the next several years.
- Work to increase the presence of retail development to provide a fiscal benefit to the county.
- Create a comprehensive business site inventory to better understand and market the region's development opportunities. This inventory should be accompanied by a comprehensive inventory of the county's infrastructure for economic development. This infrastructure should include plans for working with the North Carolina Department of Transportation on connectivity and improving existing transportation infrastructure to best serve the county's economic development needs.

The industry cluster analysis further describes Camden County's business development opportunities.

2c. Camden Industry Cluster Characterization

Introduction

This section of the report contains an industry cluster analysis for Camden County in the context of the Hampton Roads metropolitan area, including Virginia counties in the southern portion of the Hampton Roads economic sub-region. This analysis will identify industry groups for which the research region demonstrates current and emerging competitive advantages, including identification of industry clusters for which Camden County may benefit from synergies with the adjacent Hampton Roads economy.

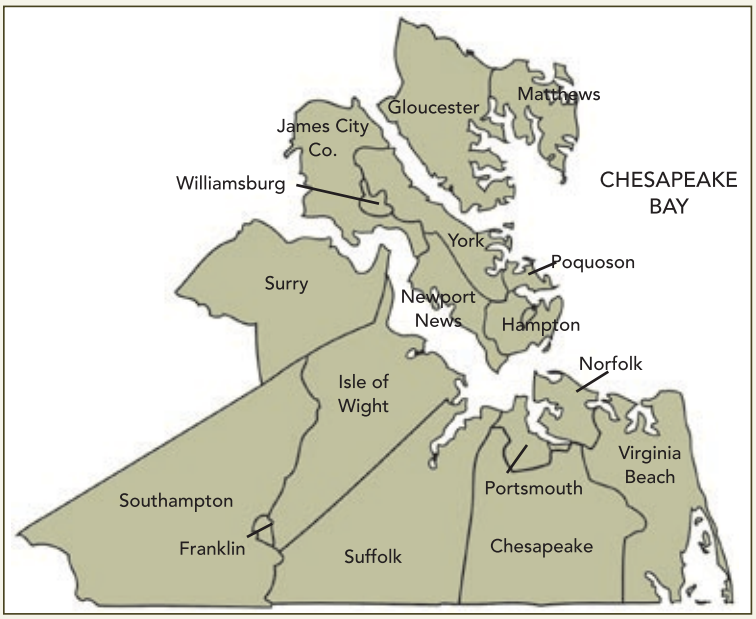


Figure 2.21
Map of areas included in Hampton Roads region

Industry clusters consist of co-located, interconnected business sectors. The major types of industry clusters are buyer/supplier relationships and research and development (R&D) institutions with business sectors that benefit from their close proximity. Clusters arise out of the linkages that span across industries in a particular location.[4]

The concept of industry clusters reaches back to Alfred Marshall's (1920) "industry districts" in which he noted the location of small, specialized firms that benefited from each other's labor, knowledge, and skills. Michael Porter's *Competitive Advantage of Nations* (1998) revived this notion to argue that the economic advantage of areas is derived from the development of inter-related industries benefiting from each other's labor, production inputs, or research activities.

Clusters are artificial constructs created by the manipulation of data on individual industries.[5] Conceptually, a cluster is a group of businesses that are connected together in meaningful ways, most commonly, by trade (or in technical jargon, by input-output linkages),

4 Porter, *The Competitive Advantage of Nations*, 1998.

5 The Center for Competitive Economies in the Kenan-Flager Business School at UNC-Chapel Hill utilizes "national benchmark clusters" identified by former UNC Professor Ed Feser. Dr. Feser's methodology uses a quantitative procedure to manipulate national-level data. An intuitive explanation of the procedure is that it groups together industries based on the strength of their sales of inputs and outputs to each other. The resulting cluster is likely to contain businesses belonging to some very different industries. Ed Feser's National Benchmark Clusters are available at http://www.urban.uiuc.edu/faculty/feser/publications.html.

shared labor pool, or utilization of similar technologies. Industries comprising a cluster likely have similar needs in terms of infrastructure and business support services, and by definition, seek proximity to other members of the cluster. For those reasons, clusters are an attractive focus for economic development policy. Public provision of (or subsidy for) cluster-specific infrastructure and services can be justified because of the appeal of the infrastructure and services to many businesses. The successful development of a cluster is likely to result in the creation of many jobs, large payrolls, and related positive outcomes.

Identifying Camden County's Industry Clusters

In practice the identification of county-level industry clusters is problematic for several reasons.

1. Most counties operate within the context of a regional economy; therefore, it is best to examine industry clusters on a regional basis to gain the most accurate determination of a county's current and emerging industry clusters.
2. In counties with a small population—such as Camden—availability of industry sector data is often suppressed to prevent identification of employment and wage rates for specific businesses. Therefore, approaching industry cluster analysis on a regional basis generates a more complete result and is more likely to contain industry-sector data suppressed at the county level.
3. In counties with a high worker commute rate—such as Camden—the lack of existing employment for residents within the county often understates the county's ability to support industry clusters that are present in the region, but do not have a strong presence in the county of study.

For these reasons, industry cluster analysis is conducted on a regional basis.

Economic Development Synergy with Hampton Roads' Economy

Camden County's location as a bedroom community for the Hampton Roads metropolitan area obscures the local economy and market potential for prospective retailers, business development interests, and site selection consultants. However, with proper infrastructure, Camden County may develop into an advantageous location for companies seeking proximity to the Hampton Roads industrial clusters.

Camden County's adjacency to Virginia and market linkages to the southern Hampton Roads region further complicates the practice of industry cluster analysis by requiring researchers to obtain and aggregate data from both North Carolina and Virginia state employment agencies. Aggregation and manipulation of employment data across a potential of sixty industry clusters is very labor intensive and adds considerable time and cost to a research project. The business team was able to capitalize on prior research on suitable industry clusters for the North Carolina's Northeast Partnership and recent economic development planning in Currituck County to limit duplication of prior analyses. Given the time limitations for completing this feasibility study, this approach gave the business team more time to explore the suitability of the targeted clusters for a green industrial park (GIP) and to better identify prospects for targeted recruitment to Camden County.

In April 2005, the business team completed a detailed industry cluster analysis for North Carolina's Northeast Partnership (now North Carolina's Northeast Commission, NCNE).

This analysis identified six industry clusters with increasing competitiveness in both the northeast region of North Carolina and southern Hampton Roads.

1. Wood products and furniture
2. Metalworking and fabricated metal products
3. Printing and publishing
4. Higher education and hospitals
5. Basic heath services
6. Hotels and transportation services

The study also identified five additional industry clusters that were competitive and growing within the southern Hampton Roads region, but were virtually nonexistent within northeast North Carolina.

1. Aluminum products (primarily shipbuilding)
2. Nonresidential building products
3. Information services
4. Business services
5. Financial services

These clusters represented industries which could take advantage of costs and regional proximity by locating facilities in northeastern North Carolina. Research suggests that there is rarely wide annual variation in cluster specialties, and the clusters identified in the report three years ago remain viable for targeting today. As part of this study, the business team further refined the NCNE industry cluster list to better differentiate the industry clusters where Camden County possessed the strongest competitive advantage.

Targeting Clusters for Camden County

Databases of information were compiled on the current Hampton Roads area corporate population for each of the potential industry clusters. Those cluster populations were investigated to identify and describe corporate location behavior. The criteria selected for use in targeting clusters for Camden County included:

- **Traded Status:** Industry clusters that maximize economic benefit. Traded clusters are those that bring new income into the regional economy from outside. Such is clearly the case for manufacturing firms that produce goods for export, thus importing new income to the local economy. While perhaps less obvious, the same is also true for service and retail businesses whose primary markets are non-local.
- **Location Quotient Trend:** Industry clusters exhibiting high or strengthening Location Quotients (LQs) for the region and the region's rural counties. LQs are an indicator of relative cluster strength by measuring the share of local employment in a given industry cluster relative to a national average employment share in that same cluster.
- **Density:** Industry clusters exhibiting high levels of "cluster density," a measure of the extent to which the cluster possesses broad presence across its constituent sub-sectors. Clusters for which the region has pronounced competitive advantage would exhibit high LQs and a large population of firms throughout the cluster's constituent subcategories.

- **Rural Location Proclivity:** Industry clusters demonstrating significant level of rural location by constituent companies, measured as a percent of total firms of the cluster located in rural areas of the Hampton Roads Metropolitan Statistical Area (MSA).
- **Locally-Based/Headquartered Population:** Industry clusters with substantial populations of regionally-based headquarters (HQs). Local HQs are considered preferable for maximum economic development and sustainability.
- **Medium and Small Enterprises (MSE) Population:** Industry clusters with significant populations of Medium and Small Enterprises (MSEs), mid-scale firms with facility, workforce (20-250) and resource requirements more appropriate to Currituck County.
- **Mean Wages:** Industry clusters with higher average wage rates.

Industry cluster analysis identified industry sectors where the proximity of the Hampton Roads metropolitan area creates opportunities for Camden County economic development. Six strong and emerging industry clusters were identified for which strengthened transportation, utility, and infrastructure could position Camden County to serve as a location for firms attracted to or expanding within those industry clusters. The six clusters are listed below, along with a few of the industries located within each cluster

1. Aluminum Products (shipbuilding): Aluminum sheet, plate and foil manufacturing, primary aluminum production, and shipbuilding and repair.
2. Basic Health Services: Doctor, dentist and other health practitioner offices, other ambulatory health care services, medical facilities support services.
3. Metal Products: Ornamental and architectural metal work manufacturing, power boiler and heat exchanger manufacturing, metal tank, heavy gauge, manufacturing.
4. Information Services: Data processing services, computer systems design services, custom computer programming services.
5. Business Services: Accounting and bookkeeping services, advertising and related services, architectural and engineering services.
6. Non-residential Building Products: Fiber optic cable manufacturing, other communication & energy wire manufacturing, paint and coating manufacturing.

A more complete list of the major industry sectors within each cluster is provided in Appendix 2B. An additional cluster—financial services and insurance—was identified as another prospective area of cluster focus. Yet, most of the components for this cluster are contained in business services and information services; therefore it was not profiled or targeted separately.

Renewable Energy

If a green or eco-industrial park is developed, renewable energy sectors contained within the traditional industry clusters are appropriate for targeting. One example is the production of windmills, many of the inputs of which are found in the aluminum and metal clusters. Other producers of renewable energy components may find location in a GIP provides a competitive advantage in the marketplace by signaling to buyers and consumers that the company is committed to environmental protection. Currently, the renewable energy industry in the United States is rather small, but is projected to grow

6 American Wind Energy Association, http://www.awea.org/

in the future. Wind energy for example, in 2007, was one of the fastest growing sources of electricity in the nation, second only to natural gas for the third consecutive year.[6] According to a recent report by the U.S. Department of Energy, wind power could account for 20% of the U.S. energy supply by 2030.[7]

Figure 2.22
U.S. renewable energy industry, 2006

Camden County Amenities

Sector	Revenues/ Budgets ($bil)	Direct Jobs	Total (Direct +Indirect)
Wind	3.0	16,000	36,800
Photovoltaics (Solar)	1.0	6,800	15,700
Hydroelectric	4.0	8,000	19,000
Geothermal	2.0	9,000	21,000
Biomass/Biofuels			
Ethanol	6.3	67,000	154,000
Biodiesel	0.3	2,750	6,300
Biomass	17.0	66,000	152,000
Fuel Cells	.9	4,800	11,100
Hydrogen	.8	4,000	9,200

Source: Adapted from Bezdek 2007

A GIP may be an attractive target to businesses involved in producing inputs for clean technology and/or renewable energy production. A complete breakdown of renewable energy by industry sector is contained in Appendix 2A, which includes information on wage rates and renewable energy industry components.

Regional Industry and Business Parks

Developing a new industrial, office, or mixed-use park, including a GIP, must be undertaken with consideration for how the regional market is performing. Utilizing site selection databases, we identified thirty-eight business parks (office, industrial, research, and/or mixed-use) in the southern Hampton Roads (SHR) region and in the counties adjacent to Camden County. Most of these parks were located in Virginia, with a heavy concentration in the Chesapeake, Suffolk, and Virginia Beach areas. In total, these parks represent over 7,000 acres of which, nearly 3000 acres are still available. The average park size is 200 acres and the average availability is seventy-nine acres. This indicates that, on average, only 60% of the current parks are full.

This methodology for assessing the existing business park performance probably undercounts existing business parks that are full and no longer advertising space. However, any business park constructed in Camden County would compete with the existing business parks in the region where there appears to be a surplus of available park acreage. To be viable, a business park (green, eco-industrial, or otherwise) in Camden County must differentiate itself from the existing market. Otherwise, Camden County may have dif-

7 "20 Percent Wind Energy by 2030: Increasing Wind Energy's Contribution to U.S. Electricity Supply," U.S. Department of Energy, May 2008, available online at: http://www.20percentwind.org/20percent_wind_energy_report_05-11-08_wk.pdf

ficulty competing with business parks with existing infrastructure and locations closer to core of the SHR region. A complete list of parks is shown in Appendix 2C.

Identifying Environmentally "Clean" and "Dirty" Industry Sectors

Understanding the pollution impacts of the six clusters (and financial and insurance services), identified for the greater region will help to further identify appropriate clusters for a GIP in Camden County. There are two arguments why the pollution profile of an industry cluster may be important for identifying appropriate industries to target. The first argument builds on a community's interest in attracting industries that will not negatively impact environmental quality. With extensive and often pristine natural resources, Camden County should promote economic development by attracting industries that would have the least environmental impacts. A second argument, which builds from the more elaborate waste stream sharing definition of an eco-industrial park, suggests that it may be more beneficial to target dirtier industries. An eco-industrial park that is designed to promote the sharing of waste streams provides greater value for dirtier industries than for cleaner industries. In theory, any company with a high level of polluting output is aware of the regulatory and financial burdens of their pollution, and would be interested in an eco-industrial park and the pollution reduction opportunities it provides. Though dirtier industries would be targeted, a properly designed eco-industrial park should also accomplish the community goal of achieving economic development with the least environmental impacts. Therefore, identifying which of the seven clusters are "dirty" and which are "clean" provides useful information for targeting specific industries for a green or eco-industrial park.

Each of the six clusters identified for Camden County is composed of a number of industry sectors, some of these sectors report data on pollution releases to the U.S. Environmental Protection Agency's Toxic Release Inventory (TRI). TRI data and other pollution indices were used by World Bank and other international researchers to construct a typology of clean and dirty industry sectors based on the typical polluting practices of industry sectors. This typology was applied to the industry clusters identified for Camden County to determine if industry sector components were clean or dirty. The translation of International Standard Industry Classification (ISIC) Codes to the North American Industrial Classification System (NAICS) Codes used for industry cluster analysis did lead to some overlap in a few industry sectors. Simply stated, this demonstrates that some industry sectors may contain both "clean" producers and "dirty" polluters.

Cluster	Total Sectors	Dirty	Clean	Overlap
Aluminum Products	24	18	9	3
Basic Health Services	142	5	3	1
Metal Products	18	4	17	3
Information Services	121	0	1	0
Business Services	204	0	1	0
Non-Residential Building Products	39	10	14	0

Figure 2.23
Clean and dirty sectors within target clusters

Figure 2.23 highlights the fact that four of the six clusters identified for the region are services clusters which have very little, if any industrial activity. A very small number of the industry sectors under the Basic Health Services cluster are identified as clean or dirty, and this may be related to the disposal of bio-waste or chemicals used in health science laboratories. The vast majority of industries in the Basic Health Services cluster do not pollute enough to register on the TRI database. The remaining three services clusters also have little pollution impacts.

Two clusters—Aluminum Products and Metal Products—are more traditional industrial clusters and the data shows that each sector associated with these clusters can be labeled clean, dirty, or both using the TRI database. The preceding table shows that the majority of sectors in the Aluminum Products cluster are identified as dirty. Three of the sectors are identified as both clean and dirty; however, this small number does not impact the conclusion that this cluster is considerably more polluting than the Metal Products cluster. One of eighteen industry sectors under the Metal Products cluster can be unequivocally identified as dirty. The remaining three industry sectors identified as dirty are also counted in the clean category. Finally, the Non-Residential Building Products cluster has roughly equal numbers of clean and dirty industry sectors.

How this information on clean and dirty sectors is used depends very much on the type of industrial park Camden County wishes to pursue. If the county chooses to pursue a park that is considered green because of the efficiency of the architecture and the preservation of open space or because the products created are eco-friendly, then it will be important for the community to target the clean industry sectors identified. These mostly exist in the Metal Products cluster and in the Non-Residential Building Products cluster. Targeting these clean industries is important because the definition of a GIP does not take into consideration the pollution outputs of the industries in the park. Therefore, if cleaner industries are not targeted, the development of an eco-industrial park could result in equal or greater environmental degradation than a traditional industrial park. If an industrial park is designed around the concept of industrial symbiosis, where firms share resources and wastes, then it may be helpful to target the dirty industry sectors identified. The majority of the dirty sectors are in the Aluminum Products cluster and to a lesser extent the Non-Residential Building Products cluster. Pursuing this vision of an eco-industrial park is considerably more complicated in that the targeted industries will be interdependent. That is, it would be necessary to both recruit a facility that creates a waste and a separate facility that can use that waste as an input. Therefore, the clean and dirty industry sector classification may be useful to know which industries are most in need of the eco-industrial park, however, all possible industry sectors in the identified clusters will have to be targeted in order to identify the opportunities for mutually beneficial waste sharing.

Identifying Renewable Energy Industrial Sectors

Total U.S. investments in renewable energy have been growing at a tremendous rate in the last several years. With the continued volatility of fuel prices, a desire for American energy independence, and concerns over the climate impacts of carbon emissions, this positive investment trend is expected to continue. Given the potential for growth and the eco-friendliness of renewable energy technologies, industrial sectors that supply the renewable energy industry would be good targets for a green or eco-industrial park. By focusing on

the seven clusters identified for Camden County and identifying the constituent industry sectors that contribute to renewable energy technologies it can be determined if there are opportunities in this industry for the park. The following chart provides the results of an analysis of the various sectors which make-up the six larger clusters.

Cluster	Total Sectors	Renewables	Detail
Aluminum Products	24	2	1 wind and 1 solar
Basic Health Services	142	3	Testing labs, environmental & scientific consulting
Metal Products	18	5	1 wind, 1 solar PV, 3 biomass/ geothermal
Information Services	121	0	
Business Services	204	3	Testing labs, environmental & scientific consulting
Non-Residential Building Products	39	5	2 solar PV, 2 biomass, 1 research

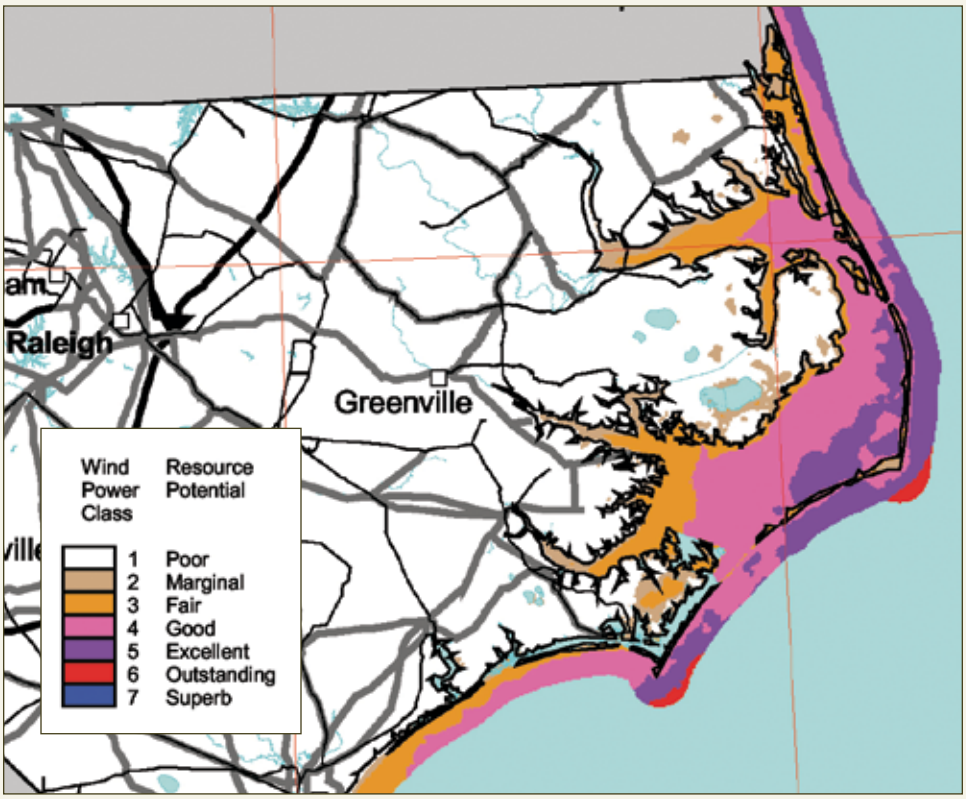
Figure 2.24
Renewable energy cluster analysis

As expected, the analysis suggests that there are few opportunities in the services clusters, though there exist some opportunities in scientific consulting and testing labs. The results for the Metal Products cluster suggest that five of eighteen (28%) of the industry sectors in that cluster contribute to the renewable energy industry. The particular renewable technologies are wind, solar photovoltaic, biomass, and geothermal. Only two of the industry sectors in the Aluminum Products cluster contribute to renewable technologies, while five of the sectors in the Non-Residential Building Products cluster are identified as contributing to Solar PV, Biomass, and Research. These results suggest that there are some opportunities to target industries related to renewable technologies, however there are other factors that must be taken into consideration.

Renewable energy technologies are location specific, meaning that certain technologies dominate in different geographic regions because of the physical requirements of the technology. Some technologies are more location sensitive than others. For instance, the successes of solar photovoltaic installations in London and San Francisco have proven that this technology is less dependent on geographic factors than previously believed. Wind power generation, however, is highly dependent on the strength of the wind resource for success. Because of the massive size of wind turbine components they are quite challenging to transport. Therefore, suppliers to this industry tend to co-locate with the wind farms themselves. According to the North Carolina Wind Resources Map from the Department of Energy's Wind Program and the National Renewable Energy Laboratory, the on-shore wind resources in Camden County are marginal or poor given current wind power generation technology. However, there are sufficient wind resources to generate wind power efficiently with turbines located nearby in the Albemarle Sound or off the Atlantic Coast.[8]

8 http://www.eere.energy.gov/windandhydro/windpoweringamerica/pdfs/wind_maps/nc_50m.pdf

Figure 2.25
Wind power classes
for eastern North
Carolina



Given that there has been some community opposition to offshore wind farms along the East Coast, other renewable technologies may find more support in a Camden County GIP. Solar photovoltaic, solar thermal, and geothermal technologies all have both industrial and residential applications allowing for a greater breadth of markets for industry suppliers to target. Additionally, these technologies, with the exception of industrial-scale geothermal, are not necessarily location specific, they are equally likely to be used in the mid-Atlantic region as anywhere else.

By investigating the opportunities in renewable energy, the analysis suggests concentrating on the three industrial products clusters identified for the region: Metal Products, Aluminum Products, and Non-Residential Building Products. These three clusters include a few industry sectors that contribute to a number of renewable energy technologies, however the most likely targets appear to be solar photovoltaic, solar thermal, and residential geothermal.

Camden Targeted Industry Prospects Identification

Prospect Profile

Databases of information were compiled on the current Hampton Roads area corporate population of each of the potential industry clusters. The cluster populations were investigated to identify and describe the characteristics of companies that show location behavior favoring a Camden County site. While there was significant variation in those companies, a general profile was developed to assist in targeting prospects:

Single locations and small headquarters

- Companies identified were not subsidiaries or branch plants; instead they were independently owned, entrepreneurial firms.

Smaller but growing

- A majority of the companies were of modest scale, employing twenty-five to seventy-five people in facilities ranging from 25,000 to 75,000 square feet.

Higher value added

- Many of the companies show a profile of firms poised for expansion, posting high revenues per employee ratios, particularly given their modest facility scale.

In general, the most appropriate targets for recruitment and expansion into Camden County will be those who are identified as having higher revenues than their industry peers given the company's size and employment levels.

Location of Existing Businesses in Targeted Clusters

In addition to profiling regional businesses and potential targets in each cluster, establishment-level data were used to map the location of businesses in these industry clusters in the region. As Figure 2.25 demonstrates, there is a significant and expected concentration of businesses in the metropolitan areas of the region. With the exception of the Highway 168 corridor, there are few businesses located in the southern portion of Virginia and few businesses in the northern portion of North Carolina. Such gaps in business locations suggest that historically this area, including Camden County, has been avoided for business locations. This could be the result of topography, land use and zoning regulations, or infrastructure limitations.

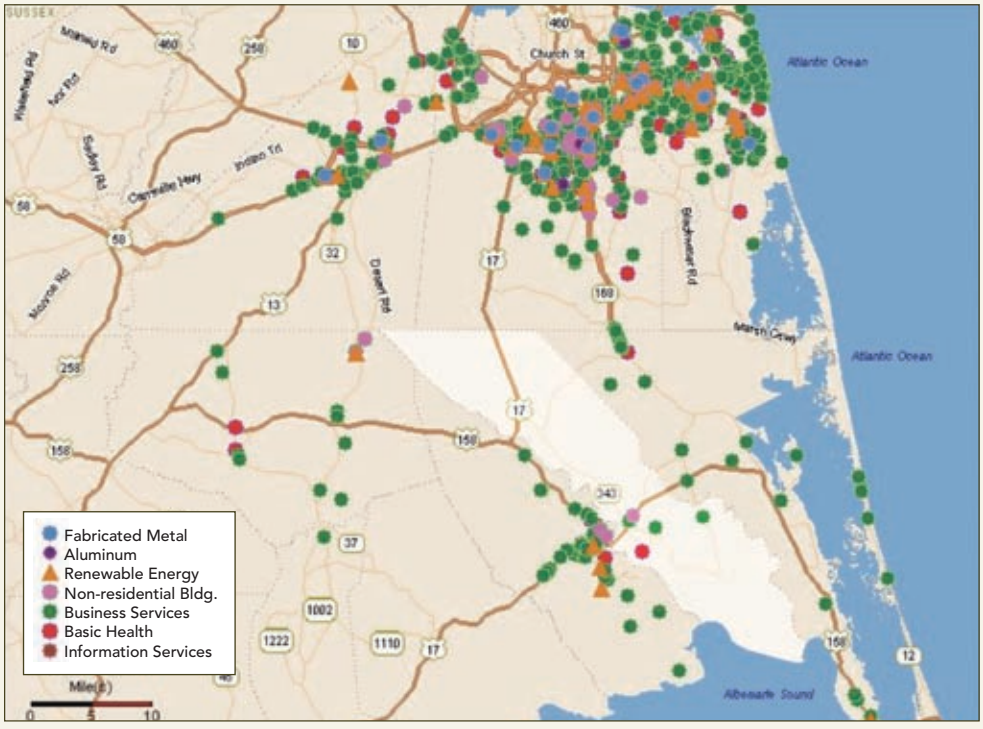


Figure 2.25
Location of existing businesses in targeted clusters

2D. Camden Targeted Industry Prospects Survey and Interviews

We conducted telephone interviews with a sample of firms from within the 625 potentially expanding industries identified in the cluster analysis to gauge their potential interest in a proposed GIP. From a sample of fifty-one companies selected, we completed twenty interviews. Geographically, the sample of companies was selected from the Tidewater area of Virginia, the areas around Richmond, and Washington, D.C., and eastern North Carolina. In general, companies were asked whether they had plans to expand or relocate in the near future and whether or not they would be interested in locating in a GIP in Camden County.

In addition, we contacted U.S. firms located in existing GIPs to assess their motivation for choosing a GIP location. We selected four GIPs from a list of 10 and interviewed a total of thirteen firms within those parks.

Interviews with Twenty Firms from the Six Industry Clusters

Some of the interests and obstacles that influence the site-selection decisions of expanding businesses in the region are summarized below. Given the small sample size, the results of the survey cannot be generalized either by industry sector or in general.

Location Factors

The two dominant site selection criteria for the companies that were interviewed were: 1) proximity to labor pools; and 2) proximity to customer and client bases. For the purposes of this report, labor pools are meant to include the current employees of a business and the general proximity to regional concentrations of residential areas. In fact, these criteria were cited by five of the twenty businesses as *critical* to their future expansion plans. Fifteen out of twenty businesses interviewed would not consider expanding or relocating to Camden County because of its perceived distance from labor pools and customer bases. Other companies listed the following as their primary site selection criteria: 1) costs (e.g., taxes, rents, etc.); 2) proximity to resources/inputs; 3) availability of green features; and 4) close proximity to transportation corridors.

Half of the businesses interviewed reported an interest in expanding or relocating to a GIP in the future. About half of those interested in relocating to a GIP (or one fourth of all interviewed) said that their interest would be contingent on location requirements and/or lease rates. These businesses expressed an interest in a GIP, but noted that location and lease rates were higher priorities. Five firms expressed an unqualified interest in GIPs.

Nearly all of the businesses interested in being in a GIP also valued having a green image. A majority of these were in niche sectors that specialize in environmentally conscious products and services. These include firms that provide services or manufacturing such as: 1) environmental audits; 2) biodiesel production; 3) sales of sustainably harvested lumber; and 4) green building products manufacturing. In addition, two other businesses—a brick making company and a fuel oil dealer—expressed an interest in fostering a greener image given their perception that environmental consciousness is increasing in importance. However, another company, which works with the military and energy sectors, said that projecting a green image would not help their marketing and could even hurt their business.

For those businesses interested in locating in a GIP, some were interested in specific green technologies and features. For instance, two businesses expressed an interest in using renewable energy if it would be available. Others were interested in features that would conserve energy and recycle wastes. One business involved in designing green buildings stated that it would be interested in a building that encompassed the whole suite of green design features associated with the Leadership in Energy and Environmental Design (LEED)-certified interiors designation.

Camden County's rural character was not generally perceived to be an obstacle, assuming that basic infrastructure would be provided and that there was adequate access to labor pools and customer bases. In fact, some companies, especially high-tech communications and electronics contractors, said they could operate in almost any location given they had advanced information infrastructure, such as internet with fiber optic cables. When asked specifically about Camden County, roughly one quarter of the businesses interviewed reported that they would be interested in expanding or relocating there, including three businesses that either manufacture and/or sell bulk products (such as bricks and petroleum) and two businesses that manufacture various electronics. Of this subset, three businesses with little similarity to one another expressed interest in a GIP in Camden County, including a gasoline distributor, a company that sells industrial machinery, and a science and advanced technology service provider.

Proximity to Hampton Roads

Geographic location did not seem to be correlated with a business' interest in locating in Camden County, with one significant exception: companies already within the Hampton Roads area would be difficult to recruit to Camden County if proximity to the ports were to be used as a selling point. In addition, even with the strong economic ties that link northeastern North Carolina to Hampton Roads, for companies that operate within Virginia sales territories, it is often not possible for an individual branch to expand into North Carolina because their territorial boundary ends at the state line.

Hampton Roads is home to several large military and other federal government installations, and the area attracts a high concentration of federal government contractors. Because the profits of these government contractors are capped by the Federal Acquisition Regulations (FAR), they may not be as interested in operating within a green facility if it meant paying a premium. Further, sometimes their sites for expansion are pre-selected as a part of their contracts.

Existing Green Features

Only two of the businesses interviewed were located in facilities that had any green features. One business operated out of a LEED silver certified building, and another built an energy-efficient building, utilizing recycled materials in its construction and furnishings.

Interests of Potential Tenants

A Virginia-based environmental design firm provided insight into the recent expansion in the field of environmental design and construction and the associated importance that potential tenants place on operating in an environmentally responsible location or building. This company has just begun a project designing a GIP in rural, southwestern Virginia for a public-private partnership with a local county. The two features of a location

that were cited as most important to this company's clients are the ease of the commute for workers (e.g., public transportation options, available parking) and the amenities that are available nearby (e.g., restaurants, retail stores, etc). The green features that were cited as most important to this company's clients were energy efficiency, due to increasing costs, and water-saving technologies. This company has found that some clients want green and efficient features to be highly visible, (e.g., green roofs), while others want the energy savings, but do not care for the visibility or the associated green image.

Interviews with Tenants of Existing Green Business Parks

We wanted to explore what motivates companies to locate in a GIP. To do so, we compiled a list of ten green parks operating in the United States, selected a sample of four parks, and interviewed firms located in those four parks. The GIPs that were selected had published tenant lists, leased space to ten or more tenants, and had been in operation for more than five years. A total of thirteen businesses were interviewed, and the interviews consisted of questions aimed at identifying factors that motivated firms to locate in a GIP.

Although responses to interview questions varied greatly, there were several common themes among respondents. First, out of thirteen interviews, five tenants responded that locating in a green facility aligned with pre-existing business or personal values. For example, according to Peace Coffee, locating in the Phillips EcoEnterprise Center in Minneapolis, Minnesota was consistent with their corporate environmental commitment. On a related note, a sense of community based on environmental commitment was mentioned by three tenants as an important part of why they chose a particular location. The second theme to emerge was decreasing energy consumption. Five tenants interviewed identified decreased energy consumption as either a reason for choosing their location or a benefit they have received as a result of their location. Another subset of respondents identified facility location as the single most influential factor in the decision to move to a facility.

Although none of the tenants interviewed were required to adopt a set of green operating principles, many tenants have voluntarily embraced some level of environmental commitment as a result of moving to a green facility. These commitments range from informal recycling goals to more formal environmental policies or practices. Regardless of tenants' levels of environmental commitment, some report that simply operating in a green facility helps to project a green image—demonstrating environmental and social responsibility—to existing and potential clients. According to Alpha Corporation, the green image projected by the Montgomery Park Business Center in Baltimore, Maryland, provides a good marketing tool. Several tenants also noted that a green image is becoming increasingly important for successful business.

2e. Industry Cluster Conclusion

Camden County could become an attractive location for companies seeking proximity to the Hampton Roads industry clusters. This will require strengthened transportation, utility, and other infrastructure to position Camden County as a location for firms attracted to or expanding within those clusters.

The county should begin targeting the emerging growth companies—those having higher revenues than their industry peers, given the company's size and employment levels—in each of the six industry clusters identified in this analysis. In particular, Camden County may be successful in targeting emerging growth companies in the basic health cluster, and the information services cluster, which are already headquartered or are sole locations in the Virginia Beach-Norfolk-Newport News Metropolitan Statistical Area (MSA). In addition, the lack of general business services within Camden County, including retail, makes the business services cluster an appropriate target.

The limited number of non-residential building products companies in rural counties in the region suggests Camden County may have limited opportunities to attract large firms in this cluster. However, a GIP may be an attractive location for firms such as LEED-certified or other sustainable construction and design projects. Finally, renewable energy industries should be targeted within the context of the identified industry clusters.

Interviews with a subset of these emerging growth companies found that the two main factors driving business location decisions are proximity to labor pools and proximity to customer and client bases. Also, it seemed that the extent to which a business valued presenting a green image was a better indicator of its potential interest in locating in a GIP than its type of industry or location within the region. Finally, Camden County's rural nature would not be an obstacle for businesses, provided adequate infrastructure was widely available.

Even with adequate infrastructure, Camden County may have difficulty competing with business parks with existing infrastructure and locations closer to the core of the southern Hampton Roads region. There appears to be a surplus of available park acreage within the southern Hampton Roads region; thus, the county must differentiate a potential business park (green or otherwise) from the existing market. This differentiation will occur in part based on the type of park the county pursues.

Green Building Design and Products

If the county chooses to pursue a park that is considered green because of the building design and the preservation of open space or because the products created are environmentally preferable, then it will be important for the community to target the "clean" industry sectors identified. Such companies may be drawn to such a park due to their production processes or competitive advantages gained through positive market signals to green consumers/buyers. This type of park may also target companies with a demonstrated commitment to Environmental Management System adoption or Green Supply Chain Management practices in their corporation. These practices demonstrate that a company has a corporate culture that would find a GIP appealing and/or is competing in a marketplace where reduced ecological impacts provide a competitive market advantage.

Industrial Symbiosis

If a GIP is designed around the concept of industrial symbiosis, where firms share resources and wastes, then it may be helpful to target the "dirty" industry sectors identified. Dirty industry sectors would gain a competitive advantage by reducing their pollution output and reusing portions of their waste stream or the waste streams of other companies.

Renewable Energy Targeted Park

Given the potential for growth and the eco friendliness of renewable energy technologies, industrial sectors that supply the renewable energy industry would be good targets for a green or eco-industrial park. In investigating the opportunities in renewable energy, the analysis suggests concentrating on the three industrial products clusters identified for the region: metal products, aluminum products, and Non-residential building products.

Traditional Industrial Park

Expanding water, sewer, highway, and other infrastructure to create a more traditional business, office, industrial, or mixed-use park in Camden County could prove successful if the park was differentiated within the existing marketplace. Overcoming the surplus of existing park acreage will be challenging. To be successful, a public sector-funded traditional park will require more upscale amenities than might be feasible through traditional public financing and will require that the county seek additional financial assistance through grants and private sources. Prospective upscale amenities may include world class information technology infrastructure, access to uninterrupted power, water and sewer allocations for future expansions, innovative architectural designs, and location of onsite housing, retail, walking trails, protected green space, or other amenities desirable in a mixed-use design.

3. Reducing Environmental Impacts

In this section, we describe the potential environmental impacts of a green industrial park, explain how those impacts could be mitigated through siting, design, and operation of the park, and offer guidelines for the development of such a park. We also include several examples of green development.

3a. Potential Environmental Impacts of a Green Industrial Park

In general, Camden County enjoys relatively clean air and water, largely because of the county's low population density and lack of major industries. The study area contains a mix of farms and forests situated on flat, low-lying land with a shallow water table. Most of the agricultural lands were ditched and drained long ago for growing crops. These drained lands, which expose the thick peat soils below, can be more vulnerable to fires, as the extensive and prolonged fires in 2008 demonstrated, as well as saltwater intrusion. Over the long term, the same ditches and canals that were created to drain low-lying areas could serve as conduits for rising seas.

Building a green industrial park in the area east of NC 17 could affect the environment in many ways. For example, impervious surfaces (e.g., roofs and parking lots) would increase the volume of stormwater running off the site, rather than seeping into the ground, and could degrade nearby receiving waters. Camden County's above average rainfall means that even moderately sized impermeable surfaces could generate significant amounts of stormwater runoff. This runoff often carries pollutants such as fertilizers (from farms and lawns) as well as oil, grease and heavy metals that are washed off roads, parking lots and driveways. Contaminated water that finds its way into the Great Dismal Swamp Canal could eventually empty into the Pasquotank River and ultimately, the Albemarle Sound. Excess runoff, combined with the county's flat, low-lying topography, makes stormwater one of the most challenging environmental issues to address in designing a green industrial park.

North Carolina wetlands

In addition, truck and car traffic generated by the site could adversely affect air quality, although this might be offset somewhat if the creation of jobs in Camden County reduces out-commuting to Virginia. Construction in low-lying areas could result in a loss of any remaining wetlands, which provide valuable habitat for fish and wildlife. Wetlands also can reduce the impacts of flooding.

Case Study 1

BUILDING A "GREEN" WAREHOUSE

JohnsonDiversey Distribution Center
Sturtevant, Wisconsin

A global leader in environmentally responsible cleaning products, JohnsonDiversey partnered with developer Liberty Property Trust to build a high-performance, 550,000-square-foot warehouse. The warehouse, which became the largest green distribution center in the country, earned LEED Gold certification in November 2007. For their development of the Johnson-Diversey warehouse, Liberty Property Trust was awarded the National Association of Industrial and Office Properties (NAIOP) 2007 Green Development Award.

GREEN FEATURES

Recycled Materials
The $24 million distribution center was built using more than 30 percent recycled materials, greatly reducing the material going into a landfill. For example, instead of using crushed, quarried rock for the building's sub-base, JohnsonDiversey used 34,000 tons of power plant ash by-product, excavated from a local landfill. In addition, of the waste that was generated during construction, 98 percent was recycled.

Energy
Using innovative ventilation and lighting designs, JohnsonDiversey has made significant cuts on energy consumption. Lighting designs include the use of florescent bulbs as well as sensors which respond to both motion and daylight. To help cool the building, the roof was covered with a bright white thermoplastic polyolefin which reduces solar heat transfer. The energy that is consumed at the warehouse is generated entirely from renewable sources such as wind and biomass. The company also purchases enough green energy credits and green power to cover annual energy consumption.

Water Conservation
To conserve water, the warehouse includes low-flow fixtures with automatic shut-off. In addition, 70 percent of the site acreage is landscaped with native and adaptive plants. These plants do not require irrigation and are less expensive to maintain.

West of NC 17 lies the historic Dismal Swamp Canal and the 14,344-acre Dismal Swamp State Park, with its extensive forested wetlands. The park is home to black bears, bobcats, river otters, and several species of rare plants. Wildlife habitat can be disturbed easily by large construction projects. For this reason, potential development should be located and designed to limit habitat loss and to preserve existing wildlife corridors. Under-road culverts can be installed to help overcome restrictions on movement caused by a raised road. Further studies would be needed to determine the type and number of species that would be effected by habitat loss or fragmentation caused by construction of a green industrial park in Camden County, as well as areas that are used by migrating birds to rest as they fly north or south along the coast.

Other potential impacts of the proposed green industrial park include a loss of open space and the generation of wastewater and solid wastes. For example, a typical warehouse and distribution facility generates roughly one pound of solid wastes per 100 square feet of space.[1] Thus, over the course of a year, six, 100,000 square foot distribution facilities (one from each industry cluster) would generate about 6,000 pounds per day of wastes, or about 1,500,000 tons of wastes annually. The proposed twelve to eighteen facilities in Phase II would generate two to three times that amount, or up to about 4.5 million tons per year. The amount of wastes generated would be much higher for manufacturing facilities.

3B. Mitigating Environmental Impacts

Many of the potential adverse environmental impacts of a green industrial park can be mitigated through innovative siting and design and through the use of green technologies. In general, the site should be selected to protect and retain the existing landscaping and natural features as much as possible, especially where wildlife (particularly, endangered species) might be affected by the project. In addition, the site should have as small a footprint as possible to minimize both the disturbance of the landscape and the creation of impervious surfaces. The site should be close to other uses, such as retail, offices and perhaps even housing, to minimize driving distances by workers, facilitate walking, and to maximize opportunities for mass transit that may be available in the future. When considering landscaping, the site should use plants that are well-adapted to local conditions, thus reducing the need for irrigation and the use of pesticides. Finally, the industrial park should be designed to maximize the use of solar energy. And it should incorporate innovative techniques to control stormwater, minimize water use, recycle wastewater, reduce or recycle solid wastes, protect open space, and use energy more efficiently, as summarized below.

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1 The Rosenthal Group. *Standard Waste Generated in Weight for Building/Business Type*, http://www.the-rosenthal-group.com/Standard%20Waste%20Generated.pdf

Managing Stormwater

Several techniques can be used to manage stormwater, including green roofs, permeable pavement, water harvesting, and bioretention, as described below.

Green Roofs

A major source of stormwater is the high-velocity runoff coming directly from roofs. Green roofs can absorb rainwater and reduce runoff substantially. A green roof involves installation of a layered system of membranes, substrate and plants onto a conventional roof. There are two main types of green roofs: extensive and intensive. *Extensive* green roof systems are lightweight and typically do not require a roof to be designed with extra reinforcement. This type of roof is relatively low cost and requires little maintenance. Installation costs are typically $10-25 per square foot. *Intensive* green roof systems offer greater stormwater retention capacity and better energy efficiency benefits for a building. They are also capable of supporting a greater variety of plants than extensive systems, and allow for the creation of different plant habitats. Intensive green roofs are generally more attractive aesthetically than extensive systems, but they have a higher capital cost, typically $16-35 per square foot, and require more maintenance.

Water Harvesting

Rainwater harvesting refers to a system of capturing stormwater runoff and using it to supplement or replace water from a centralized system or a well. Typically, water is captured from a rooftop and stored in a cistern for later use or released in a slow and controlled manner to facilitate infiltration into the soil. Harvested rainwater has many practical uses, from irrigation during dry periods and washing vehicles to flushing toilets, or virtually any industrial use that does not require treated water. With increasing demand on the water system in Camden County and growing concerns over water availability, water harvesting could significantly reduce the water needs of a green industrial park. For example, a harvesting system under normal rainfall conditions in Camden County would collect approximately 28 gallons per square foot of roof per year. In other words, a 10,000 square foot roof area would collect approximately 282,000 gallons of water in a year.[2] Large scale rain harvesting cisterns are available in a variety of sizes and configurations. For aesthetic reasons, cisterns often are located below ground. In Guilford County, NC, the Northern Guilford Middle and High Schools irrigate their ballfields with rainwater collected from the school's roof and stored in an underground cistern. The 300-gallon cistern lies under the school's tennis courts.

GREEN ROOF

Ford Motor Company:
Dearborn Truck Assembly Plant
Dearborn, MI

KEY FEATURES

The Ford Motor Company's Dearborn Truck Assembly Plant features a 454,000 square foot green roof—one of the largest in the world. The green roof is made up of drought-resistant plants like sedum.

This roof was designed to reduce stormwater runoff by capturing up to an inch of rain from each rain event and half the total rainwater that falls on it each year. It also provides habitat for birds and other animals, helps reduce energy use in the building, and protects the roof from damage caused by ultraviolet radiation.

Other stormwater management features at the plant include retention ponds, swales seeded with native plants, and porous pavement which allows water to filter through a thick layer of compacted stones.

Sources:
http://www.mcdonoughpartners.com/projects/ford-dtp/default.asp?projID=ford-dtp
http://www.greenroofs.com/projects/pview.php?id=12

Green roof at UNC-Chapel Hill

2 A Rainwater Harvester computer model is available through NCSU; see http://www.bae.ncsu.edu/topic/waterharvesting.

Permeable Pavement

Permeable pavement enables stormwater to drain through the surface and into the soil below, rather than collect on the surface and run off into storm sewers. Permeable paving materials include, but are not limited to, porous concrete, permeable interlocking concrete pavers, concrete grid pavers, and porous asphalt. Permeable surfaces, if installed correctly and maintained properly, duplicate the structural and functional features of traditional pavement, but generate less runoff. The various forms of permeable pavements can be used in many areas, including low-traffic roads, emergency access roads, parking lots, sidewalks, and road shoulders. The parking lot for the Public Service Complex in the City of Kinston, North Carolina consists of porous concrete and two types of permeable, interlocking concrete pavers.

Permeable pavement

For permeable pavement to perform effectively, the soils beneath the pavement must have sufficient infiltration capacity to drain, and the pavement must not be clogged by runoff from adjacent surfaces.[3] In general, the Coastal Plains are ideal locations for use of permeable pavement.

Permeable pavement typically costs 25-100% more than traditional asphalt; however, such pavement can reduce the need for large stormwater detention basins as well as reduce flooding downstream. Thus, over time, permeable pavement may be more cost effective than traditional pavement.

Bioretention Systems

Bioretention systems use filtration to treat stormwater runoff. These systems rely on vegetation, such as trees, shrubs, and grasses, to remove pollutants from stormwater runoff. Typically, bioretention systems are constructed directly within a drainage swale or installed off-line, for example where flow in a swale is directed into a bioretention system for treatment. The latter is generally more efficient and cheaper to install than the former. Bioretention systems offer several advantages over traditional holding ponds with sand filters. For example, bioretention systems provide a variety of pollutant removal mechanisms, a higher degree of treatment, are more aesthetically pleasing, and they provide stormwater peak flow and volume control as well as water quality control. Another advantage of bioretention systems is that no special maintenance is required, only routine periodic maintenance typical of any landscaped area. Bioretention systems vary in size but are typically at least 25 feet wide by 40 feet long; the minimum length should be at least twice the width.

WATER HARVESTING

Williamston High School Retrofit Project
Williamston, NC

KEY FEATURES

A 1500-gallon heavy-duty plastic cistern collects rainwater from the roof of the high school's vocational agriculture building. Two down-spouts channel water into the cistern, which sits above ground. The cistern is gravity-fed, but includes a pump for optional use.

Water collected in the cistern is used, in part, to irrigate plants grown in the high school's greenhouse. Other uses include irrigation of trees and other plants on the property as well as irrigation of athletic fields. Because the water is used for non-potable applications, filtration is not necessary.

The site also uses permeable pavement, rain gardens, a bio-retention cell, and multiple grassed swales to limit, slow, and filter the stormwater runoff generated from the site.

Sources:
Phone interview with Tom Ward, Williamston Sustainability Officer.
http://www.bae.ncsu.edu/topic/lid/pastprojects.html

3 These conditions are described in subchapter 3.10 of NC-DENR Division of Water Quality's Stormwater Best Management Practices Design Manual (available online at http://h2o.enr.state.nc.us/su/bmp_forms.htm).

Protecting Open Space

Open space—greenways, farmland and forests—can be viewed as a kind of green infrastructure that is as fundamental to the county's economic well-being as a road or sewage treatment plant. Many companies are attracted to regions with scenic recreational opportunities for their employees. Increasingly, what draws newcomers to a community is not just the prospect of a good job, but also a decent place to live. Communities that have preserved their scenic, ecological and recreational assets could have a competitive edge over those that have not. Open space can serve many purposes: habitat for wildlife, stormwater management, or recreation—a place to walk or for quiet reflection. While the county contains ample open space, in particular, lands within the Dismal Canal State Park and nearby Great Dismal Swamp, open space within the green industrial park might be more accessible to those who work in the park or live nearby.

For development to conserve and link key open spaces, the county will have to be proactive in identifying what it wants to protect (e.g., floodplains, wildlife corridors, and scenic vistas) and establish incentives for developers to help meet those needs. Those incentives could include density bonuses or expedited permit review. Clustering of buildings is another way to preserve open space.

Wastewater Treatment

The area of Camden County being considered for a possible green industrial park currently lacks connection to the county's centralized sewage treatment plant. If the green industrial park were developed, a sewer line would likely be extended to the site

PERMEABLE PAVEMENT

Alice Hannibal Public Works Building
Kinston, NC

KEY FEATURES

The Alice Hannibal Public Works Building employee parking lot consists of standard asphalt as well as four types of permeable pavement. The 9,340 square foot parking lot includes sections of porous concrete, two types of permeable interlocking concrete pavers, and a concrete grid paver. Underneath each section lies a bed of crushed rock and perforated pipe.

The permeable parking lot was implemented as a North Carolina State University study focusing on the performance of each type of pavement and its removal of pollutants in the Coastal Plains area. The results of the study demonstrate that the volume of surface water runoff from the permeable pavement was significantly reduced compared to runoff from standard asphalt. The study also showed that this parking lot is able to retain up to six millimeters of water, or about 30% of the average rain event during the study.

Sources:
http://www.bae.ncsu.edu/info/permeablepavement/ICPI.2007Report.Final.EDITED.pdf
http://www.bae.ncsu.edu/stormwater/PublicationFiles/NWQEPnotes2001.pdf

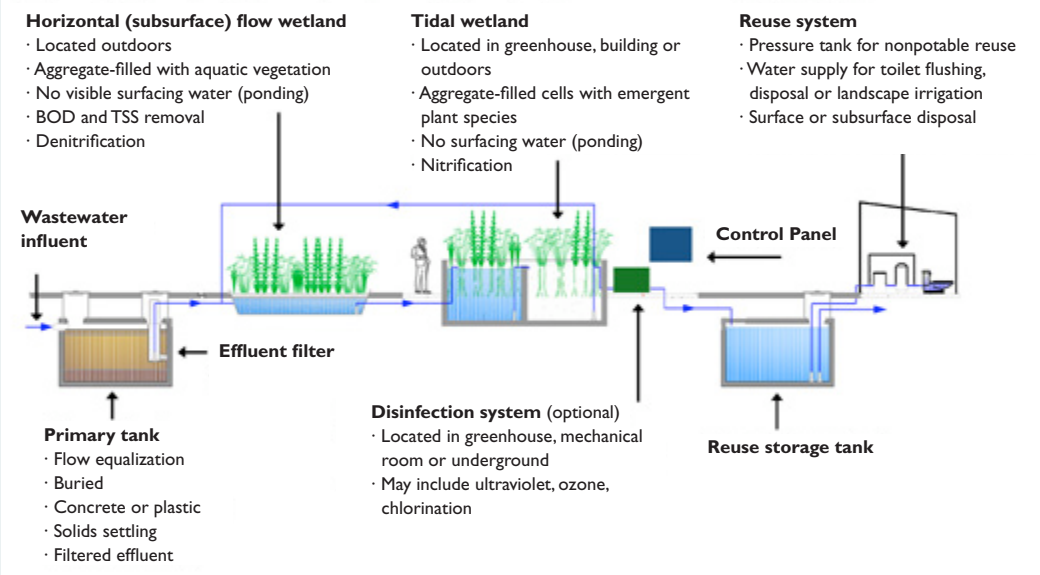

Figure 3.1
Diagram of a wastewater treatment system known as the "living machine," which was installed at Northern Guilford Middle and High Schools in Guilford County, NC[4]

4 http://www.livingmachines.com/products/livingmachine/hybridwetland.php

in Phase I and either a new sewage treatment plant would be built or the existing plant would be expanded. Other options, particularly for Phase II, could include purchasing a packaged plant or relying on other types of technology to reduce or process wastewater. For example, one way to reduce the need for additional treatment capacity is to recycle greywater. Water from sinks, showers, bathtubs and laundry facilities can be collected, filtered and treated (usually through chlorination), and then reused on-site for irrigation or to flush toilets. This type of recycling would work best if the green industrial park included residential and commercial uses, rather than just industrial. Treated effluent from sewage treatment plants can also be reused (reclaimed). In 1995, the last year for which wastewater-treatment data was compiled, about 44,400 wastewater-treatment plants in the U.S. sent about 44,600 million gallons per day of treated water back into the environment. About 983 million gallons per day was used again after treatment, mainly as irrigation water.[5]

Another option is to combine a septic-like system, which collects wastes in large tanks, and use constructed wetlands to "treat" the effluent that flows out of the tanks. This type

Case Study 2

A COMMUNITY OF ENVIRONMENTAL COMMITMENT

Jean Vollum Natural Capital Center, Portland, Oregon

The Jean Vollum Natural Capital Center, a multi-tenant, mixed-use building, provides an example of a successful business community built on the principles of environmental and social responsibility. Located in a former industrial area of downtown Portland, Oregon, the Center was developed by EcoTrust, a nonprofit dedicated to conservation and the "triple bottom line" of economy, ecology, and social equity. Rather than construct a new building, builders redeveloped a century-old, 70,000 square-foot warehouse at a total cost of $12.4 million. Approximately 75 percent of the building's shell was reused, and 98 percent of construction-related debris from the renovation was recycled. The Jean Vollum Natural Capital Center was awarded LEED Gold certification in 2001.

Green Features

The building has an impressive list of green features. The atrium features abundant skylights, and natural sunlight is available in 75 percent of the building's interior. After daylight, areas are lit by energy efficient lights controlled by photo sensors. To conserve and protect water sources, low-flow plumbing fixtures were installed. A vegetated roof on the building helps capture and filter rainwater. Stormwater is also directed towards a "bioswale" on-site, naturally filtering into the ground instead of emptying into Portland's municipal stormwater system or the Willamette River. The Jean Vollum Natural Capital Center has a particularly interesting way of reducing energy costs. In colder months, the building is heated entirely by one of the tenants, Hot Lips Pizza. Use of public transit is encouraged, and the Center is accessible by streetcar and several bus routes. There are also showers for employees who choose to walk, jog, or bike to work.

Environmental Commitment

One intangible green feature of the Jean Vollum Natural Capital Center is the shared attitude of environmental commitment among tenants. Tenants at the Center include businesses, agencies and nonprofits—all with a focus on social or environmental responsibility. Tenants are not required to adopt formal green operation or design principles, but many have voluntarily put green measures in place. For example, Portfolio 21 Investments has committed to purchasing carbon offsets for all commuting and business travel. Another tenant, World Cup Coffee and Tea, has cut waste by 75 percent since they began composting waste like napkins, cups and plastic ware.

Marketing

Tenants of the Jean Vollum Natural Capital Center have also gained benefits related to image and marketing. Operating in such an environmentally friendly facility helps bolster the green image that most tenants strive to project to potential clients. Businesses at the Center report that operating in such a building aligns well with company goals and values and demonstrates a forward-thinking company. Because many of the tenants already have an environmentally-minded client base, locating in the building makes good marketing sense and helps tenants express their environmental commitment.

of system has been used in many small cities and towns across the country as an alternative to a centralized sewage treatment plant. Vegetation growing in the created wetlands removes the excess nutrients in the effluent, which can then be used for irrigation and other purposes. The Northern Guilford Middle and High Schools in Guilford, NC, rely on this type of system to treat up to 30,000 gallons of wastewater per day. The school was sited miles from the nearest sewage treatment plant, and this innovative method of treatment was less expensive than extending sewer lines. More advanced systems use a sophisticated filtration system, rather than settling tanks, to separate liquids from solids, and the resulting effluent is then discharged into a constructed wetland for final treatment. Such a system is being built in the Town of Carnation in Kings County, Washington.[6] Finally, rather than discharge treated effluent into a nearby stream or river, the effluent can be used by industry. In Hutchinson County, Texas, Agrium U.S. purchases treated wastewater from the nearby town of Borger, Texas and uses it in its fertilizer production process.[7]

Energy Use

A green industrial park could be powered largely by renewable sources of energy, such as wind, solar, geothermal, and biofuels, rather than by oil, natural gas, or electricity from coal or nuclear power plants. In fact, the park could start, during Phase I, with a large array of solar panels—a solar farm—placed on the ground and on top of buildings to generate at least a portion of the electricity needed by companies at the site. A solar farm could be built today using off-the-shelf photovoltaic panels. Over time, other sources of renewable energy could be tapped to meet a larger share of the electric demand at the site. Eventually, using a combination of sources coupled with strong energy conservation measures, the green industrial park could be powered entirely by renewable energy and operate off the grid.

Rising energy prices and concerns over global warming have spurred interest in renewable energy sources and prompted North Carolina policymakers to adopt legislation requiring major utilities in the state to generate at least a portion of their electricity from renewables. A 2007 law (Renewable Energy and Energy Efficiency Portfolio Standard) requires private utilities in the state to produce a growing portion of their electricity from renewable sources such as sun and wind: three percent of their 2011 electricity sales in the state by 2012 and 12.5 percent by 2021. In 2008, Progress Energy announced plans to build a 1.2 MW solar array or farm on 10 acres in Wilmington. The solar farm could generate enough electricity from the sun to power about 800 homes. Similarly, Duke Energy Corp. plans to build a $100 million network of solar electric panels. The panels would be installed on rooftops of homes and on the ground. The network of panels would generate electricity that would feed into the larger power grid. In Davidson County, a planned 16

5 http://ga.water.usgs.gov/edu/qahome.html#HDR6

6 http://dnr.metrokc.gov/wtd/carnation/index.htm

7 http://www.zerowastenetwork.org/success/story.cfm?StoryID=764&RegionalCenter=

megawatt solar farm will generate electricity from the sun and sell it to Duke Energy. This will be the largest solar farm in the state. In March 2008, a Spanish company announced plans to build a 280-megawatt solar energy plant in Arizona. The $1 billion plant would generate enough electricity to supply up to 70,000 homes. The plant will use mirrors to collect heat from the sun. Pipes filled with fluid are heated by the sun's energy, much like a huge magnifying glass. The heated fluid is then sent to a heat exchanger where steam is created, and that steam is then used to turn a turbine.[8]

Advances in solar and wind energy technology, as well as continuing research in biofuels, are making renewable energy more competitive with conventional fuels. With plenty of flat, undeveloped land and ample sun, Camden County could become a leader in the state in producing electricity from the sun and perhaps from biofuels as well.

3c. Development Guidelines

The following guidelines can be used to reduce or mitigate the environmental impacts of a green industrial park. In general, the guidelines do not stand alone, but overlap and are mutually reinforcing.

1. ***Create compact design.*** By reducing the size of building footprints as well as parking, a compact design reduces impervious surfaces and thus stormwater runoff from the site. Also, compact, well-integrated design facilitates moving about by means other than automobiles (e.g., biking and walking). Short trips, such as from a warehouse to a sandwich shop or cafe, can be made on foot rather than by car.

2. ***Restore wetlands.*** Much of the land in the study area has been ditched and drained for agriculture. This has led to a loss of wetlands in the area. The proposed green industrial park would provide an opportunity to restore wetland areas and enhance wildlife habitat. Wetlands can also be used to handle excess runoff from a site or even treated wastewater, as long as the runoff or wastewater is not contaminated with heavy metals.

3. ***Preserve open space.*** Most of the site should be preserved as open space. A network of interconnected open space--which could include water, wetlands, fields and forests--could provide areas for recreation and for wildlife corridors. The network could connect to the Dismal Swamp State Park.

4. ***Minimize/reuse wastes.*** Reducing or reusing wastes generated in the construction and operation of the site can be accomplished by (a) using construction materials and products that have high reused and recycled content, (b) designing rooms on 4-foot multiples to conform to standard-sized wallboard and plywood sheets, which reduces waste, (c) reusing and recycling construction and demolition materials, and (d) providing contained space within building envelopes and within the industrial park to facilitate day-to-day recycling.

5. ***Reduce or eliminate stormwater runoff.*** The volume of stormwater generated can be reduced substantially or eliminated through compact design (see above) and the adoption of technologies such as green roofs, permeable pavement and bioretention systems. Phase I of the green industrial park could include a pilot stormwater management system that demonstrates the effectiveness and cost-savings of green technologies.

8 MSNBC. "Solar farm to rise over 3 square miles in Arizona," March 7, 2008

6. ***Mix uses.*** Industrial parks typically contain only industrial uses. A green industrial park, however, could feature a mix of uses, including offices, retail and even residential. A mix of uses could allow workers and nearby residents to get around by walking, rather than by car, thus reducing air pollution.

7. ***Use renewable energy.*** Solar energy (active and passive), wind, geothermal and biomass should be explored as potential energy sources for the site. Camden County could serve as a demonstration site for renewable energy sources, particularly solar and biomass. At a minimum, all buildings should be energy efficient, include solar rooftop collectors, green roofs, and be designed to take advantage of passive solar energy.

8. ***Use energy and water efficiently.*** The green industrial park should incorporate a variety of techniques for reducing water use, including (a) dual plumbing to use recycled water for flushing toilets and for irrigation, (b) ultra low-flush toilets, low-flow shower heads, and other water conserving fixtures and appliances, (c) recirculation systems tied to a roof top solar hot water heater for centralized pre-heated hot water distribution, (d) a water budget approach that schedules irrigation only at night and does not irrigate when needs have been met by natural rainfall and (e) an efficient rainwater capture and use sys-

Case Study 3

PIONEERING ECO-INDUSTRIAL PARK

Sustainable Technology Park, Cape Charles, Virginia

The Cape Charles Sustainable Technology Park in Northampton County, Virginia was the country's first eco-industrial park. In 1994, responding to substantial economic and environmental challenges, public officials in Northampton County initiated a planning process that resulted in a sustainable development action strategy, which included plans to develop an eco-friendly industrial park. In 1999, the first building was completed and was leased to Energy Recovery, a manufacturing, research and development firm.

Initial Developments

In the first few years after its opening, the Cape Charles Sustainable Technology Park attracted approximately $8 million in local investments from private companies. It also recruited two other companies—Hauge Technologies, a manufacturer of pressure exchangers, and Delisheries, a gourmet baking mixes company. Northampton County incorporated and delegated responsibility of the park to the Joint Industrial Development Authority of Northampton County and towns within the county. A non-profit 501(c)(3), the Authority raised private funds, including public bond finance, federal and state grants, and corporate investments.

Green Features

Located on a brownfield site in the harbor at Cape Charles, the park's 31,000 square-foot building was outfitted with solar panels, low-energy light and water fixtures, protected wetlands and native landscaping. The building meets requirements for the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) silver rating. In addition, local water resources are protected through an innovative water recycling system. The eco-industrial park also includes preserved natural habitat, including the 30-acre Coastal Dune Natural Area Preserve and 60 additional acres of natural areas. Walkways and trails, including a Chesapeake Bay Overlook, were constructed at the site.

Challenges

Despite these green features and the original investment and growth of the Cape Charles Sustainable Technology Park, the park has experienced great difficulty in the last five years in attracting and retaining the types of firms that desire to participate in resource exchange systems. Thus, management was forced to abandon any further attempts to develop the park's green focus, and the park is now for sale. Northampton County anticipates that they will be unable to find a buyer prepared to operate the park according to the original eco-friendly values.

tem, which also greatly reduces run-off to local streams. Similarly, several techniques exist to reduce energy use, including (a) high efficiency lighting systems with advanced controls, (b) a thermally efficient building shell, (c) energy efficient, and appropriately sized, HVAC systems, (d) high efficiency equipment and appliances throughout all buildings.

3d. Conclusion

Compared to traditional industrial parks, green industrial parks offer numerous environmental advantages, including reduced stormwater runoff, energy use, and waste. Still, the construction of a green industrial park in northern Camden County could have negative environmental impacts. The extent of those impacts would depend on the size, location, design and operation of the park. Impervious surfaces, vehicle traffic, water and energy use, solid wastes, and emissions from the facilities within the industrial park will all impact the environment. Given the proximity to the Dismal Swamp Canal and Dismal Swamp State Park, a green industrial park should be designed and operated, at a minimum, to minimize its overall footprint on the environment, including reducing energy and water use, relying on renewable sources of energy, and minimizing and reusing or recycling wastewater, as discussed in this report.

In addition, feedback from a community workshop in Camden County indicates that stormwater management is a primary environmental concern. This report highlights several techniques that can be used to reduce or manage stormwater, including permeable pavement, green roofs, vegetated swales and water harvesting. These techniques have been used successfully throughout the state and in other parts of the country as well.

Not all environmental impacts of the proposed park would be negative. Three-fourths of the workforce in Camden County commutes to jobs outside the county, mostly in Virginia. Some of these commuters could work at the proposed green industrial park instead, thus reducing vehicle emissions. Shorter commuting times could also add to worker's quality of life.

Overall, the proposed green industrial park could serve as a model project that uses innovative design and technologies to generate energy from renewable sources, reduce wastes substantially, and reuse or recycle water and solid wastes as well as wastewater.

4. Finance and Governance

The development of a green industrial park would involve a number of key finance and governance choices and options. These options should be considered in the context of the county's long-term strategies and goals for development and should grow out of its broader strategy for leveraging its assets to broaden its tax base and creating jobs, businesses, and economic opportunities for its residents. This section of the report discusses some of the different green industrial park (GIP) governance and finance options available to Camden County.

Project Components

A GIP is comprised of several interrelated components and supporting facilities. For the purposes of analyzing finance and governance options, the components are categorized as follows:

1. Off-site infrastructure.
2. On-site infrastructure.
3. Land.
4. Buildings and parking.

Most large industrial parks take years to plan, construct, and populate with tenants. This analysis assumed that the costs for the Camden County GIP will be phased in over many years. Early phase investments will include the provision of basic infrastructure. Each phase and each component presents unique finance and governance challenges. It is likely that multiple funding options will be required to make this project feasible and that the county will develop different finance and governing strategies for individual components or groups of components.

Project Phasing and Green Features

The study team conducted several brainstorming sessions with Camden County officials to identify a representative phasing plan in order to develop rough cost estimates. There are many options for designing and implementing a GIP. The phasing used for this analysis should not be interpreted as a recommended design, but simply a potential scenario to study potential financing needs and strategies. Examples of potential green/sustainable features were grouped into three phases: year one to five (Phase I); year six to ten (Phase II); and after ten years (Phase III). Potential key elements or initiatives in each phase are presented below.

Phase I

- Expand existing water and wastewater facilities to serve up to 200 acres of development
  - Dual water (potable and reclaimed) distribution system on site

- Wastewater collection system on site
- New water line to site
- New sewer force main running from site to existing collection system
- Expansion of existing wastewater treatment facility

- Develop sixty-acre mixed-use development
  - First phase would likely include warehouses, commercial, and industrial buildings
- Construction of LEED-certified publically owned outreach and/or research facility similar to facilities in other parts of the state such as:
  - Coastal studies research center
  - Biofuels/renewable energy research center
- Construct low impact parking lot facilities (e.g., permeable pavement or garage with green roof)
- Install pilot renewable energy sources such as:
  - A 2,000 m^2 solar rooftop for a combined 730,000 kWh/yr
  - On-site geothermal heat production
- Innovative stormwater management demonstration project
  - Reconstructed wetlands would serve as the cornerstone along with building and paving materials intended to capture stormwater and promote infiltration

Phase II

- Expand capacity of water system and wastewater system capacity to serve up to 1000 acres
- Create new on-site wastewater treatment facility
- Purchase additional 1,000 acres
- Expand existing mixed-use development

Phase III

- Acquire up to 4,000 acres
- Construct a full scale renewable energy facility
- Expand all facets of the mixed-use development
- Expand all infrastructure facilities

4a. Project Capital Costs

A GIP, as with any industrial park, will require significant up-front capital investment in infrastructure. This is particularly true in Camden County, where there is very little pre-existing infrastructure on the scale needed to support an industrial park. Although operating costs tend to be lower for environmentally friendly infrastructure, up-front costs may be greater Total up-front costs will be driven, to a large extent, by the types of green features designed into the park. As discussed in subsequent sections, infrastructure funding can come from both public and private sources. It is likely that the majority of majority of funding for infrastructure will come from public sources. Regardless of where the funding comes from, it is vital that some estimate of infrastructure costs be made as part of scoping and visualization of the proposed GIP in Camden County.

To begin to evaluate potential cost and financing options for a GIP, the study team has developed a simplified cost model which accounts for offsite and onsite infrastructure construction, land acquisition and building construction, as described by the phasing

plan. This model can be adjusted for factors such as total developed acreage, total developed square footage, total water demand, and total energy needs.

Without specifying industrial and commercial tenants of the park, it is impossible, of course, to predict the exact amount of space needed, water demanded, or the size of future waste streams. Some educated guesses can be made based on other GIP project examples. The project phasing plan lists some of the assumptions about the scale of the park and some of the green features included in the cost model.

Given the current state of infrastructure (i.e., roads, water and sewer coverage, energy transmission), it is likely that a significant amount of new and expanded infrastructure will need to be put in place as a prerequisite to situating a green industrial park in the county. Water, wastewater, and energy needs are the largest cost contributors and they are also the most variable, depending on tenant type. For this reason, cost numbers should be approached with caution and revised as the project becomes more defined.

Project Phase	Project Year	Project Component	Total Cost ($ Millions)
Phase I	0 to 5	Mixed-use development	
		100-acre wetland reconstruction	
		LEED-certified public facility	
		Permeable parking areas	
		Water\wastewater infrastructure	
		On-site renewable energy production	
		Total: Phase I	**40 to 60**
Phase II	5 to 10	Mixed-use development	
		Water\wastewater system capacity expansion	
		Permeable parking	
		1,000-acre acquisition	
		Total: Phase II	**200 to 240**
Phase III	Beyond 10	2,940-acre acquisition	
		Full-scale renewable energy facility	
		Mixed-use development build-out	
		Infrastructure expansions	
		Total: Phase III	**375 to 425**

Given the innovative nature of the proposed GIP, public investment will be needed to cover many of these costs, especially in the early phases, to entice private investors and to set the stage for green development. However, private sector participation may play a

larger role in subsequent phases, particularly in mixed-use development build-out. The cost model is designed to allow for the user to adjust the level of private sector investment in each phase.

The extent to which costs will be shared by the private sector, particularly in later phases of development, will depend on the success of efforts to attract tenants in the earlier phases. It will also depend on the ability of those tenants to benefit financially from the cost-saving advantages of the GIP such as reduced energy and water use and stormwater management.

Partnerships with private developers and private industry should be established as soon as possible to gain private-sector buy-in and to take advantage of their competitive knowledge of the development climate. Moreover, as observers have noted, the long-term success of a GIP will depend on the level of involvement of the private sector in the planning, financing, and marketing of the project. Projects which rely solely on government financing with the intent of promoting economic development are less likely to succeed than projects which rely significantly on private financial and advisory support.[1]

4B. Crafting Appropriate Partnerships

All examples of successful industrial parks, whether they include environmental features or not, incorporate partnerships into their finance and governance structure. The nature and scope of these partnerships varies widely among different developments and selecting the proper type and level of partnerships will be critical for Camden County. The partnerships may be as simple as the relationship linking a government park owner with an industrial tenant or as complex as a detailed revenue, governance, and cost-sharing agreement among dozens of entities ranging from the federal government to local non-profit organizations.

Some of the types of organizations that Camden County could partner with on a GIP include:

- Other local governments in North Carolina
- Real estate developers
- Local governments in Virginia
- Industries
- Public and private utilities
- Energy service companies
- State agencies
- Regional planning agencies
- Federal agencies
- Financial institutions
- Not-for-profit entities (multiple types)

Each type of partnership will have its own benefits. The Kerr-Tar Mini-Hub Project, described in subsequent sections, is a good example of the benefit that can arise from local

1 Heeres, R.R. et al. (2004). "Eco-industrial park initiatives in the USA and the Netherlands: first lessons." *Journal of Cleaner Production* 12:985-999.

government partnerships. As a result of resource, tax revenue and cost-sharing among the inter-local partners of Vance, Granville, Warren and Franklin counties, Tier 1 state jobs tax credits are applied to jobs created throughout the region by the Mini-Hub. Camden County's Tier 1 status could be extended to development in neighboring Pasquotank or Currituck County under a similar arrangement.

One of the most critical questions that Camden County needs to address from the outset is the extent to which it wants to partner with other entities. Partnerships serve many functions ranging from creating economies of scale with operations to sharing financial risk. Concern over maintaining local control is one of the most common barriers to implementing extensive partnerships. Given the ambitious nature of this project relative to the size of Camden County's resource base, crafting innovative partnerships will likely play a major role in increasing the feasibility of a GIP.

4c. General Governance Options

There are many ways to categorize and group governance options ranging from who participates in decision making to who legally holds title to a particular component of the GIP. For this analysis, the following general categories are included:

- ***County government:*** GIP governed by a line department or organizational unit within the county government.
- ***Nonprofit organization:*** GIP governed by a nonprofit organization that has been delegated certain responsibilities by the local government.
- ***For-profit organization:*** GIP governed by a private, for-profit company.
- ***Inter-local partnership:*** Often a combination of one of the other options—GIP could be governed through one or more inter-local governments either directly or through a nonprofit or for-profit entity.

County Government

In North Carolina, local governments can manage economic development projects through a number of departments (including economic development, planning, and others), and some North Carolina counties assume the sole economic development role for their particular jurisdiction. Local governments can also own and develop property, construct shell buildings, and borrow money.[2] However, property owned by a local government is exempt from property tax, and county governments cannot guarantee private loans. Finally, because local government units are comprised entirely of public officials and employees, economic development projects initiated from a local government line agency may result in lower levels of private sector involvement.[3]

Nonprofit Organization

In North Carolina, a local government can create and/or contract with a private, nonprofit organization to carry out a range of economic development activities.[4] It is typical

2 Morgan, J.Q. and Lawrence, D.M. (2007). Economic Development (Article 26). In County and Municipal Government in North Carolina, David M. Lawrence (Ed.). School of Government, University of North Carolina at Chapel Hill.

3 Lawrence, D.M. (2000). Economic Development Law for North Carolina Local Governments. Institute of Government, University of North Carolina at Chapel Hill.

for county governments in North Carolina to delegate certain economic development functions to a variety of nonprofit entities, including chambers of commerce, economic development corporations, business councils, and industrial development authorities. According to state law, nonprofit organizations can own property, develop industrial parks, and construct shell buildings.[5] Nonprofit organizations can also borrow money and can guarantee private loans (so long as they are reasonably independent from the governing entity). Importantly, nonprofit 501(c)(3) organizations can accept tax-deductible contributions from the private sector. In addition, independent nonprofit organization governance tends to result in higher levels of private sector involvement and "buy in" (as compared with those entities more closely tied to local governments).

The degree of independence afforded to any local government's nonprofit partner varies by the local government's control over the appointment of board members and the extent of public funding allocated to the organization.

- *Dependent* nonprofit organizations are those in which the local government exercises significant control over the budget and/or board membership of its nonprofit partner.
- *Independent* nonprofit organizations are those in which the local government relinquishes control over the budget and/or board membership to other actors in the community.

The level of local government control is not a binary choice between dependent and independent, but rather these represent endpoints on a continuum of options in which the local government can structure the entity in a manner that best suits its particular set of circumstances. In most cases, governing an economic development program or project through a nonprofit entity (as opposed to a local government line agency) allows for greater involvement from the private sector, as members of the business community can assume leadership roles in the organization.

The *Cape Charles Sustainable Technology Park* in Northampton County, Virginia is an example of a project governed by a single-county nonprofit entity. In the mid 1990s, responding to substantial economic and environmental challenges, public officials in Northampton County initiated a planning process that resulted in a sustainable development action strategy. One key element of the county's strategic plan was to develop a green industrial park, and the Cape Charles Sustainable Technology Park was the first such industrial park in the U.S.

Northampton County incorporated and delegated responsibility for the Cape Charles Sustainable Technology Park to the Joint Industrial Development Authority of Northampton County and Towns. The Authority is a nonprofit 501(c)(3) and is governed by a seven-member board of directors that is appointed by the governing bodies of Northampton County and the towns in the county. The board includes both public and private sector interests. It has raised public and private funds, including public bond finance, federal and state grants, and corporate investments.

4 Morgan & Lawrence, 2007.

5 Morgan & Lawrence, 2007.

For-Profit Organization

In North Carolina, a local government can transfer a parcel of land to a private, for-profit developer, with deed restrictions or covenants on the property that compel the development to meet various public purpose outcomes.[6] Public purpose outcomes might include job creation, tax base expansion, or environmental protection. Deed restrictions are clauses that place limitations on the future use of a particular property. A covenant is a contract between a property owner and another party stating that the property owner will use or refrain from using their property in a certain manner. Once placed in deeds, covenants become deed restrictions. In North Carolina, a county that owned a particular piece of property could transfer that property to a private developer with restrictions requiring the developer to construct a certain type of building or development. Unlike nonprofit organizations, for-profits cannot accept tax-deductible contributions. However, for-profit organizations tend to have access to greater levels of risk capital and therefore, tend to result in the highest level of private sector buy-in (as compared with the local government and nonprofit options).

Inter-local Partnerships

Rural communities with limited resources face major challenges in developing industrial parks or other infrastructure for industrial development projects. However, counties and municipalities that cooperate on economic development infrastructure projects can pool risks, enjoy economies of scale and cost savings and pursue projects that otherwise might not be feasible.[7] The North Carolina General Assembly has enacted legislation to encourage and facilitate inter-local cooperation on economic development. The General Statutes authorize two or more units of local government to enter into a contract or agreement—*including with local governments in adjacent states*—to share financing responsibilities, expenditures, and revenues related to joint development projects.[8] Inter-local cooperation is a tool that is available to local governments, which can be used to share risks, costs, revenues, and oversight of economic development projects through a variety of organizational structures.

The General Statutes specifically authorize local governments to share property tax revenues generated from a joint industrial park.[9] Typically, inter-local cooperation on economic development projects include the creation of a regional 501(c)(3) with board representation from all partner entities. However, it is also possible to create an inter-local agreement stipulating that a particular economic development project was to be governed through one local government line agency, whereas the costs, revenues and oversight of the project will be shared among varying jurisdictions.

The *Kerr-Tar Mini-Hub Project* is an example of inter-local cooperation leading to the creation of a regional nonprofit organization. In December 2005, county officials from Franklin, Granville, Vance, and Warren counties in North Carolina signed an inter-local agreement to share the costs of developing a mini-hub industrial park on one site that was intended to benefit all four counties. The Mini-Hub Project resulted from a Kenan Institute study which suggested that mini-hubs, or enhanced technology parks geared towards mid-tech businesses, would benefit counties surrounding the Research Triangle

6 Lawrence, 2000.

7 Morgan & Lawrence, 2007.

8 Morgan & Lawrence, 2007.

9 Morgan & Lawrence, 2007.

Park by attracting businesses that needed to be near the Park but not in it. The mini-hub was envisioned as a network of sites, offering a variety of enhancements to businesses, but requiring a more substantial investment than any single community could provide on its own. Since 2005, the project has grown to include four sites--one in each county. Through the inter-local agreement, partners from each county agreed to the creation of the Kerr-Tar Regional Economic Development Corporation (EDC), a 501(c)(3) organization that is housed within the Kerr-Tar Regional Council of Governments. The agreement stipulates that each county contribute $40,000 per year to the Kerr-Tar EDC and, in exchange, to share the tax revenues generated from the hub. The regional EDC is charged with managing and developing the industrial sites in each county.

Similarly, the *North Mecklenburg Industrial Park* is governed by inter-local cooperation. In 2002, widespread concern that North Mecklenburg County was becoming one big bedroom community led the Lake Norman Chamber of Commerce to commission a study, which concluded that "the towns of Huntersville, Cornelius, and Davidson should jointly establish a nonprofit Economic Development Corporation to act on their behalf in promoting, facilitating, and coordinating economic development activities." It was from this study that the Lake Norman Regional Economic Development Corporation (EDC) was born. Shortly after its formation, the new EDC brought together town managers and elected officials from Huntersville, Cornelius, and Davidson to create a new industrial park in Huntersville.

The first step in creating the North Mecklenburg Industrial Park was to negotiate and draft an inter-local agreement spelling out how each municipality would share construction costs and revenues from the new park. Each town, including their town managers and elected officials, collaborated extensively to create a management agreement under which they agreed to share the $4 million construction cost based on each town's population. Huntersville would pay 60%, Cornelius, 25%, and Davidson, 15%. When the park produced property tax revenues, the towns agreed to share them according to the same formula. The inter-local agreement carries a forty-year term for revenue sharing among the towns. The agreement also created a seven-person team to manage the park, including the three mayors, three town managers, and the executive director of the EDC. In 2005, the park welcomed its first tenant, a plastics manufacturer with 242 jobs and $48 million to invest in the region.

4D. Feasibility Of Governance Options

Governance of any economic development initiative must be considered in the context of the jurisdiction's long-range strategy and vision for development. Such a vision and strategy for development in Camden County is absent from this analysis and therefore, it must be considered as informational and not prescriptive. Given Camden's relatively limited tax base and historically challenged local economy, this analysis will consider the options based on three main criteria: ease of implementation, financial feasibility, and political control.

County Government

Camden County could govern the development of a GIP out of its county government. Assuming that the county owns property that is appropriate for a GIP, this option likely would enable the county to move most quickly in terms of implementation. Governing

an economic development project out of the county government would give local elected officials the maximum level of control. However, because local government control tends to result in less involvement from the private sector, this option could create challenges in terms of financing the project. The key question, with respect to governing a GIP project out of the county government, is whether the county has access to sufficient financial resources to go it alone.

Nonprofit Organization

Camden County could create a 501(c)(3) nonprofit organization to govern the development of a GIP. The nonprofit organization could be dependent or independent of the local government, depending on the political and financial interests involved. Alternatively, in Camden County, a nonprofit governing entity could be born from inter-local cooperation, in which the participating jurisdictions would contribute toward the expense of creating and managing the organization and its various activities. With nonprofit governance, the major benefit of inter-local cooperation is that participating jurisdictions can assume board positions and the nonprofit can serve as a regional entity with regional buy-in. If officials in Camden County prefer that its GIP project develop as a regional entity, this is perhaps the most politically and financially feasible option.

For-Profit Organization

If Camden County were presented with a situation in which a private developer had an interest in developing a GIP on county-owned property, the county could initiate a process to transfer the property to a private developer with deed restrictions or covenants on the property to require the development to meet certain public purpose outcomes. However, given the challenging market conditions in rural Camden County, this option is perhaps the least feasible at this point and will not be discussed at length. This is not meant to imply that private developers ought not to be considered as valuable stakeholders. However, the overall financing and governance of a GIP project in Camden County is not likely to be assumed by the private sector.

Figure 4.1
Characteristics associated with each governance option[10]

Characteristic	County Government Governance	Nonprofit Organization Governance	For-Profit Organization Governance
Taxing authority	Yes	No	No
Can own property	Yes	Yes	Yes
Can develop industrial park	Yes	Yes	Yes
Can borrow money	Yes	Yes	Yes
Can guarantee private loans	No	Yes	Yes
Income tax status	Exempt	Exempt	Taxable
Property tax status	Exempt	Taxable	Taxable
Inter-local cooperation possible	Yes	Yes	Depends
Private sector involvement	Low	Medium	High

10 Adapted from Morgan and Lawrence, 2007.

The trend among industrial park developments is to use the non-profit governance option. A 501(c)(3) will provide the greatest flexibility to change governance structure as it grows and it is therefore recommended for the proposed Camden County GIP. Given the relatively limited resource base in Camden County, we also recommend that the project reach outside the County, by way of an inter-local partnership, for resource and risk sharing.

4E. Funding Options

A proposed GIP in Camden County would depend on a variety of sources in order to provide funding for the initial investment in land, building, and on- and off-site infrastructure improvements. The four basic mechanisms for acquiring funding for economic development projects are pay-as-go county resources, debt, state and federal grants, and partnerships. Tax incentives are a valuable source of funding accessed through the leveraging of partnerships with private for-profit entities.

The following discussion provides a brief description of many of the commonly used funding mechanisms for economic development projects in North Carolina, as well as a listing of sources for grants and subsidized capital. For a list of funding options available to Camden County, please see Appendix 4-B.

Pay-As-Go

Pay-as-go financing draws on existing capital reserves or cash balances or on revenues and taxes that exceed annual operating expenses. This funding source has the benefit of little to no transaction cost, local autonomy in determining how the money should be spent, and reduced debt load and interest burden. The limitations of pay-as-go financing are that they place the burden of paying for future benefits on today and yesterday's tax payers, they are frequently inadequate to cover the costs of large capital investments, and they can hide the opportunity costs of the capital being deployed.[11]

Debt

Debt financing uses an asset, such as a building or land parcel or the right to assess and collect taxes or other revenues, as security for a loan. The loan is then paid back over time at an interest rate that reflects the perceived risk of failure to repay the full amount of the loan. If the loan is not paid back, then the pledged security is generally forfeited to the lender. The primary forms of public debt are:

General obligation bonds are backed by the full faith and credit of the issuer. The issuing public entity promises that all available revenue sources and resources, including the power to raise taxes, will be used to pay back the loan. These bonds are the most secure form of public debt, and typically carry the lowest interest rates.

Revenue bonds are backed by the cash flows generated by the project they financed. Good examples of likely candidates for revenue bond financing would include toll roads or water systems that charge user fees. The project itself may also be used to secure the loan.

Lease or lease-purchase debt comes in a number of similar forms, and is used to provide greater financial freedom to local governments while also securing needed

11 Vogt, J. (2004). *Capital Budgeting and Finance: A Guide forLocal Governments.* Washington, D.C.: International City/County Management Association.

infrastructure in a timely fashion. The three most prominent forms of capital leases are installment purchase financing, lease purchase financing, and long-term true capital leases.[12] The biggest difference between these forms is the point at which the title to the property passes to the lessee (i.e., local government). In an installment purchase financing, the title passes at lease inception. In a lease-purchase financing, the lease passes to the lessee at the end of the lease term. In a long-term, true capital lease, the title remains with the lessor. Other factors in lease or lease-purchase debt include the option to purchase at any given point in time, and the option to cancel the lease agreement. Very large capital leases may be divided into smaller shares and privately placed with multiple investors as certificates of participation. This approach expands the usefulness of the leases as financial tools but also incurs a greater transaction cost.

Industrial revenue bonds are a form of qualified debt that is used to leverage the advantages of tax exempt public debt while placing the security and repayment burden on the participating private entity. In order to qualify for an industrial revenue bond a project must pass strenuous tests ascertaining that the industrial facility financed with the bond will be used for manufacturing.[13] These qualifications also limit the amount of debt to $10 million.[14]

Self financing bonds (more commonly known as tax increment financing) are a relatively new financing mechanism in the state of North Carolina and are still quite controversial. In tax increment financing, the increased tax revenues that result from development which arises around a project are used to secure debt to finance the project. The process involves first identifying an area to be designated as a development financing district. Following approval by the local government commission, a valuation of the property in the development financing district is performed, and taxes resulting from increases in property value following the project are used to repay the bond.[15]

Grants and Tax Incentives

Grants are sums of money contributed to the project by outside parties that do not require repayment. They are a good source of funds to extend existing resources. However, they frequently bear an administrative and oversight burden that may be considerable. They also frequently require matching local funds to be invested, or require documentation of significant economic impacts such as job creation. As an example, the North Carolina Rural Economic Development Center offers water and sewer infrastructure grants under their Economic Infrastructure Program valued at $10,000 for every job created up to $500,000. Both a timetable for job creation and funding plans for a 5% match are required at time of application.

Tax incentives depend upon partnerships with for-profit private sector enterprises that would benefit from a reduced tax burden. If negotiated well, the reduced tax burden

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12 Vogt, J (2004).

13 Industrial revenue bond program. Retrieved April 9, 2008, from North Carolina Department of Commerce Web site: http://www.nccommerce.com/en/BusinessServices/SupportYourBusiness/FinancingBusinessGrowth/IndustrialRevenueBondsProgram/Index.htm

14 Lawrence, D (2000).

15 Amendment one project development financing. Retrieved April 9, 2008, from North Carolina Department of State Treasurer Web site: http://www.nctreasurer.com/NR/rdonlyres/26DF90C8-DF73-4AAF-9832-3830EA07B089/0/AmendmentOnedraftrevised9205docrevised307.pdf

should enable the private entity to make a larger initial contribution to the project while still maintaining an adequate return on their investment.

Given both the potential for job creation in an economically underdeveloped region and the environmental focus of the proposed GIP, there are many promising grant and tax credit opportunities for this project. The GIP governing body should enlist a real estate developer with significant experience utilizing federal and state tax credits and grants for project financing.

4f. Conclusion: Likely Funding Scenarios

Given the size of Camden County's revenue base, funding a major industrial park of any kind will require assembling a financing package that relies heavily on external funding sources. A preliminary financial analysis indicated that Camden's ability to issue more debt in the short and medium term is limited and most likely could not exceed $3 to $5 million dollars. Even this modest contribution would put Camden County in excess of its internally adopted financial policy, and would be further constrained if Camden is required to carry significant financial responsibility for the construction of a new high school, costs of which have been estimated at $40 million. More local resources might be available if inter-local partnerships are formed for the purpose of establishing the GIP. Given the historical economic environment within the county, most private investors and potential tenants would view the area as tentatively linked to the strength of the overall commercial and industrial market in Hampton Roads. Although recent market conditions have made rents and vacancies difficult to predict, an initial estimate indicates that a private entity could only contribute an investment in the range of $1.5-2.5 million per 100,000 square foot building in Phase I, given a required rate of return on a before-tax basis of 15 percent.

No single existing grant program would likely cover the multi-million dollar investment shortfall needed for this project to advance. The project meets the stated objectives of several grant programs and a short-term investment in grant research and grant writing could help the county obtain some investment funds to offset costs; but even with four or five modest grants, the county still needs a major infusion of capital from an outside source.

Any decisions regarding which option(s) to pursue must be made in the context of the county's long-term strategies and goals for development and should grow out of its broader strategy for leveraging its assets to broaden its tax base and to create jobs, businesses, and economic opportunities for its residents.

5. Engaging the Local Community

The focus of the community engagement activities of this project was to solicit input from a full range of potential stakeholders that might be interested in a green industrial park in Camden County, North Carolina. To do so, the study team interviewed local leaders and residents, held a local planning session, and conducted a half-day workshop in Camden County. During the workshop, community members representing various stakeholder groups in the county heard from study team members and collectively guided the feasibility analysis, as well as identified resources that might be used in the development of a future industrial park.

Prior to the workshop, team members conducted thirty-nine phone interviews to introduce the project, gather background information, and begin identifying potential workshop participants. We conducted telephone interviewees with the following stakeholder groups: local and regional businesses, local and state governments, environmental and community-based organizations, educational institutions, and residents. Staff also participated in a meeting of the Albemarle-Pamlico Conservation and Communities Collaborative, where over eighty citizens and advocates from coastal North Carolina counties discussed perceived assets of the region and common challenges. From these activities, the study team identified a small, local planning group that met with team members on February 28, 2008 to discuss the community workshop goals, agenda, and logistics. Participants also assisted the team in defining stakeholder categories and prioritizing and balancing the list of invitees.

Ultimately, all of the input gathered from local leaders and residents was incorporated into the design of a community workshop that was held on March 13, 2008 at the Dismal Swamp State Park in South Mills, N.C. Thirty-two participants attended the half-day workshop, representing all of the identified stakeholder groups. (The workshop agenda and attendee list are attached as Appendices 5A and 5B.) After team members described research foci and methods and presented initial findings, two rounds of concurrent breakout sessions were conducted, with each round including a facilitated discussion on the three foci of the feasibility study: Business Opportunities, Environmental Quality, and Governance/Finance.

5a. Common Themes

A number of common themes emerged across the breakout sessions, and they are summarized here, followed by brief summaries of unique issues that arose in each session. In terms of local assets, many participants noted the availability of large tracts of undeveloped land in Camden County, which would be affordable relative to nearby markets in the Hampton Roads metropolitan area. They also emphasized the value of the recently improved Highway 17 as a key transportation corridor to Hampton Roads, Virginia. There was general agreement that Camden County residents possess a strong sense of community and

volunteerism—especially evident in the support for the county school system, which is the second-largest employer in the county.

Camden County's rich and diverse ecology was also highlighted as an asset, and many participants suggested eco-tourism as an economic development opportunity. They specifically noted that the northern part of the county hosts tourism destinations for boaters and includes parts of the North Carolina Birding Trail and the National Underground Railroad Network to Freedom. Participants also noted that although these natural attractions may draw tourists, Camden County has little to offer them in the way of services—such as lodging and restaurants—creating a perception that the county is losing potential tourism revenues. Workshop participants also identified tourism-related retail opportunities, including canoe rental/repair and outdoor outfitters, and mentioned opportunities to develop eco-tourism support services through the training programs already available at the College of the Albemarle and Elizabeth City State University. In addition, participants expressed a desire to see the development of general support services such as doctors' offices, child-care centers, gas stations, and grocery stores, and to integrate such services into any industrial park development.

Several challenges mentioned in the workshop represented broad consensus among workshop participants, particularly those related to infrastructure. Participants agreed that current population growth is stressing Camden County schools. In addition, a lack of water and sewer infrastructure in the county was identified as a limiting factor in attracting businesses to an industrial park and to developing eco-tourism. A number of people noted that Camden County has lost business to southern Hampton Roads due to inadequate infrastructure, and further, that making necessary improvements and expansions to the county infrastructure would require significant, diversified investment from various sources, including grants. According to one local government participant, water and sewer improvements alone are estimated to cost the county as much as $10 million.

Another challenge identified by participants was the lack of affordable housing in Camden County and its relatively high property taxes. Participants noted problems retaining college graduates returning to the area due to higher real estate costs as compared to neighboring counties. In addition, the rental market was identified as an issue of concern, and several participants noted that it would be difficult to find housing for teachers, government employees, service workers, and single parents.

Throughout the workshop, participants identified economic viability as a primary concern for a green industrial park. They suggested that the county focus first on the feasibility of a traditional industrial park, then if such a park were feasible, think about how to make it

green. Many participants felt that, given the difficulty in attracting businesses to Camden County in the first place, adding a "green requirement" might make it impossible. Thus, it was suggested that economic developers work with any willing industry to innovate in making their processes "greener" rather than turning them away for being "too dirty."

5b. Breakout Sessions

The following summaries highlight issues raised in each breakout session that were unique to the topic being discussed.

Business Opportunities

Participants identified numerous opportunities for economic development within an industrial park setting. First, distribution for military or other shipping interests was suggested. In addition, aviation and other military support businesses, including modeling and simulation were mentioned as possible components of an industrial park. One participant noted that simulation and "telepresence" are being taught at Fayetteville Technical Community College in conjunction with special operations and training. Another participant suggested manufacturing and repair services, in particular for the Coast Guard. The same participant noted that Suffolk, Virginia had sought modeling and simulation companies and had been successful in bringing five companies to the area.

Renewable energy was also identified as an economic development opportunity, in particular, biofuels and wind energy. Participants were curious about opportunities for partnerships in the biofuels sector. There was also discussion about wind turbines, though at least one person mentioned insufficient wind in Camden County. Another noted that if Camden did develop wind turbines, it would make sense to manufacture the blades on-site due to the difficulty of transporting them. Participants mentioned that they had heard of several companies, including Acciona Energy, that are interested in putting wind turbines in the Canadian Hole area on the Pamlico Sound side of Hatteras Island in Dare County. Other participants expressed interest in exploring small-scale renewable energy.

Participants identified several assets within Camden County that are relevant to economic development. They noted that the county has many skilled workers, including retirees who want to begin a second career. Second, the county has a good relationship with the United States Department of Agriculture, which may be interested in working with the county to site a grocery store. Also, railroad and water access provide unique opportunities for transport and business development.

One of the biggest challenges identified in these sessions was competition with Hampton Roads, Virginia. Participants mentioned that significant wage disparities exist between Camden County and Hampton Roads. Also, one participant suggested that Camden County has lost business to Hampton Roads, because there is no paved road to Blackwater Worldwide. It was further suggested that if there were such a road, Camden County might be able to create lodging and other support services for the private military company.

Another challenge discussed was controlling growth. Current residents recognize that the county is growing and the new residents are largely commuting to Virginia for jobs; they would prefer to be able to offer jobs locally, which could boost the county's tax base.

Environment

In considering what features may make an industrial park "green," participants focused on maximizing efficiency, minimizing waste, recycling water, installing energy saving devices and geothermal applications, and designing for Leadership in Energy and Environmental Design (LEED) certification.

Several challenges were identified in these sessions. First, it was noted that Camden County is a sensitive and biologically diverse ecological area. Many bird species have migration routes that run through the county. There was some concern that construction and operation of a large industrial park could harm native animal species or their habitats and have negative effects on the quality of life of residents. Specific concerns were raised regarding the light pollution, noise pollution, and safety concerns that increased traffic from an industrial park might bring. The county's soft soil was also identified as a challenge to any large-scale industrial development, and participants noted that, in some areas of the county, the soft consistency of the soils, combined with a shallow water table, makes buildings unstable. Participants also expressed frustration at the perceived inflexibility of the North Carolina Department of Environment and Natural Resources (NCDENR) in embracing innovation. Specifically, participants noted that there are few incentives to build structures using "green" technologies (such as green roofs, rain gardens, etc.), especially when many traditional technologies (such as storm water retention ponds) are still required by law.

Challenges related to water use and management were also identified. Efficient management and collection of stormwater represents an opportunity to use recycled storm water, or "grey water." Given the county's limited water treatment capacity and high cost of municipal water delivery, water recycling for landscaping activities was discussed as a possibility for limiting treatment costs. However, the extent of water recycling will depend on the grey water regulations set forth by NCDENR. In addition, because Camden County regularly experiences heavy rain storms and even hurricane conditions, any structure must be able to withstand flooding. Global warming was also identified as a concern due to the potential for sea level rise and saltwater intrusion into the county's marshes.

Participants suggested that a good first step in planning for an industrial park would be to create guidelines for development informed by analysis of the site's wildlife, soil, and drainage conditions. In doing so, the county could identify "off-limits" areas that are priorities for conservation or unfit for development. Several people suggested that an industrial park should be integrated into its surrounding community with sidewalks and trails for walkability and pedestrian safety.

Governance and Finance

Two assets discussed in the governance and finance sessions are Camden County's eligibility for various development grants and possible funding through members of their state and federal delegations (i.e., state senator and representative; Congressional representative and U.S. Senator). Participants also discussed seeking assistance from their area North Carolina Department of Transportation (NCDOT) board member with regard to transportation infrastructure needs and from the Clean Water Management Trust Fund regarding stormwater system funds. Primary contacts for possible sources of water and sewer funding were less clearly identified, although the Golden LEAF Foundation's

new county assistance project was mentioned. Given that Camden County needs major infrastructure improvement, grants will be an integral component of the financing.

Some unique considerations for an industrial park surfaced from these sessions as well. Participants felt that an industrial park should be part of a plan for long-term competitiveness and should be a continually expanding endeavor. Regarding infrastructure development, participants expressed the need to develop water and sewer lines to benefit the whole county—not just an industrial park. It was suggested that a public/private partnership would be a good way to develop infrastructure, and it was noted that Camden County must work to understand how other communities are attracting industries and creating jobs.

Challenges discussed in the governance and finance sessions largely focused on financing infrastructure improvements. Participants mentioned that sales tax revenue is not likely to be a significant source of income for the county due to lack of retail shopping opportunities that create significant point-of-origin revenue. Most spending is done outside the county in either Elizabeth City or Hampton Roads, Virginia. Also, because Camden County has limited borrowing capacity, it will have to look to other sources (i.e., grants, partnerships) to finance infrastructure projects. However, recent partnerships have proven difficult for Camden County, as it has not always been able to match the resource investments of neighboring counties.

5c. Information Needs

An important component of the community workshop was to identify information needs of workshop participants. These questions were recorded and, where appropriate, addressed in the feasibility study. A brief summary of the key information needs identified is outlined below.

- Workshop participants were interested in understanding the components of LEED certification as well as how a green industrial park in Camden County might incorporate aspects of sustainability, more generally. They also expressed a strong interest in learning about other green industrial parks referenced at the workshop, especially any success stories.
- Participants wanted information on competing regions and their unique advantages. In addition, participants were curious about the types of businesses outside of Camden County to which Camden residents commute.
- Participants expressed interest in learning about regional development partnerships, including success stories. In regard to financing of a green industrial park, participants wanted to know about the resources available to Camden County, particularly grants.
- Participants were also interested in what types of businesses might serve as "anchors" of an industrial park and what governing structures might successfully manage a green industrial park.

- Participants were interested in knowing how much revenue an industrial park could generate for the county and how soon.

Some of the identified information needs could not be addressed by this feasibility study, as they were beyond its scope. Should planning for a green industrial park proceed, the following information needs could also be addressed:

- There was a desire to see how a green industrial park might fit into a long-term plan for the county.
- Finally, Camden County residents would like to know whether specific public policy changes might increase the success of such a park.

5d. Follow-Up Meetings

Following the community workshop, the study team facilitated a discussion among local and regional developers and economic development professionals. The purpose was to hear their reactions to the preliminary study findings, gauge whether these findings were consistent with the experience of the participants, and solicit additional input that would inform our analyses. During this session, ideas were generated about the most appropriate type of facilities for a green industrial park and what prerequisites must be met in order to maximize the economic viability of the proposed park. There was consensus that lack of infrastructure was a major barrier to business development in Camden County. The benefits of creating a mixed-use development were discussed, but questions were also raised as to whether such a development would generate sufficient revenues for the county, particularly if businesses did not thrive and it ended up being primarily a residential development. In addition, the group brainstormed a list of potential partners in future development, including individual landowners, federal agencies, UNC system schools (through the UNC Tomorrow initiative), and various public-private partnerships.

Following this session, the study team participated in a regional tour that included a trip to the Norfolk port facilities led by the Virginia Port Authority, and a trip to the Greenbrier industrial park in Chesapeake, Virginia led by commercial real estate professionals. The Port Authority presented ambitious expansion plans and identified a need for additional distribution facilities in the near future. The Greenbrier representatives explained some of the practices that have contributed to its success, such as creating a regional stormwater management system for all facilities and buildings in the development.

5e. Conclusion

Through interviews and community meetings, the study team was able to solicit input from a diverse array of local leaders and residents representing a balance of interests, including business, government, and community-based organizations. This input helped the team to identify participants' perceptions of key local assets and challenges as well as their information needs, all of which were incorporated into the feasibility study to the extent practicable.

Through this process, the following community assets were identified:

- availability of large tracts of undeveloped land;
- a recently-improved transportation corridor to Hampton Roads, Virginia;
- strong schools
- a sense of community and volunteerism;
- a rich and diverse ecology; and
- eligibility for various development grants and possible state-level funding sources.

Challenges were also identified, including:

- lack of water and sewer infrastructure in the county;
- limited general support services;
- limited tourism services;
- population growth stressing county schools;
- lack of affordable housing;
- relatively high property taxes;
- competition with Hampton Roads, Virginia, including wage disparities; and
- a significant percent of the population commuting out of the county to work.

In addition, participants recognized that necessary infrastructure improvements would require significant, diversified investment from various sources, including grants.

Workshop participants identified promising businesses, including the following: distribution for military or other shipping interests; aviation and other military support businesses, such as modeling and simulation; manufacturing and repair services for governmental entities such as the Coast Guard; renewable energy, including biofuels and wind energy; and eco-tourism.

Participants emphasized that economic viability was a primary concern for an industrial park and expressed concern that adding "green requirements" might hamper success. They also expressed concern about the potential impact of development on native animal species and their habitats as well as residents' quality of life due to light pollution, noise pollution, and increased traffic.

Workshop participants would like to see guidelines for any new development informed by analysis of a proposed site's wildlife, soil, and drainage conditions. If development were to occur, participants would like to see water and sewer infrastructure improvements that would benefit the whole county, and they expressed a desire to see creative approaches to controlling storm water runoff. They would also like to see development that includes general support and retail services. Overall, participants indicated that they would like to see development that recognizes that long-term competitiveness is a continually expanding endeavor, and they noted that Camden County must work to understand how other communities are attracting industries and creating jobs.

6. Envisioning Green Development

6a. Purpose

The purpose of the visioning phase of this study was to provide a vision for a green industrial park (GIP) in Camden County, NC. This vision was based on input from interested groups including Camden County staff and elected officials, regional economic developers, commercial real estate agents and the local community. In developing a unified vision for the GIP, we sought to incorporate as much local input as possible.

6b. Vision

The vision for the GIP has three major themes that were incorporated into the overall design of the project.

1. ***Mixed use:*** Spatially orienting land uses within the project to include industrial, commercial, open space and possibly even residential components proximate to one another in an integrated development.
2. ***Mix of industrial spaces:*** Providing a dynamic range of industrial buildings to accommodate a variety of prospective industrial tenants.
3. ***Environmental protection:*** Limiting the impact of development on the site by preserving open space through clustering, using the site's natural hydrology to manage stormwater runoff, and efficient use of traditional and carbon-neutral sources of energy.

6c. Process

Three landscape architects joined the study team to design and illustrate this vision, under the supervision of a senior UNC faculty member from the Department of City and Regional Planning. They first reviewed GIS data and identified the natural on-site drainage and soil types for the County-owned land. In addition, the landscape architects coordinated with the study team to ensure that the vision reflected the phased approach for the development of a proposed green industrial park and created linkages to the existing Dismal Swamp Canal State Park. Through an iterative process—with feedback from the community, elected officials and the project team—the landscape architects created a vision that builds on the existing features of the site (including a large pond) and incorporates the main elements of the first two phases. Protection and restoration of wetlands became a central design feature, and provides an amenity for the users, stormwater management, natural habitat, and a buffer between incompatible uses.

6d. Results

The resulting vision for a proposed green industrial park in Camden County encompasses two of the three potential phases of development discussed earlier in the report includ-

ing a mix of industrial and commercial development, as well as areas for a solar farm and wetlands. This design also preserves a significant amount of open space. The design is far more ambitious than that of a traditional industrial park, as it strives to maximize both economic development and stewardship of the environment while creating a dynamic destination where people would be drawn to live and conduct business.

Figure 6.1 illustrates the overall site plan. Figures 6.2 and 6.3 illustrate aerial renderings of the hypothetical development, and Figures 6.4 – 6.11 provide close-up images of various focal points and districts within the hypothetical development and include additional visual detail.

Figure 6.1
Vision concept

Figure 6.2
Three phases of the proposed green industrial park

Figure 6.3
Hydrolic flow design concept

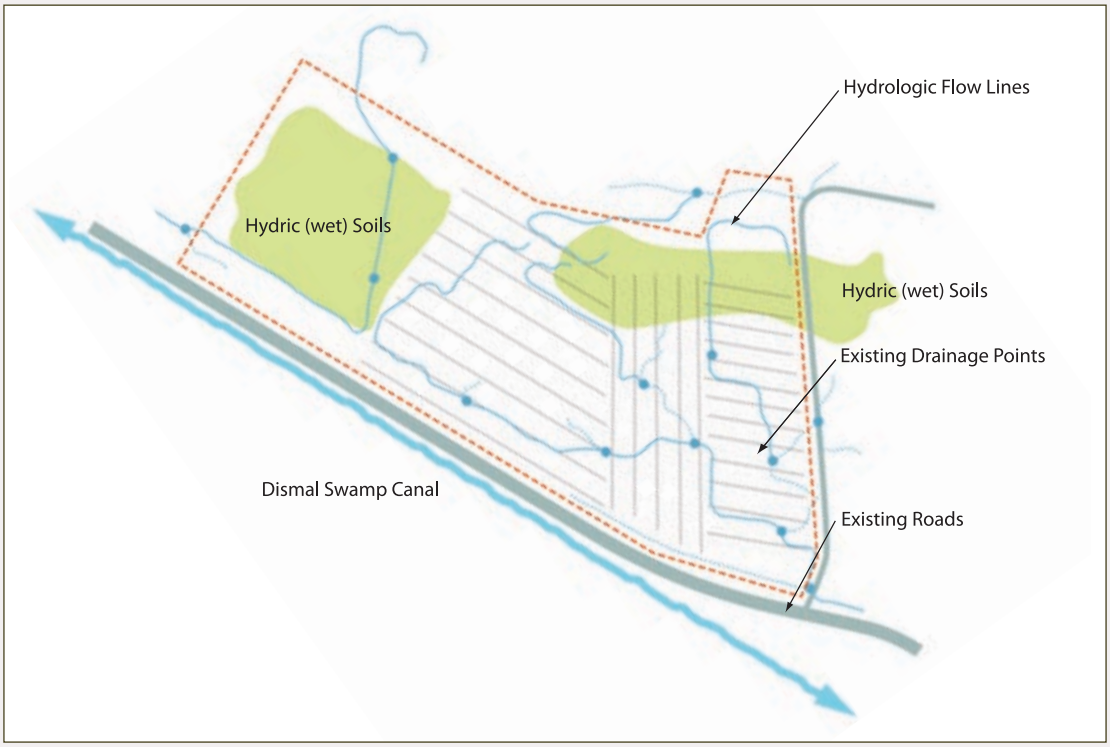
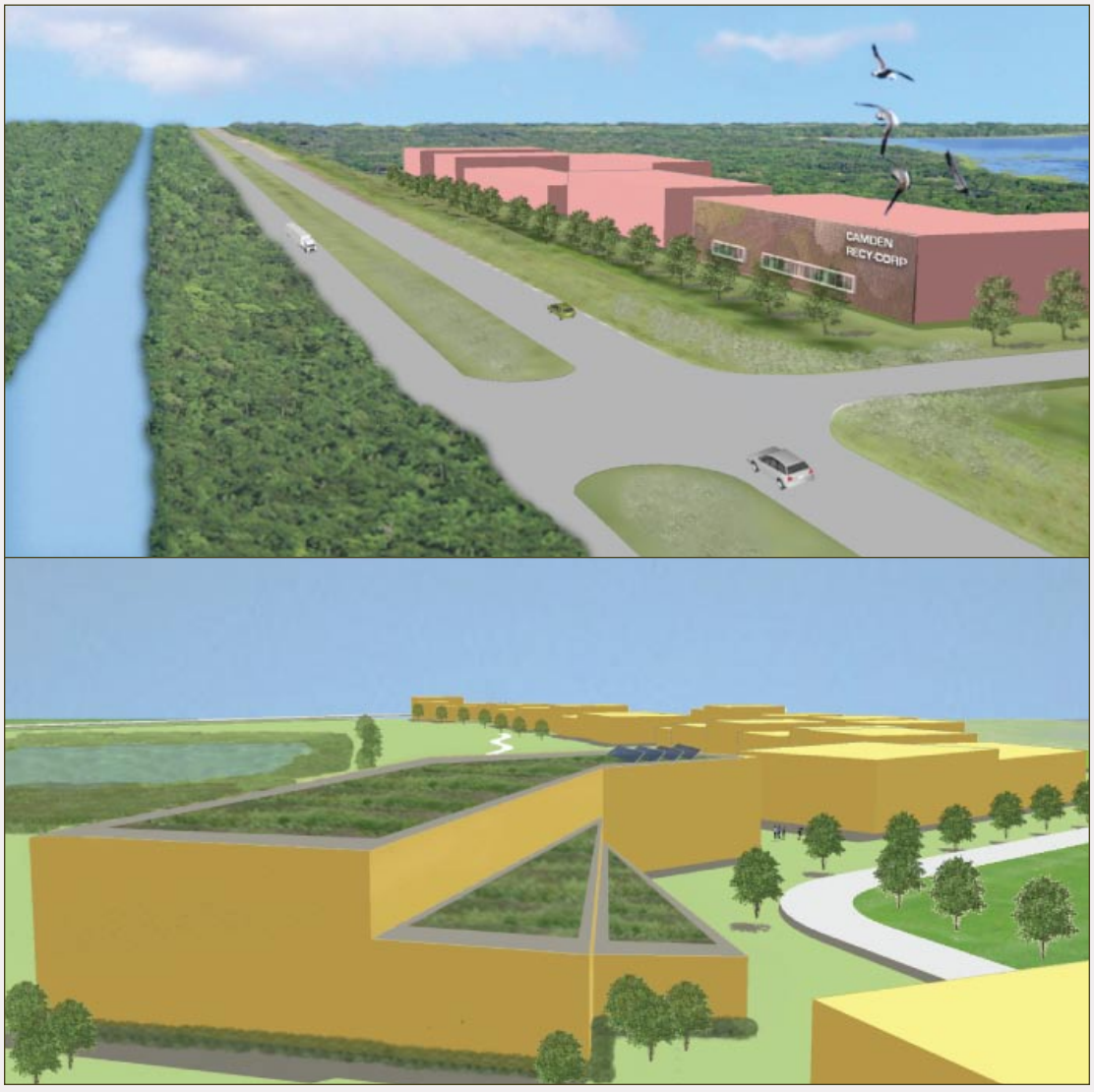


Figure 6.4

(1) Industrial development along Route 17

(2) Green roofs on commercial and industrial buildings. By capturing rain, green roofs reduce stormwater run-off.



1

2

Figure 6.5

(1) Restored wetlands could be used to manage stormwater and provide an amenity for nearby residents as well as a link to the Dismal Swamp State Park.

(2) Small-scale park environments would be created near buildings and along wetland borders.

1

2

Figure 6.6

(1) A mixed-use development, with retail and nearby residences, could serve as a gateway to the green industrial park.

(2) A small marina built next to the existing Dismal Swamp Welcome Center could provide a link between the green industrial park and the swamp and support eco-tourism.

1

2

7. Conclusion

Camden County, North Carolina faces many of the same opportunities and challenges of other rural North Carolina counties. Its distance from major metropolitan areas and the lack of infrastructure have made it difficult to attract industries, and the county lacks commercial development options and job opportunities for its citizens. In addition, 76 percent of the workforce commutes to jobs outside the county, mostly in Virginia. Yet, the county is rapidly developing into a lower cost bedroom community for the southern Hampton Roads region. In addition, it possesses an available workforce and a demand for retail development that could be used as a basis for making improvements in commercial development and other job creation areas.

Nationwide, there is growing interest in green development, for a variety of reasons. First, green buildings can provide a competitive advantage to users. Energy and water conservation, waste recycling, and reuse of stormwater can lower operating costs. Other firms are going a step further and are developing zero energy projects that produce more energy than they consume, selling the excess electricity to the grid. Second, firms may be attracted to a green industrial park because it is consistent with their core values (sustainability), products, or because it would help promote their image as a green company. From corporate headquarters to manufacturing and warehousing facilities, companies are going green.

What firms would be attracted to a green industrial park in Camden County? Our analysis suggests that the county should target industries in the following clusters: aluminum products, basic health services, metalworking and fabricated metal products, information services, business services, and non-residential building products. Our interviews with a small sample of firms in these clusters suggests that there is some interest in a green industrial park in Camden County, particularly among firms seeking to lower their operating costs (specifically for energy and water use and waste disposal).

Is a green industrial park feasible for Camden County? It depends. Several issues would have to be addressed, including the lack of infrastructure, competition from existing industrial parks in the region, and potential environmental impacts.

At present, northern Camden County lacks infrastructure to support a green industrial park, or any industrial development for that matter. By strengthening its transportation, utility, and other infrastructure, Camden County could attract companies seeking proximity to the Hampton Roads industry clusters. Financing the industrial park, however, will prove challenging. Given the size of Camden County's revenue base, funding a major industrial park of any kind will require assembling a financing package that relies heavily on external funding sources. Our analysis indicates that the county's ability to issue more debt in the short and medium term is limited and most likely could not cover more than a fraction of the project's investment needs. For Phase I alone, approximately $30-40 million in outside funding would be needed to support infrastructure investments.

No single existing grant program would likely cover the multi-million dollar investment shortfall needed for such a project to advance. This kind of project meets the stated objectives of several grant programs, and a short-term investment in grant research and grant writing could help the county obtain some investment funds to help offset costs; but if the county were to attract four or five modest grants, it would still need a major infusion of capital from an outside source.

Even with investments in infrastructure, however, Camden County may have difficulty competing with business parks with existing infrastructure and locations closer to the core of the Hampton Roads region. There appears to be a surplus of available park acreage within this region, thus the county would need to differentiate a potential business park (green or otherwise) from the existing market. We contacted 38 industrial parks in the southeastern Virginia and northeastern North Carolina region. Although a few of these industrial parks contained firms that produced green products (e.g., recycled glass), none could be considered green industrial parks. Thus, a green industrial park in Camden County could differentiate itself from regional competitors.

Finally, the construction of a green industrial park in northern Camden County is likely to have an impact on the environment. How much of an impact depends on the size, location, design and operation of the park. Impervious surfaces, vehicle traffic, water and energy use, solid wastes, and emissions from the facilities within the industrial park could all have an adverse impact on the environment. Given the proximity to the Dismal Swamp Canal and Dismal Swamp State Park, a green industrial park should be designed and operated, at a minimum, according to the guidelines discussed in this report (e.g., minimize building footprint, conserve water and energy, recycle wastes, use renewable energy). This report discusses several techniques that could be adopted to reduce environmental impacts.

Not all environmental impacts of a green industrial park would be negative, however. Some of the workers who commute to jobs outside the County could, presumably, work in such a park, thus reducing commute distances and vehicle emissions. Shorter commuting times could also add to workers' quality of life. Finally, a green industrial park could also result in the restoration of wetlands as well as stronger linkages to the Dismal Swamp State Park.

Given the growing interest in sustainable development along with concerns over global warming, a green industrial park could be feasible in Camden County, assuming the main issues or challenges raised in this report are addressed: infrastructure, competition and environmental impacts. In addition, a green industrial park could capitalize on rising energy prices, which have spurred interest in renewable energy. In fact, the project, if developed, could serve as a model for the rest of the state, attracting investment in renewable energy and other green technologies and demonstrating the competitive advantages of green design, operations and management.

Appendices

Appendix 1: Economic Impact Assessment for Green Business Park in Camden County

Introduction

The following is an estimate of the total economic impact of a proposed green business park in Camden County. The area of study used for the impact assessment is the Elizabeth City Micropolitan Statistical Area, which includes Camden County, Pasquotank County, and Perquimans County. The period of study falls within the first phase of construction in the park, from 2009 to 2013. This section ends with an estimate of property tax amounts that would be generated by the business park for Camden County.

Economic Impact Scenarios

The economic impacts of construction in the business park were based on estimated construction expenditures for buildings, roads, and an offsite water treatment plant (Table 1).[1] Figure 1 graphically displays this construction expenditure scenario. Two sectors were selected for building construction (Light manufacturing facility construction and Office building construction) in order to reflect the expected attraction of both manufacturing and service industry firms to the park. Several expenditures, listed in Table 2, were not able to be included in the economic impact analysis. All expenditures on labor and other inputs for construction were assumed to be made locally, inside the study area.

Construction Expenditures (2009-2011)

Table 1

Sector	2009	2010	2011
Light Mfg. Facility	$3,330,000	$2,580,000	$1,580,000
Office Building	$3,330,000	$2,580,000	$1,580,000
Roads	$3,517,740	–	–
Water & Sewer	$4,573,000	$4,573,000	–

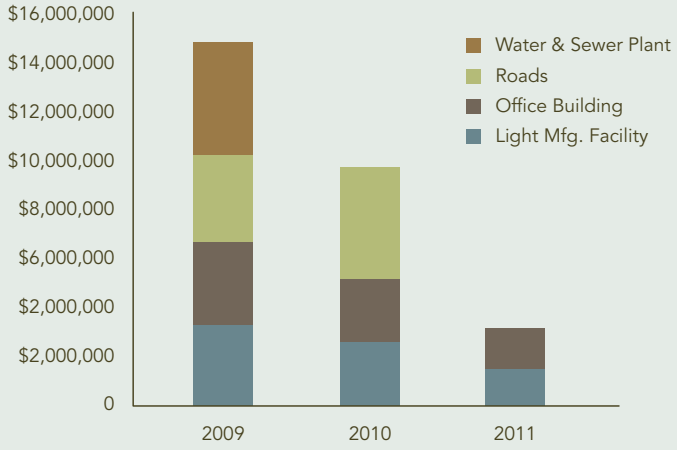
Construction costs excluded from IMPLAN

Table 2

Storm water Pilot Project
Distribution System
Collection System
Solar power generation

1 Camden Cost Model 8-5-08.xls

Construction Expenditures



The economic impacts of firm operations were based on a scenario in which 6 firms locate in the park, beginning in 2010. Each of the six firms in represents a sector that is considered to be part of an industry cluster that Camden County is targeting (Tables 3a–3d). Employment numbers for these sectors are based on the average employment level of firms in each industry cluster.[2] For the years 2010, 2011, 2012, and 2013 the average employment is modeled at 50%, 100%, 200%, and 300% respectively. This scenario is intended to simulate a gradual growth of firms in the park, while at the same time serving as a sensitivity analysis for the economic impact of firm operations in the business park. In this scenario it is assumed that the local percentages of firm spending on inputs are equal to the regional purchase coefficients for their respective industries, which are calculated by IMPLAN.

Table 4 displays the average size of a facility (in square feet) for a single firm from each of the six targeted industry clusters.[3] The total square footage that would be occupied by these six firms is estimated to be around 81,000 square feet. This figure represents half of the 158,000 square feet of building space expected to be built in Phase 1 of construction.[4]

2010 Operations (Half of Avg. Employment)

Table 3a

Event	Employment	Year	% Local (RPC)
Basic Health	28 * 0.5	2010	18.5%
Metal Working	27 * 0.5	2010	0.2%
Renewable Energy	26 * 0.5	2010	7.1%
Information Services	32 * 0.5	2010	43.3%
Business Services	33 * 0.5	2010	78.5%
Non-residential Construction	21 * 0.5	2010	46.3%

2011 Operations (Avg. Employment)

Table 3b

Event	Employment	Year	% Local (RPC)
Basic Health	28	2011	18.5%
Metal Working	27	2011	0.2%
Renewable Energy	26	2011	7.1%
Information Services	32	2011	43.3%
Business Services	33	2011	78.5%
Non-residential Construction	21	2011	46.3%

2 Camden County Cluster Targets

3 Camden County Cluster Targets

4 Camden Cost Model 8-5-08.xls

Table 3c

2012 Operations (Double Avg. Employment)

Event	Employment	Year	% Local (RPC)
Basic Health	28*2	2012	18.5%
Metal Working	27*2	2012	0.2%
Renewable Energy	26*2	2012	7.1%
Information Services	32*2	2012	43.3%
Business Services	33*2	2012	78.5%
Non-residential Construction	21*2	2012	46.3%

Table 3d

2013 Operations (Triple Avg. Employment)

Event	Employment	Year	% Local (RPC)
Basic Health	28*3	2013	18.5%
Metal Working	27*3	2013	0.2%
Renewable Energy	26*3	2013	7.1%
Information Services	32*3	2013	43.3%
Business Services	33*3	2013	78.5%
Non-residential Construction	21*3	2013	46.3%

Table 4

2013 Operations (Triple Avg. Employment)

Cluster	Avg. Facility Size (square feet)
Basic Health	11,621
Metal	13,800
Information Services	14,443
Business Services	11,877
Non-residential Building Products	6,000
Renewable Energy	23,664
TOTAL	**81,405**

Economic Impact of Green Business Park

Table 5 reports the total (direct, indirect, induced) increases in output, employment, and labor income in the Elizabeth City Micropolitan area resulting from phase 1 of construction in the business park. These economic effects can be seen graphically in Figures 2, 3 and 4. All values are expressed in 2009 dollars.

The total impacts of firm operations on output, employment and labor income in the study area are reported in Table 6. These impacts are based on average levels of employment for the six firms. It is assumed that the number of firms and/or employees in the business park will grow over time. The estimates for 2010, 2011, 2012, and 2013 also serve as a sensitivity analysis. Operations impacts for 2010 represent below average (50%) employment in the park; impacts for 2011 represent average (100%) employment; impacts for 2012 represent above average (200%) employment in the business park; 2013 impacts represent triple the average employment for the six firms. Figures 5, 6 and 7 graphically display the impact firm operations on output, employment and labor income.

Construction Impact

Table 5

Output*	2009	2010	2011
Direct	$14,750,745	$9,577,660	$3,059,936
Indirect	$,331,310	$1,572,405	$429,896
Induced	$3,934,418	$2,605,405	$886,341
TOTAL	$21,016,473	$13,755,471	$4,376,174
Employment	**2009**	**2010**	**2011**
Direct	201.4	133.4	46.9
Indirect	24.8	16.8	4.6
Induced	46.2	30.6	10.4
TOTAL	272.4	180.8	61.9
Labor Income*	**2009**	**2010**	**2011**
Direct	$6,383,813	$4,212,137	$1,473,031
Indirect	$855,408	$582,446	$156,434
Induced	$1,277,783	$846,159	$287,857
TOTAL	$8,517,004	$5,640,742	$1,917,322

*2009 dollars

Operations Impact

Table 6

Output*	50% of Avg. Employment	100% of Average Employment	200% of Average Employment	300% of Average Employment
	2010	2011	2012	2013
Direct	11,523,595	22,049,801	44,099,602	63,200,702
Indirect	435,862	817,462	1,634,925	2,341,394
Induced	935,455	1,778,989	3,557,978	5,097,689
TOTAL	12,894,912	24,646,253	49,292,505	70,639,784
Employment	**2010**	**2011**	**2012**	**2013**
Direct	25.6	48.3	96.5	138.4
Indirect	4.7	8.9	17.8	25.5
Induced	11	20.9	41.8	59.9
TOTAL	41.4	78.1	156.1	223.8
Labor Income*	**2010**	**2011**	**2012**	**2013**
Direct	1,619,964	3,084,854	6,169,709	8,839,841
Indirect	153,088	286,835	573,670	821,531
Induced	303,808	577,763	1,155,526	1,655,579
TOTAL	2,076,861	3,949,453	7,898,905	11,316,951

*2009 dollars

Total Output Impact of Construction

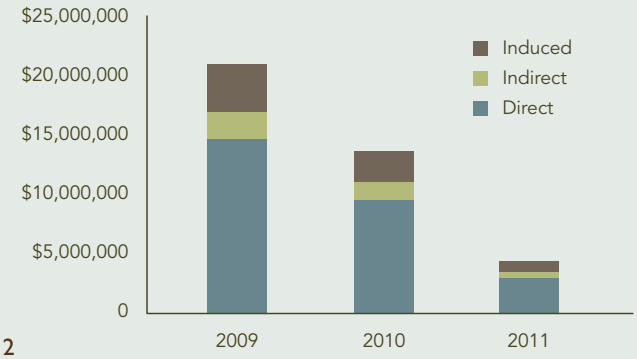


Figure 2

Total Employment Impact of Construction

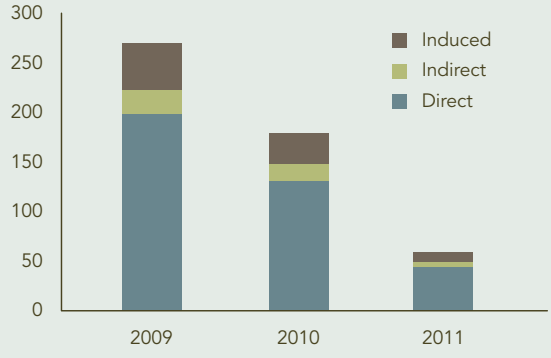
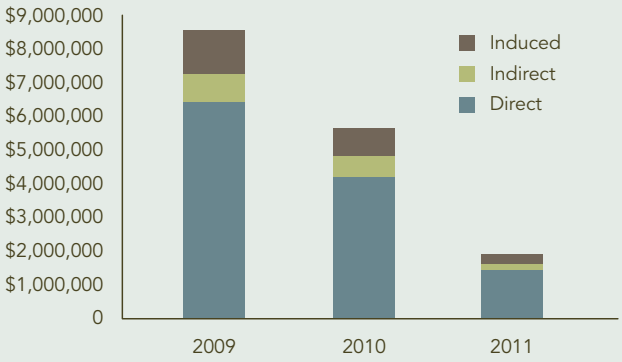


Figure 3

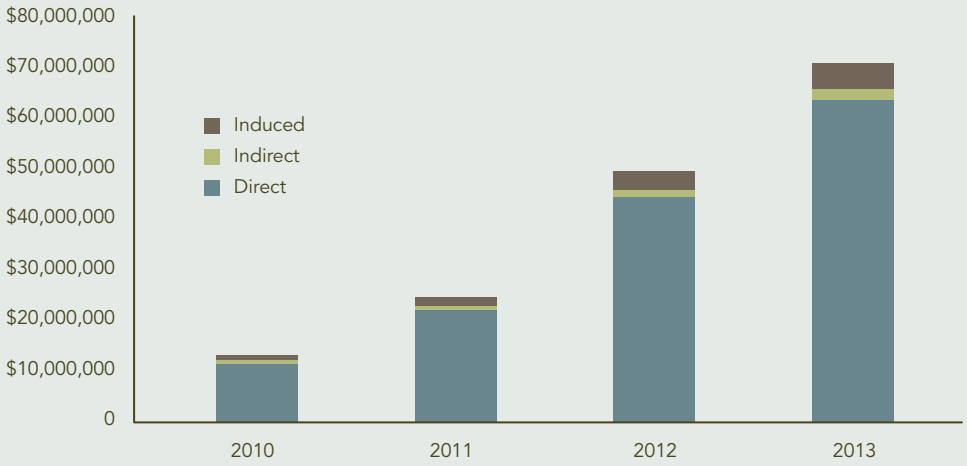
Total Labor Income Impact of Construction

Figure 4



Total Output Impact of Operations

Figure 5



Total Employment Impact of Operations

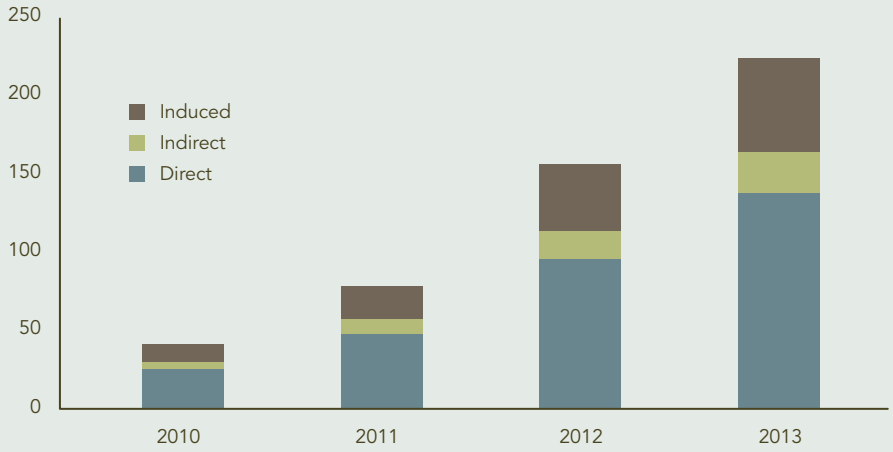


Figure 6

Total Labor Income Impact of Operations

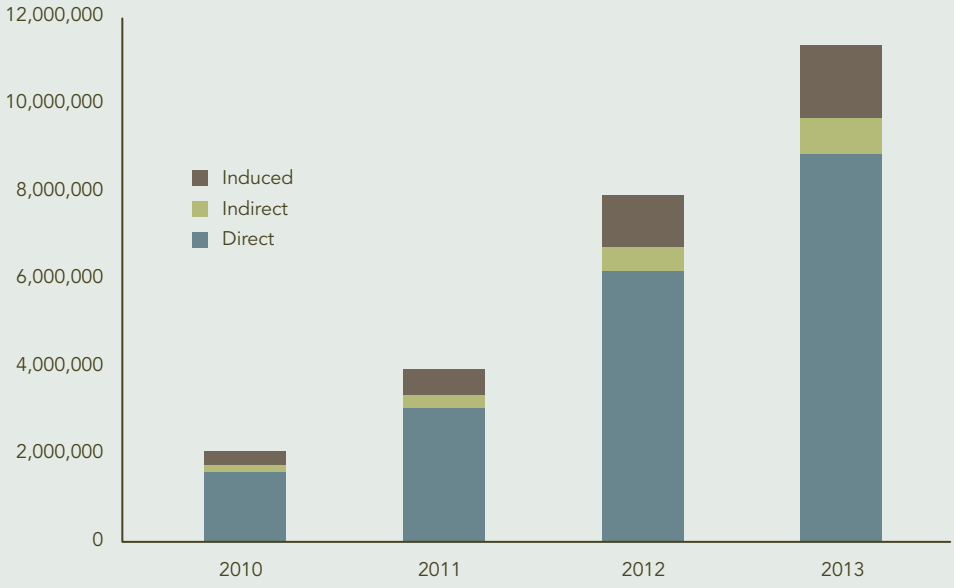


Figure 7

Fiscal Impact of Green Business Park

The amount of property tax generated by the business park is based on the current property tax rate of Camden County and the value of constructed buildings in the three phases of construction. The assessed value of the buildings for each year is assumed to be the cumulative contruction costs from all previous years. The current property tax rate for Camden County is 59 cents per $100 valuation. The annual amounts of property taxes collected by Camden County are displayed in Table 7, along with the total amounts during each phase of construction, and the total amount of property taxes over all three phases.

Table 7

Camden County Property Taxes

PHASE 1 (2009-2013)	2009	2010	2011	2012	2013	TOTAL
construction cost*	6,660,000	11,820,000	14,980,000	–	–	
assessed value**		6,660,000	11,820,000	14,980,000	14,980,000	
property tax rate		0.0059	0.0059	0.0059	0.0059	
property taxes*		39,294	69,738	88,382	88,382	**285,796**

PHASE 2 (2014-2018)	2014	2015	2016	2017	2018	TOTAL
construction cost*	22,513,607	22,513,607	22,513,607	–	–	
assessed value**	14,980,000	37,493,607	60,007,214	82,520,820	82,520,820	
property tax rate	0.0059	0.0059	0.0059	0.0059	0.0059	
property taxes*	88,382	221,212	354,043	486,873	486,873	**1,637,383**

PHASE 3 (2019-2023)	2019	2020	2021	2022	2023	TOTAL
construction cost*	45,077,893	45,077,893	32,577,893	–	–	
assessed value**	82,520,820	127,598,713	172,676,605	205,254,498	205,254,498	
property tax rate	0.0059	0.0059	0.0059	0.0059	0.0059	
property taxes*	486,873	752,832	1,018,792	1,211,002	1,211,002	**4,680,500**

TOTAL (2009-2023)
6,603,679

*2009 dollars

**assessed value assumed to be cumulative construction costs from past years

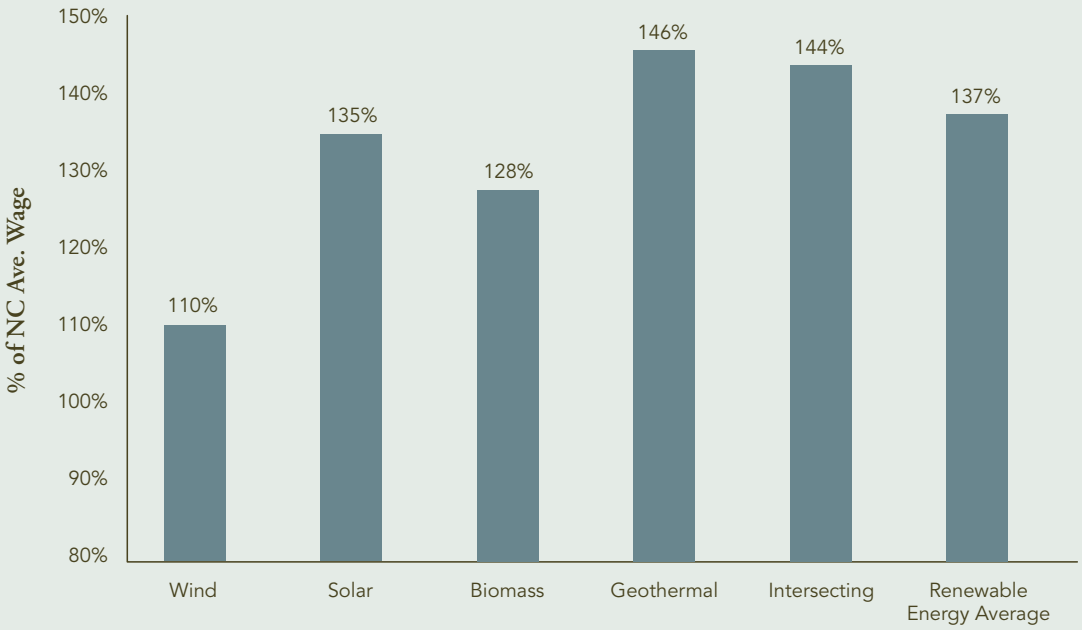
Appendix 2A: Renewable Energy Sector

The table below outlines industry sectors with renewable energy ties where North Carolina has demonstrated a competitive advantage.

NAICS	NAICS Description	Sector Type	% NC Wage Rate	NC LQ (US Base)
333411	Air Purification and Equipment Mfg	Biomass	84%	5.19
335931	Current-Carrying Wiring Device Mfg	Solar PV	111%	4.32
333612	Speed Changer, Industrial High-Speed Drive and Gear	Wind	149%	2.34
333912	Air and Gas Compressor Mfg	Biomass, Geothermal	239%	2.24
332991	Ball and Roller Bearings	Wind	121%	1.99
333611	Turbines and Turbine Generators	Wind	180%	1.92
327211	Flat Glass Mfg	Solar PV	116%	1.78
335312	Motors and Generators	Wind	104%	1.76
333120	Construction Machinery Mfg	Biomass	146%	1.68
237130	Construction of Alternative Power (Wind, Solar, Thermal, alternative energy structure)	Miscellaneous	118%	1.68
335911	Storage Battery Mfg	Solar PV	136%	1.51
332911	Industrial Valve Mfg	Biomass	115%	1.49
326113	Unlaminated Plastics Film and Sheet	Solar PV	124%	1.46
332312	Fabricated Structural Metal Mfg	Wind	111%	1.41
333412	Industrial and Commercial Fans and Blowers	Biomass, Geothermal, Wind	104%	1.34
335313	Switchgear & Switchboard Apparatus	Biomass, Solar PV	149%	1.33
334519	Other Measuring and Controlling Device Mfg	Wind	121%	1.30
335999	All Other Miscellaneous Electrical Equipment and Components	Biomass, Wind and Solar PV	98%	1.27
333414	Heating Equipment (except warm air furnaces) Mfg	Biomass	81%	1.14
541620	Environmental Consulting Services	Research	143%	1.12
326199	All Other Plastics Product Mfg	Wind	91%	1.00

The chart below further outlines that renewable energy sectors pay higher than average wage rates across all categories in North Carolina. Although Virginia data were not available, it is expected that similar high wage patterns exist for Virginia based renewable energy firms.

Renewable Energy Sector Wage Rates



Source: Calculated from NC Employment Security Commission data

All NAICS Codes for the Renewable Energy Industry

NAICS	NAICS Description	Sector Type
325211	Plastics Material and Resin Mfg	Solar PV
326113	Unlaminated Plastics Film and Sheet	Solar PV
326199	All Other Plastics Product Mfg	Wind
327211	Flat Glass Mfg	Solar PV
327993	Mineral Wool Mfg	Biomass
331210	Iron and Steel Pipe and Tube Mfg from Purchased Steel	Biomass, Geothermal
331422	Copper Wire (Expect Mechanical) Drawing	Wind
331511	Iron Foundries	Wind
332312	Fabricated Structural Metal Mfg	Wind
332322	Sheet Metal Work Mfg	Solar PV
332410	Power Boiler and Heat Exchanger Mfg	Biomass, Geothermal
332420	Metal Tank (Heavy Gauge) Mfg	Biomass, Geothermal
332911	Industrial Valve Mfg	Biomass
332991	Ball and Roller Bearings	Wind
333120	Construction Machinery Mfg	Biomass
333411	Air Purification and Equipment Mfg	Biomass
333412	Industrial and Commercial Fans and Blowers	Biomass, Geothermal, Wind
333414	Heating Equipment (except warm air furnaces) Mfg	Biomass
333415	Air-Conditioning and Warm Air Heating Equipment and Commercial	Biomass, Geothermal
333611	Turbines and Turbine Generators	Wind
333612	Speed Changer, Industrial High-Speed Drive and Gear	Wind
333613	Power Transmission Equipment	Wind
333911	Pump and Pumping Equipment Mfg	Biomass, Geothermal
333912	Air and Gas Compressor Mfg	Biomass, Geothermal
333922	Conveyor and Conveying Equipment Mfg	Biomass
333923	Overhead Traveling Crane, Hoist, and Monorail System Mfg	Biomass, Geothermal
333995	Fluid Power Cylinder and Actuator Mfg	Biomass
333999	All Other Misc Gen Purpose Machinery Mfg	Biomass
334413	Semiconductor and Related Device Mfg	Solar PV
334418	Printed Circuit Assembly (Electronic Assembly)	Wind
334513	Instrument mfg for measuring and testing electricity	Biomass
334515	Instrument Mfg for Measuring and Testing	Solar PV
334519	Other Measuring and Controlling Device Mfg	Wind
335311	Power, Distribution, and Specialty Transformer Mfg	Biomass
335313	Switchgear & Switchboard Apparatus	Biomass, Solar PV
335911	Storage Battery Mfg	Solar PV
335931	Current-Carrying Wiring Device Mfg	Solar PV
335999	All Other Miscellaneous Electrical Equipment and Components	Biomass, Wind and Solar PV
Miscellaneous		
221119	Other Electric Power Generation	Miscellaneous
237130	Construction of Alternative Power (Wind, Solar, Thermal, alternative energy structure)	Miscellaneous
324199	Alternative Fuels Production	Miscellaneous
Research		
541380	Testing laboratories	Research
541620	Environmental Consulting Services	Research
541690	Other Scientific and Technical Consulting Services	Research
541710	Research and Development in the Physical, Engineering, and Life Sciences	Research
926110	Administration of General Economic Programs	Research

Source: Sterzinger and Svrcek 2005; Glasmeier and Bell 2006; Development Research Partners 2007.

Components of Wind Energy Production

NAICS	Description	Sector
326199	All Other Plastics Product Mfg	Wind
331511	Iron Foundries	Wind
332312	Fabricated Structural Metal Mfg	Wind
332991	Ball and Roller Bearings	Wind
333412	Industrial and Commercial Fan and Blower Mfg	Wind
333611	Turbines, and Turbine Generators	Wind
333612	Speed Changer, Industrial High-Speed Drive and Gear	Wind
333613	Power Transmission Equipment	Wind
334418	Printed Circuit Assembly (Electronic Assembly)	Wind
334519	Measuring and controlling Devices	Wind
335312	Motors and Generators	Wind
335999	Electronic Equipment and Components	Wind

Source: Glasmeier and Bell 2006, Table 5

Components of Solar Energy Production

NAICS	Definition	Sector
325211	Plastics Material resin Mfg	Solar PV
326113	Unlaminated Plastic Film and Sheet Mfg	Solar PV
327211	Flat Glass	Solar PV
331422	Copper Wire	Solar PV
332322	Sheet metal work mfg	Solar PV
334413	Semiconductors and related devices	Solar PV
334515	Instrument mfg for measuring and testing electricity	Solar PV
335313	Switchgear and switchboard apparatus mfg	Solar PV
335911	Storage Batteries	Solar PV
335931	Current carrying wiring devices mfg	Solar PV
335999	Electronic equipment and components NEC	Solar PV

Source: Glasmeier and Bell 2006, Table 9

Components of the Biomass Energy Sector

NAICS	Description	Sector
327993	Mineral Wool Mfg	Biomass
331210	Iron and Steel Pipe and Tube Mfg from Purchased Steel	Biomass
332410	Power Boiler and Heat Mfg	Biomass
332420	Metal Tank (Heavy Gauge) Mfg	Biomass
332911	Industrial Valve Mfg	Biomass
333120	Construction Machinery Mfg	Biomass
333411	Air Purification and Equipment Mfg	Biomass
333412	Industrial and Commercial Fans and Blowers	Biomass
333414	Heating Equipment (except warm air furnaces) Mfg	Biomass
333415	Air-Conditioning and Warm Air Heating Equipment and Commercial…	Biomass
333911	Pump and Pumping Equipment Mfg	Biomass
333912	Air and Gas Compressor Mfg	Biomass
333922	Conveyor and Conveying Equipment Mfg	Biomass
333923	Overhead Traveling Crane, Hoist and Monorail Systems Mfg	Biomass
333995	Fluid Power Cylinder and Actuator Mfg	Biomass
333999	All Other Misc Gen Purpose Machinery Mfg	Biomass
334513	Instrument mfg for measuring and testing electricity	Biomass
335311	Power, Distribution, and Specialty Transformer Mfg	Biomass
335313	Switchgear and Switchboard Apparatus Mfg	Biomass
335999	Electronic Equipment and Components NEC	Biomass

Source: Sterzinger and Svrcek 2005

Components of the Geothermal Energy Sector

NAICS	Description	Sector
331210	Iron and Steel Pipe and Tube Mfg from Purchased Steel	Geothermal
332410	Power Boiler and Heat Exchanger Mfg	Geothermal
332420	Metal Tank (Heavy Gauge) Mfg	Geothermal
333412	Industrial and Commercial fans and blowers	Geothermal
333415	Air-Conditioning and Warm Air Heating Equipment and Commercial…	Geothermal
333911	Pump and Pumping Equipment Mfg	Geothermal
333912	Air and Gas Compressor Mfg	Geothermal
333923	Overhead Traveling Crane, Hoist, and Monorail System Mfg	Geothermal

Source: Sterzinger and Svrcek 2005

Intersecting Components of the Renewable Energy Industry

NAICS	Description	Sector
221119	Other Electric Power Generation	Miscellaneous
237130	Construction of Alternative Power (Wind, Solar, Thermal, alternative energy structure)	Miscellaneous
324199	Alternative Fuels Production	Miscellaneous
541380	Testing laboratories	Research
541620	Environmental Consulting Services	Research
541690	Other Scientific and Technical Consulting Services	Research
541710	Research and Development in the Physical, Engineering, and Life Sciences	Research
926110	Administration of General Economic Programs	Research

Source: Development Research Partners 2007

Sources Cited:

Development Research Partners, Inc. 2007 "Colorado Energy Industry Cluster Profile" A report for the Metro Denver Economic Development Corporation. Available at http://www.metrodenver.org/files/Documents/Industries-Companies/Industries/Energy_State2007.pdf (see also Nine-County Energy Cluster Study available at: http://www.metrodenver.org/files/Documents/Industries-Companies/Industries/Energy_9County2007.pdf)

Glasmeier, Amy and Tom Bell. 2006 "Economic Development Potential of Conventional and Potential Alternative Energy Sources in Appalachian Counties." A report for the Appalachian Research Council, June 21, 2006. (part three) Available at: http://www.arc.gov/index.do?nodeId=3108

Sterzinger, George and Matt Svrcek. 2005 "Component Manufacturing: Ohio's Future in the Renewable Energy Industry." Renewable Energy Policy Project (REPP), http://www.crest.org/articles/static/1/binaries/Ohio_Manufacturing_Report_2.pdf

Appendix 2B: Industry Sectors Within Clusters

1. Aluminum products (ship building)
- Aluminum sheet, plate & foil manufacturing
- Primary aluminum production
- Ship building & repair
- Metal can, box & other container manufacturing
- Copper rolling, drawing & extruding
- Sheet metal work manufacturing
- Iron & steel mills
- Blind & shade manufacturing

2. Basic health services
- Offices of physicians, dentists & other health practitioners
- Other ambulatory health care services
- Facilities support services
- Electro-medical apparatus manufacturing
- Pharmaceutical & medicine manufacturing
- Surgical & medical instrument manufacturing
- Surgical appliance & supplies manufacturing
- Environmental & other technical consulting services

3. Metalworking and fabricated metal products
- Ornamental & architectural metal work manufacturing
- Power boiler & heat exchanger manufacturing
- Metal tank, heavy gauge, manufacturing
- Prefabricated metal buildings & components
- Fabricated structural metal manufacturing
- Metal window & door manufacturing
- Fabricated pipe & pipe fitting manufacturing
- Steel wire drawing
- Industrial & commercial fan & blower manufacturing

4. Information services (includes finance and insurance components)
- Data processing services
- Computer systems design services
- Custom computer programming services
- Software publishers
- Electronic equipment repair & maintenance
- Telecommunications
- Advertising & related services
- Investigation & security services
- Travel arrangement & reservation services
- Photographic services

5. Business services (includes finance and insurance components)
- Accounting & bookkeeping services
- Advertising & related services
- Architectural & engineering services
- Legal services
- Management consulting services
- Machinery & equipment rental & leasing
- Environmental & other technical consulting services
- Specialized design services
- Sound recording industries
- Custom computer programming services

6. Nonresidential building products
- Fiber optic cable manufacturing
- Other communication & energy wire manufacturing
- Paint & coating manufacturing
- Engineered wood member & truss manufacturing
- Switchgear & switchboard apparatus manufacturing
- Architectural & engineering services
- Ornamental & architectural metal work manufacturing
- Ceramic wall & floor tile manufacturing
- Lighting fixture manufacturing

Appendix 2C: Industrial Parks Near Camden County

Business/Industrial Park	Location	Park Type	Contact Company
Pasquotank County Commerce Park	Elizabeth City, NC USA	Industrial	Albemarle Econ Development Commission
Steuart Industrial Park	Chesapeake, VA USA	Industrial	Insignia Thalhimer Real Estate
Cavalier Industrial Park	Chesapeake, VA USA	Industrial	Chesapeake Dept of Economic Development
Battlefield Lakes Corporate Park	Chesapeake, VA USA	Mixed-Use	CB Richard Ellis
Cavalier South Industrial Park	Chesapeake, VA USA	Industrial	Chesapeake Dept of Economic Development
Crossways Commerce Center	Chesapeake, VA USA	Mixed-Use	Advantis Real Estate
Dominion Industrial Park	Chesapeake, VA USA	Industrial	Chesapeake Dept of Economic Development
Gateway Commerce Park	Chesapeake, VA USA	Mixed-Use	CB Richard Ellis
Cavalier East Industrial Park	Chesapeake, VA USA	Industrial	L M Sandler & Sons, Inc.
Oakbrooke Business & Technology Park	Chesapeake, VA USA	Mixed-Use	Chesapeake Dept of Economic Development
Kingsdale Industrial Park	Franklin, VA USA	Industrial	Isle of Wight Dept of Economic Development
copeland industrial park	Hampton, VA USA	Industrial	City of Hampton
hampton roads center	Hampton, VA USA	Office	City of Hampton
langley research and development park	Hampton, VA USA	Science/ Research	City of Hampton
Lake Wright Executive Center	Norfolk, VA USA	Office	Norfolk Dept of Economic Development
Central Business Park	Norfolk, VA USA	Mixed-Use	Norfolk Dept of Economic Development
Churchland Commerce Park	Portsmouth, VA USA	Mixed-Use	Advantis Real Estate
Greenwood Industrial Park	Portsmouth, VA USA	Industrial	Portsmouth Dept. of Economic Development
Victory Crossing Business Park	Portsmouth, VA USA	Mixed-Use	Portsmouth Dept of Economic Development
PortCentre Commerce Park	Portsmouth, VA USA	Mixed-Use	Portsmouth Dept of Economic Development
Waterford Oaks Business Park	Smithfield, VA USA	Mixed-Use	Isle of Wight Dept of Economic Development
Isle of Wight Industrial Park	Smithfield, VA USA	Industrial	Isle of Wight Dept of Economic Development
Wilroy Industrial Park	Suffolk, VA USA	Industrial	Suffolk Dept of Economic Development
Suffolk Industrial Park	Suffolk, VA USA	Mixed-Use	Suffolk Dept of Economic Development
Northgate Commerce Park	Suffolk, VA USA	Mixed-Use	Suffolk Dept of Economic Development
Lake View Technology Park	Suffolk, VA USA	Science/ Research	Suffolk Dept of Economic Development
Hillpoint Business Park	Suffolk, VA USA	Mixed-Use	Virginia Commercial Real Estate Services
Harbour View Commerce Park	Suffolk, VA USA	Mixed-Use	Advantis Real Estate Services
Hampton Roads Technology Park	Suffolk, VA USA	Mixed-Use	Suffolk Dept of Economic Development
Benton Road Industrial Park	Suffolk, VA USA	Industrial	Advantis Real Estate Services, Inc.
Bridgeway Commerce Park	Suffolk, VA USA	Mixed-Use	CB Richard Ellis
Godwin Commerce Park	Suffolk, VA USA	Office	Northgate LLC
Welch Industrial Park	Suffolk, VA USA	Industrial	NAI Harvey Lindsay
Oceana West Corporate Park	Virginia Beach, VA USA	Industrial	City of Virginia Beach
Oceana East Industrial Park	Virginia Beach, VA USA	Industrial	Oceana Development Corporation
Oceana South Industrial Park	Virginia Beach, VA USA	Mixed-Use	NAI Harvey Lindsay
Corporate Landing	Virginia Beach, VA USA	Mixed-Use	City of Virginia Beach
Shirley T. Holland Commerce Park	Windsor, VA USA	Mixed-Use	Isle of Wight Dept of Economic Development

	Total Acres	Available Acres	Rail	Water	Taxiway	Miles to ORF	Miles to ECG	Miles to Interstate	$/ACRE	Year Opened
		356	No	No	No	40	8	0	25000	
	53.3	53.3	Yes	Yes	No	16		1.2	75000	
	700	23.3	Yes	No	No	15		0.9	40000	1986
	180	51	No	No	No	14		0.5	200000	1988
	30	15	No	No	No	15		0.2	60000	1998
	200	7.3	No	No	No	14.5		0.9	260000	1990
	40	40	No	No	No	14		0.3	65000	2000
	185	80	Yes	No	No	22		0.3	80000	1995
	93.5	30	No	No	No	15		0.3	85000	1999
	331	130	Yes	No	No	16		4	125000	2001
	231	231	Yes	No	No	26		30	5000	1994
	100	14	Yes	No	No	20		1	60000	1980
	700	250	No	No	No	20		2	60000	1990
	70	15			No	20		5	60000	1980
	64	12.4	No	No	No	0.8		0.5	150000	1998
	30	30	No	No	No	2.8		0.3	115000	2000
	86	36	Yes	Yes	No	22		3.7	60000	2000
	60	5	Yes	No	No	14		0.5	65000	1987
	125	125	No	No	No	10.5		0.5	35000	2000
	60	18	No	No	No	15.8		0.7	50000	1985
	60	30	No	No	No	20		14	200000	2001
	99	66	No	No	No	20		15	30000	1991
	208	28.8	Yes	No	No	20		7	30000	1980
	150	121	Yes	No	No	25		10	25000	1998
	460	442.5	Yes	No	No	15		2.5	45000	1997
	150	5	No	No	No	20		0.3	80000	1992
	62	25	No	No	No	30		15	80000	2000
	260	260	No	No	No	15		0.5	100000	1992
	57	57	No	No	No	20		0.3	75000	2000
	73	73	Yes	No	No	25		10	15000	1998
	250	140	No	No	No	20		0.3	75000	2000
	50	46	No	No	No	30		10		1999
	464	100	Yes	No	No	22		5	25000	2000
	1100	50			No	10		1	145000	
	25.9	21.7	No	No	No	12.5		1.7		1999
	190	50	No	No	No	14		2.5	90000	2000
	350	225				10		5	260000	
	89	35	No	No	No	36		19	30000	2001
Total	**7436.7**	**2942.3**								
Average	**200.992**	**79.522**								
Vacancy Rate		**40%**								

Appendix 4A: Project Cost Model

The cost model was developed to give a rough order-of-magnitude estimate of costs for development of a GIP in Camden County, North Carolina. Cost estimates include onsite and offsite infrastructure as well as building and land acquisition costs. The output of the model, based on broad assumptions about the design of the GIP and its features are in two parts: a detailed, phase-by-phase cost schedule and a simple analysis of private developer participation.

Phase I

Year	2009	2010	2011	2012	2013	Total
	1	2	3	4	5	
Expenses *(in millions)*						
Onsite						
Parking	$0.10	-	-	-	-	$0.10
Wetland reconstruction	$0.03	$0.03	-	-	-	$0.05
Distribution System	$0.16	$0.16	-	-	-	$0.31
Collection System	$0.26	$0.26	-	-	-	$0.52
Reclaimed Water Pipe	$0.16	$0.16	-	-	-	$0.31
Solar power generation	$0.93	$0.93	$0.93	-	-	$2.80
Subtotal						$4.10
Offsite						
Water Treatment Plant	$0.68	$0.68	-	-	-	$1.35
Force Main Construction	$2.85	-	-	-	-	$2.85
Water Main Extension	$1.87	-	-	-	-	$1.87
Reclaimed Line Extension	-	-	-	-	-	-
Wastewater Trtmt. Plt.	$2.00	$2.00	-	-	-	$4.00
Subtotal						$10.07
Land	-	-	-	-	-	-
Buildings (Construction)	-	-	-	-	-	-
Geothermal Energy Pilot	-	-	-	-	-	-
Mixed-use development	$7.90	$7.90	$7.90	-	-	$23.70
Eco-feature Center	$20.00	-	-	-	-	$20.00
Subtotal	-	-	-	-	-	$43.70
TOTAL COSTS	$36.93	$12.11	$8.83	-	-	$57.88

Phase II

Year	2014 6	2015 7	2016 8	2017 9	2018 10	Total
Expenses *(in millions)*						
Onsite						
Parking	$0.59	-	-	-	-	$0.59
Wetland reconstruction	$0.03	$0.03	-	-	-	$0.07
Distribution System	$0.61	$0.61	-	-	-	$1.21
Collection System	$1.01	$1.01	-	-	-	$2.03
Reclaimed Water Pipe	$0.61	$0.61	-	-	-	$1.21
Solar power generation	$7.73	$7.73	$7.73	-	-	$23.19
Subtotal						$28.30
Offsite						
Water Treatment Plant	$1.30	$1.30	-	-	-	$2.61
Force Main Construction	-	-	-	-	-	-
Water Main Extension	-	-	-	-	-	-
Reclaimed Line Extension	-	-	-	-	-	-
Wastewater Trtmt. Plt.	$2.32	$2.32	-	-	-	$4.64
Subtotal						$7.25
Land	$1.05	$1.05	$1.05	$1.05	$1.05	$5.25
Buildings (Construction)	-	-	-	-	-	-
Geothermal Energy Pilot	-	-	-	-	-	-
Mixed-use development	$56.28	$56.28	$56.28	-	-	$168.85
Eco-feature Center	-	-	-	-	-	-
Subtotal	-	-	-	-	-	$168.85
TOTAL COSTS	$71.54	$70.94	$65.06	$1.05	$1.05	$209.64

Phase III

Year	2019 11	2020 12	2021 13	2022 14	2023 15	2024 16	2025 17	2026 18	2027 19	2028 20	Total
Expenses *(in millions)*											
Onsite											
Parking	$0.69	-	-	-	-	-	-	-	-	-	$0.69
Wetland reconstruction	$0.09	$0.09	-	-	-	-	-	-	-	-	$0.19
Distribution System	$3.51	$3.51	-	-	-	-	-	-	-	-	$7.02
Collection System	$5.88	$5.88	-	-	-	-	-	-	-	-	$11.75
Reclaimed Water Pipe	$3.51	$3.51	-	-	-	-	-	-	-	-	$7.02
Solar power generation	$14.79	$14.79	$14.79	-	-	-	-	-	-	-	$44.37
Subtotal											$71.03
Offsite											
Water Treatment Plant	$2.12	$2.12	-	-	-	-	-	-	-	-	$4.23
Force Main Construction	-	-	-	-	-	-	-	-	-	-	$2.81
Water Main Extension	-	-	-	-	-	-	-	-	-	-	$0.89
Reclaimed Line Extension	-	-	-	-	-	-	-	-	-	-	$0.94
Wastewater Trtmt. Plt.	$18.81	$18.81	-	-	-	-	-	-	-	-	$37.63
Subtotal											$46.50
Land	$4.70	$4.70	$4.70	$4.70	$4.70	-	-	-	-	-	$23.52
Buildings (Construction)	-	-	-	-	-	-	-	-	-	-	-
Geothermal Energy Pilot	$12.50	$12.50	-	-	-	-	-	-	-	-	$25.00
Mixed-use development	$81.44	$81.44	$81.44	-	-	-	-	-	-	-	$244.33
Eco-feature Center	-	-	-	-	-	-	-	-	-	-	-
Subtotal	-	-	-	-	-	-	-	-	-	-	$269.33
TOTAL COSTS	$148.05	$147.35	$100.94	$4.70	$4.70	-	-	-	-	-	$410.38

Park Component Costs

Phase I (Year 0-5, 158,000 sq ft)	Total	Grant Funded	Camden Funded	Developer Funded
Land	–			
Building	$43,700,000			
Onsite Infrastructure	$4,101,450			
Offsite Infrastructure	$10,074,355			
Total	$57,875,806	$51,324,361	$2,893,790	$3,657,655
% Breakout	100%	89%	5.0%	6%
Phase II (Year 6-10, 1,040,000 sq ft)	**Total**	**Grant Funded**	**Camden Funded**	**Developer Funded**
Land	$5,250,000			
Building	$168,852,051			
Onsite Infrastructure	$28,295,051			
Offsite Infrastructure	$7,245,463			
Total	$209,642,565	$157,132,501	$4,192,851	$48,317,212
% Breakout	100%	75%	2.0%	23%
Phase III (Year 11+, 2,040,000 sq ft)	**Total**	**Grant Funded**	**Camden Funded**	**Developer Funded**
Land	$23,520,000			
Building	$269,334,194			
Onsite Infrastructure	$71,030,667			
Offsite Infrastructure	$46,498,854			
Total	$410,383,715	$321,508,813	$6,155,756	$82,719,147
% Breakout	100%	78%	1.5%	20%

The first 3 figures show how costs are detailed year by year and by project component. The above figure shows the basic cost-sharing analysis among grant sources, Camden County, and private developers. The cost-sharing analysis is based on assumptions about rents, vacancies, and a minimum, before-tax internal rate of return of 15 percent for developers. As the analysis shows, public funding will necessarily play a large role in all three phases of development.

Inputs for the cost model include various assumptions about the amount of land developed and the amount of infrastructure needed to service the park including roads, storm water management, water, sewer and on-site electricity generation. Assumptions about scaling costs and the data sources for those assumptions are all included under the "Assumptions" tab in the cost model file.

Costs, for many of the GIP's features, will be driven by selection of technologies, whether conventional or eco-friendly. The following section describes some of the features selected for this cost model.

1. Permeable Parking. Stormwater runoff is an important vehicle for non-point source pollutants. Storm water rinses pollutants, which accumulate in the built environment, into waterways during rainfall events. Managing stormwater in a way that mitigates this impact is an important component of green development. In this project, basic low-impact development (LID) design considerations were figured into the cost model. LID features here include permeable paving materials, such as interlocking paving blocks and permeable asphalt, as well as reconstructed wetlands and storm water basins.

2. On-site power generation. Two sources of on-site power generation were considered in this cost model: solar power and geothermal energy. Solar power is suitable for this project given the large amount of contiguous space available for development. Also site design can easily incorporate placement of solar panels; however, land for spray irrigation will likely compete with solar panel deployment. Geothermal energy potential is rated as "Good" in northeastern North Carolina, according to the U.S. Department of Energy. Cost estimates are based on an installed capacity of 730,000 kWh/yr of solar in Phase I and 15,000,000 kWh/yr of combined solar and geothermal power in Phase III.

3. Wetland Reconstruction. Wetlands have many benefits from an ecological standpoint and can also serve as a useful tool for mitigating storm water runoff impacts for large-scale developments.

4. LEED Certified Eco-Center. The cost model includes a platinum-level LEED-certified center to feature LEED and LID technologies and to showcase the GIP's environmental focus. Potential uses of the eco-center might include a Biofuels Research Center or an Eco-tourism Center. In the case that the center is used for research purposes, the Coastal Studies Institute in Manteo may serve as an instructive model.

5. On-site wastewater treatment. In this cost model the assumed basis is traditional centralized wastewater treatment with a collection system network. However, there may be significant cost savings, as well as environmental benefits, to a decentralized wastewater management approach. Centralized management of decentralized systems is gaining support as a wastewater management system and should be considered for this project.

   The current cost model assumes that wastewater is sent to an existing treatment facility owned by the county which will, itself, be expanded. The facility produces reclaimed quality effluent; and reclaimed wastewater will be sent back to the GIP site for irrigation and other consumptive uses.

Rendering of the new LEED certified Visitor Education Center at the North Carolina Botanical Garden

Appendix 4B: Funding Sources

Community Assistance Initiative
Type: Advocacy
Administrator: Golden LEAF Foundation
Funds Recipient: NA
Maximum Size: NA
Size of Required Local Match: No
Required Qualification: No
General Statute: NA
Web: www.goldenleaf.org

21st Century Community
Type: Advocacy
Administrator: N.C. Department of Commerce
Funds Recipient: NA
Maximum Size: NA
Size of Required Local Match: No
Required Qualification: No
General Statute: NA
Web: www.nccommerce.com/en/communityservices/communityplanningassistance/21stcenturycommunities

One North Carolina Fund
Type: Grant
Administrator: N.C. Governor
Funds Recipient: Company
Maximum Size: NA
Size of Required Local Match: 100%
Required Qualification: Average Wage Test
General Statute: § 143B-437.70 - § 143B-437.74
Web: www.nccommerce.com/en/businessservices/locateyourbusiness/whync/incentives/onenorthcarolinafund

The Job Development Investment Grant Program (JDIG)
Type: Grant
Administrator: Economic Investment Committee
Funds Recipient: Company
Maximum Size: 18,000,000
Size of Required Local Match: No
Required Qualification: Cost Benefit
General Statute: § 143B-437.50 - § 143B-437.63
Web: www2.nccommerce.com/finance/incentives/jdig

The North Carolina Economic Infrastructure Program
Type: Grant
Administrator: N.C. Rural Center
Funds Recipient: Municipality
Maximum Size: 500,000
Size of Required Local Match: 5%
Required Qualification: Job Creation
General Statute: NA
Web: www.ncruralcenter.org/grants/water.htm

United States Department of Energy
Type: Grant
Administrator: Office of Energy Efficiency and Renewable Energy
Funds Recipient: Company/Municipality
Maximum Size: NA
Size of Required Local Match: No
Required Qualification: No
General Statute: NA
Web: www.eere.energy.gov

The North Carolina Green Business Fund Program
Type: Grant
Administrator: North Carolina Board of Science and Technology
Funds Recipient: Company
Maximum Size: 100,000
Size of Required Local Match: No
Required Qualification: No
General Statute: NA
Web: www.energync.net

Community Connect Grant Program
Type: Grant
Administrator: United States Department of Agriculture
Funds Recipient: Company/Municipality
Maximum Size: 1,000,000
Size of Required Local Match: 15%
Required Qualification: No
General Statute: NA
Web: www.rurdev.usda.gov

Continued

Community Development Block Grant
Type: Grant/Loan
Administrator: NC Division of Community Assistance
Funds Recipient: Municipality
Maximum Size: NA
Size of Required Local Match: WAIVED FOR TIER 1%
Required Qualification: Job Creation
General Statute: NA
Web: www.nccommerce.com/en/communityservices/communitydevelopmentgrants/communitydevelopmentblockgrants

Renewable Energy Systems and Energy Efficiency Improvements Grants and Guaranteed Loans
Type: Grant/Loan
Administrator: United States Department of Agriculture
Funds Recipient: Company/Municipality
Maximum Size: 500,000
Size of Required Local Match: No
Required Qualification: No
General Statute: NA
Web: http://www.rurdev.usda.gov

Clean Water State Revolving Fund
Type: Loan
Administrator: North Carolina Department of Environment and Natural Resources
Funds Recipient: Municipality
Maximum Size: NA
Size of Required Local Match: No
Required Qualification: No
General Statute: NA
Web: www.nccgl.net/fap/cwsrf

North Carolina Green Power
Type: Partner
Administrator: NA
Funds Recipient: NA
Maximum Size: NA
Size of Required Local Match: No
Required Qualification: No
General Statute: NA
Web: ncgreenpower.org

Northeast Commission Regional Spec Building Program
Type: Revolving Loan
Administrator: NC Northeast Commission
Funds Recipient: Municipality
Maximum Size: 100,000
Size of Required Local Match: No
Required Qualification: No
General Statute: NA
Web: www.ncnortheast.info/news/pdfs/northeast_spec_building_program_final_media_release.pdf

Article 3J Tax Credits
Type: Tax Credit
Administrator: NC Department of Commerce
Funds Recipient: Company
Maximum Size: NA
Size of Required Local Match: No
Required Qualification: Job Creation
General Statute: §105-129.83 - §105-129.89
Web: www.nccommerce.com/en/businessservices/locateyourbusiness/whync/incentives/3j.htm

Renewable Energy Tax Credits
Type: Tax Credit
Administrator: NC Department of Commerce
Funds Recipient: Company
Maximum Size: NA
Size of Required Local Match: No
Required Qualification: No
General Statute: § 105-129.15 et seq.
Web: www.nccommerce.com/en/businessservices/locateyourbusiness/whync/incentives/renewableenergytaxcredits

Appendix 5A: Community Workshop Agenda

Community Workshop on a Sustainable Industrial Park for Camden County

March 13, 2008, 9a – 1:30p
Dismal Swamp State Park Education Center

Desired Outcomes

1. Discussion participants understand what the UNC-Chapel Hill study team considers to be the **basic concepts** underlying the development and operation of a sustainable industrial park.
2. The study team understands **local perspectives** on what values, goals, concerns, and resources would be relevant to such a park operating in Camden County.

Agenda

8:45a Doors Open

9:00a Convene

- Welcome
- Introductions and Meeting Overview

9:20a Basic Concepts and Assumptions (60 minutes)

- Overview
- Environmental Team
- Business Opportunities and Regional Development Team
- Governance and Finance Team

10:20a Break

10:30a, 1st Concurrent Session (45 minutes) and 11:20a, 2nd Concurrent Session (45 minutes)

- Stations are set up around the room or in break out rooms for each of the study teams.
- Attendees may choose to visit with any study team whose topic interests them, and they are requested to stick with that team for the duration of each concurrent session.
- Study teams will briefly present an overview of methods and key questions and will have a substantive expert available to answer questions.

12:10p Working Lunch

- First 20 minutes: participants get their lunch, have informal conversations.
- At 12:30p, each study team facilitators and presenters have 15 minutes to recap what they heard from participants and respond to comments or clarification from participants.

1:15p Wrap Up

- What the Feasibility Study Team will do from this point out.
- Thanks for coming!

1:30p Adjourn

Appendix 5B: Workshop Attendees

Last Name	First Name	Organization	Stakeholder Group	
Andrews	Mike	Camden County Commission	Government	Developer Funded
Aydlett	Mike	Camden County Education Foundation	Community	
Barnes	Harold	Hesed Consultants	Business	
Bland	Bill	Camden Citizens Action League	Community	
Browner	Richard	Lakes at Shiloh (res. development)	Business	
Duckwall	Sandy	Camden County Commission	Government	$3,657,655
Faison	Phil	Camden County Commission	Government	6%
Gilchrist	Willie	Elizabeth City State University	Education	Developer Funded
Hall	Katie	Office of President Pro Tem Basnight	Government	
Hampton	Jeff	The Virginian Pilot	Media	
Harris	Wayne	Albemarle Economic Development Commission	Business	
Henderson	John	The Daily Advance	Media	
Lane	Rocky	Elizabeth City State University	Education	$48,317,212
Lawrence	Larry	Camden County Schools-Director of Auxilliary Services	Education	23%
Leary-Smith	Penny	Dismal Swamp Canal Welcome Center	Community	Developer Funded
McClendon	Robert	Coastal Studies Institute	University	
Melchiorre	Ron	Camden County Superintendent	Education	
Meiggs	Garry		Community	
Moehring	David	Camden United Methodist Church	Community	
Palestrant	Jennifer	Elizabeth City Chamber of Commerce	Business	$82,719,147
Perry	Robert	Albemarle Ecological Field Site, UNC IE	University	20%
Phaneuf	Donna	VIA Design Architects	Business	
Porter	Dan	Camden County Planning Director	Government	
Rogerson	Vann	NC Northeast Commission	Business	
Rudiger	David	Boyd Homes/Camden Plantation	Business	
Sawyer	Brenda	Camden County School Board	Education	
Sorrells	Mark	Golden LEAF	Nonprofit	
Tollaksen	David	Southern Chesapeake Land Co.	Business	
Vogel	Ted	Blackwater Worldwide	Business	
Watts	Teresa	NC Dept. of Commerce - Heritage Tourism & Comm. Development	Government	
White	G. Wayne	Camden County School Board	Education	
Wessel	Dave	College of the Albemarle	Education	
Williams	Signa	Dismal Swamp State Park	Community	
Williams	Frank T.		Community	
Woodruff	Randell	Camden County Manager	Government	