

**Economic Impact on Delaware's Economy:
The Brownfield Program**

by

Daniel T. Brown
John M. Laznik
Edward C. Ratledge

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Executive Summary

The Center for Applied Demography & Survey Research at the University of Delaware conducted this study to measure the economic impact of Delaware's brownfield program. The study was made possible by a grant from the Delaware Department of Natural Resources and Environmental Control. The Center conducted the study independently and the authors are solely responsible for its design and execution.

A brownfield is a vacant or underutilized property with a real or perceived environmental hazard that strongly discourages development. As a result, properties that could generate economic and social benefits remain undeveloped. Delaware's brownfield program encourages the remediation and private development on these sites with financial assistance and liability protection.

This report evaluates the economic impact of brownfield development. The impact is measured through changes in the brownfield's property value and neighboring business activity. It does not address other important aspects of the program, such as poverty, health, crime, urban sprawl, and the public's preference for clean properties.

Data has been collected from Delaware Department of Natural Resources and Environmental Control (DNREC), the Delaware Department of Labor (DOL), the Delaware Economic Development Office (DEDO), county tax assessment records, and the Center for Applied Demography & Survey Research (the Center). The report also uses output from the REMI PI+ general equilibrium model. The model is tailored to Delaware using data from the Bureau of Census, the Bureau of Economic Analysis, the Bureau of Labor Statistics, and the Energy Information Administration (among others).

In general, brownfield development has been very positive in New Castle County and Sussex County, but less so in Kent County. We attribute this differential to unfinished development. Overall, large economic benefits have been generated in the state from brownfield development. The main findings are outlined below.

Property Values

- The total assessed value of brownfield properties in New Castle County increased \$455 million since 1998. Most of this has occurred on the Wilmington Riverfront. The total assessed value of Sussex County brownfields increased \$15 million since 2000. Assessed values in Kent County increased less than \$200,000 since 2001.
- Brownfield property values in New Castle County increased more than ten times higher than other properties in their district. Brownfield property values in Sussex County increased 73 percentage points more than district property values. Brownfield property values in Kent County increased by 18 percentage points less than other properties in the district.
- Property tax revenue in New Castle County was \$2.7 million higher in 2008 due to brownfield development. Approximately \$1.2 million went to the Christina School District and \$950,000 went to the City of Wilmington. Brownfield development increased 2008 property tax revenue less than \$47,000 in Sussex County and less than \$2,000 in Kent County.

Local Economic Impact

- Local impact refers to activity that occurs within a specified distance of a brownfield at any time. If a business moves near a brownfield, the local impact ignores all activity before the move. If a business moves away from a brownfield, the local impact ignores that business's future activity.
- Local employment increased less than overall employment in the county.
- Local brownfield wages grew faster than overall wages in New Castle County and Sussex County. Local wages may have declined in Kent County.

- The local average annual wage per worker increased absolutely and increased relative to the county. This was particularly strong in Sussex County.
- Higher paying jobs in finance and insurance increased near brownfields. Lower paying jobs in retail and wholesale trade declined near brownfields.

Countywide Economic Impact

- Countywide brownfield activity refers to the employment and wages of all businesses that were within a specified distance from a brownfield at any time. If a business moves near a brownfield, the countywide definition includes the business's activity before it moved. If a business moves away from a brownfield, the countywide definition includes any activity that takes place after the move.
- Countywide brownfield employment increased faster than expected in New Castle and Sussex counties, but decreased in Kent County.
- Change to the industrial composition of countywide business activity is similar to the local analysis, though less pronounced.
- Countywide brownfield wages increased faster than wages in New Castle and Sussex counties. For these two counties, the annual wage per worker increased substantially and was above average in 2008.

Economic Simulation

- The REMI PI+ model simulated the total impact of above average brownfield growth.
- Above average brownfield growth created 695 jobs and \$394 million in GDP in 2008.
- Total wage and salary disbursements in 2008 were \$135 million larger than they would be had development matched county growth. Disposable personal income per capita was nearly \$200 larger than it would have otherwise been.
- Most of the gains in economic benefits stem from growth in the finance and insurance sector and the administrative support, waste management and remediation services sector.

Introduction

A brownfield is a vacant or underutilized property with a real or perceived environmental hazard. Because any past or present owner is held liable for these hazards, private brownfield development is strongly discouraged. Delaware's brownfield program encourages the remediation and development of brownfields with financial assistance and liability protection. This report quantifies the economic impact of brownfield development through changes in property values and neighboring businesses. It does not address the social aspects of the program, such as poverty, health, crime, urban sprawl, and the public's preference for clean properties.

We briefly consider a particular site to foreshadow the upcoming analysis. Between 1906 and 1982 a large chemical and textile factory operated at the Del Chapel Place brownfield. This type of manufacturing is known for releasing hazardous materials. Any potential owner of the property (including banks in a leveraged transaction) had to consider the potential liability being assumed. Not surprisingly, the property remained vacant for 16 years after closing despite a prime location.

In February 1997, the brownfield program conducted preliminary assessments and found the soil to be relatively clean.¹ A developer purchased the site for \$5.8 million within a year.² The developer received financial assistance to remediate the property and liability protection once it was deemed safe. The old factory was razed and a new apartment complex was operating by 2000 (see Figure 1). The current assessment has a 2008 market value of nearly \$42 million.

¹ www.dnrec.state.de.us/DNREC2000/Divisions/AWM/sirb/Final_Plans/Final%20Plan%20Del%20Chapel%20OUI.pdf

² The sales price was obtained from New Castle County's property sales records.

Figure 1 Aerial Photographs of the Del Chapel Place Brownfield Before and After Remediation



- Center for Applied Demography & Survey Research

Businesses in the immediate area have adapted to the new population. The apartment complex employs workers for maintenance and administrative purposes and contracts with other Delaware businesses. An internet café, tanning salon, car rental shop, and retail bank have opened on adjacent properties. An exercise gym, a new and used sporting goods store, and a used car dealership have since closed or relocated. As workers spend their incomes and businesses purchases inputs from other businesses, any net change in business activity is multiplied in the economy. This example ignores some important points that will be made explicit later in the report. However, it characterizes how the economic impact of brownfield development will be measured.

We find that benefits in Kent County are consistently lower than in other counties. For example, the assessed value of brownfield properties increased more than ten times what could be expected in New Castle County but 81% *less* than expected in Kent County. However, this report measures only a snapshot of activity in 2008. We expect benefits in every county to improve as more brownfields finish development.

Although the analysis may be premature, we still find large economic gains have happened near Delaware brownfields. For every nominal dollar spent by the brownfield program (both state and federal funds), property values have increased approximately \$17.50. Brownfield employment may have increased or decreased depending on which measure one uses to define brownfield employment. Brownfield wages, on the other hand, have unambiguously increased. More generally, brownfield economic growth is well above average.

We describe our data and methodology in the next section before turning to the results in more detail.

Data and Methodology

Data Sources

DNREC provided a list of 119 different brownfield sites in Delaware.³ DNREC indicated each brownfield's physical address, tax parcel identification, date of certification, remediation status, and the nominal dollars spent by the brownfield program and Hazardous Site Cleanup Act (HSCA) grants. DNREC's online database of proposed and final plans of remedial action indicated the type of development planned.⁴

Table 1 describes Delaware brownfields by their respective characteristics. Most brownfields are in New Castle County, though Sussex County and Kent County each have ten certified sites. More than half of all brownfields are scheduled for business use. Of those that are not, 21 have plans for residential use, 19 are intended for mixed use, and eight are expected to be open space.⁵ Ten brownfields are being remediated for nonprofit agencies, like homeless shelters and museums. Table 1 also shows that as of 2008, 44 brownfields completed remediation, 54 were being remediated, and 21 stopped responding to DNREC since obtaining brownfield status.⁶

³ The list contains all official brownfields as of December 31, 2008. Fourteen additional sites were certified in 2009.

⁴ <http://docs.dnrec.delaware.gov/sirbsitefiles.cfm>

⁵ Open space refers to parks as well as parking lots.

⁶ Most inactive brownfields have probably not begun development, though some sites could be developed outside of the brownfield program.

Table 1 Delaware Brownfields Classified by Remediation Status and Development Plans

| County | Remediation Status | Type of Development Proposed for Brownfield | | | | | | Total |
|------------|--------------------|---|-------------|------------------------|------------|--------------------|---------------------|-------|
| | | Business | Residential | Business & Residential | Open Space | Nonprofit Business | Nonprofit Residence | |
| New Castle | Complete | 22 | 9 | 2 | 1 | 2 | 3 | 39 |
| | In Progress | 20 | 6 | 9 | 4 | 2 | 0 | 41 |
| | Inactive | 13 | 0 | 4 | 0 | 0 | 2 | 19 |
| | Total | 55 | 15 | 15 | 5 | 4 | 5 | 99 |
| Sussex | Complete | 1 | 2 | 1 | 1 | 0 | 0 | 5 |
| | In Progress | 1 | 2 | 0 | 0 | 0 | 0 | 3 |
| | Inactive | 0 | 0 | 0 | 2 | 0 | 0 | 2 |
| | Total | 2 | 4 | 1 | 3 | 0 | 0 | 10 |
| Kent | In Progress | 4 | 2 | 3 | 0 | 1 | 0 | 10 |
| | Total | 4 | 2 | 3 | 0 | 1 | 0 | 10 |

- Source: DNREC and the Center for Applied Demography & Survey Research

The Center also obtained historical snapshots of all tax parcel assessments from each county's government. Each county had different years of data available. In New Castle County, complete electronic records begin in 1998. In Sussex and Kent counties, records are available beginning in 2000 and 2001 respectively. The 2008 assessment records are available for every county. The records give the assessed value, zone type, and exemption status for every tax parcel. Property tax rates were obtained from an annual report produced by the Delaware Economic Development Office (DEDO).⁷

The Delaware Department of Labor (DOL) provided the number of employees, quarterly wages, and NAICS industrial code for all Delaware establishments paying unemployment insurance since 2000. This sample includes 999,192 quarterly establishment reports. Each establishment's reported Delaware address was mapped using the Center's GIS software.

⁷ http://dedo.delaware.gov/pdfs/main_root/publications/2008-2009_Property_Tax_Report.pdf

Defining Brownfields

DNREC identified each brownfield by the tax parcels that were relevant when the property was certified. This identification did not change over time for most brownfields. However, some brownfields lost their original definition when land was redistricted. In these cases, a new brownfield definition was used that formed the smallest common area across time. This implies that a brownfield could be defined by different tax parcels each year.

The Lexington Avenue brownfield in Smyrna is an example of this redistricting. The dashed trapezoid on the left side of Figure 1 highlights three tax parcels that originally defined the brownfield. The right side of Figure 1 outlines the current tax parcels and overlays the original brownfield area. Clearly, the new tax parcels cannot replicate the original brownfield area, so an alternative definition was needed. The alternative definition includes all tax parcels in the original trapezoid and darkened region. This new definition is comparable across time.

Estimating Market Value from Assessed Value

In most markets the sale price is a good indicator of market value. However, sale prices are not useful measures of market value for our interests. First, the necessary theoretical assumptions of a competitive market are rarely true for any single transaction. Second, properties do not sell frequently, so many changes to market value are unobservable. In addition, properties often sell in a bundle with other properties so there is no explicit sales price for any single property. Changes in the property markets also obscure comparisons across time. Redistricting compounds all of the above problems.

Figure 2 Lexington Avenue Brownfield Before and After Redistricting



- Source: DNREC SIRB site files and Kent County Mapping Site

Tax assessments overcome many of the problems associated with sale prices. Assessments (aka assessed values) are independent evaluations of potential market value. Each assessment assumes that the property sells in a competitive market. In addition, new assessments are mandatory with every material change, so improvements will be observed even if the property does not sell. Assessments also ignore changes in the market by fixing the date of the hypothetical sale. For example, tax assessors in New Castle County assume that hypothetical transactions occur in 1983. In Sussex County and Kent County, that year is 1974 and 1986 respectively.⁸ Because prices rose over time, assessed values must be inflated to capture the current market value.

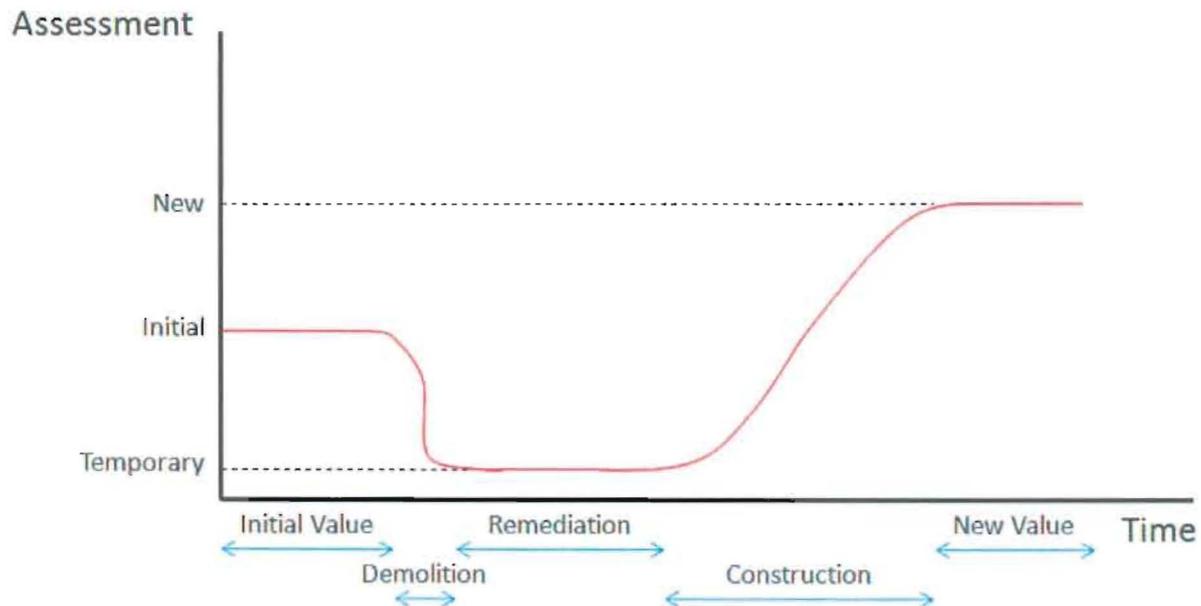
Assessment-to-sales (AS) ratios inflate assessments to current market values. These ratios apply statistical and sampling techniques to recent sales in each school district. Separate ratios are calculated for businesses, residences, farms, and open lots. Most recently, the AS ratio for all properties in New Castle County was 0.2499. This implies that the average assessment in New Castle County is approximately a quarter of its 2008 market value.

The Timeline of a Brownfield's Assessed Value

Figure 3 is a heuristic timeline of a brownfield's assessed value. The brownfield has an initial assessment that does not change when it is underutilized or vacant. The first phase of development demolishes any existing structures causing the assessment to decline. The property is then remediated. As will be explained shortly, remediation does not affect assessed values. Construction begins and the assessment increases as new structures are built. A new assessment is available once development is complete.

⁸ These years are also the last time an assessment was performed on every property at the same time. Every assessment done since that time is retrospective and reflects the prices for the particular base year.

Figure 3 Hypothetical Timeline of Assessed Value for a Brownfield Undergoing Development



A brownfield could be at any point on the timeline at any time. Figure 4 shows the example of the Howard St. Development Project on the Wilmington Riverfront. The left side is the brownfield before development, and the right side is as of its most recent assessment. Not surprisingly, its current assessment is lower than its previous assessment. However, even the most recent assessment may be out of date. A supermarket has since opened on the site, so we expect the assessment to increase substantially in 2009.

Assessed values have two important limitations. First, assessments ignore pollution and capital depreciation. Thus, remediation by itself will not change an assessment even though market value will change.⁹ This also implies that the initial assessment overstates market value, since brownfields are not in good condition. The change in assessed value is therefore a conservative estimate of the change in property value.

⁹ Theoretically, remediation increases market value by the net change in the discounted value of expected damages. In perfect competition, this equals the cost of remediation. Liability protection eliminates expected damages.

Figure 4 Howard Street Redevelopment Project Before and After Remediation

Before Remediation



After Remediation



- Source: Google Maps and Bing Maps

The second limitation is that assessments are not continuous. Assessments are supposed to occur only with a material change to the property. For example, assessments occur when land is redistricted or when structures are modified. Because the owner must pay a percentage of assessed value in property tax, there is an incentive to assess brownfields immediately after demolition and prolong assessments after construction is finished. Developers should also slow construction when there are few buyers (e.g. during a recession). Thus, some properties may have outdated assessments as of 2008. This is another reason why the observed change in assessed value is a conservative estimate of a change in property value.

Measuring the Impact on Property Taxes

Every year, most property owners pay a percentage of their property's assessment. New Castle County bases this rate on 100% of assessed value. Kent County's tax base is 60% of assessed values, while Sussex County uses 50%. The tax rate itself depends on multiple factors, including the property's school district and municipality (if any).¹⁰ Most nonprofit organizations, like the Sunday Breakfast Mission, Delaware Children's Museum, and Kalmar Nyckel Challenge Program are exempt from paying property tax.

The impact of brownfield development on property taxes is determined by multiplying the change in the tax base by the appropriate tax rate. For example, suppose that a nonexempt property in Sussex County increases \$20,000 in assessed value and the tax rate is 3%. The tax base increases \$10,000 ($\$20,000 \times 50\%$), so tax revenue increases \$300. Tax revenue will fall if the assessed value declines.

¹⁰ Some municipalities do not use the county assessment records as a base to levy city taxes. For example, Milton uses a tax base of 50% of 1994 market values to levy a city tax despite the fact that the county uses a base from 1974. Therefore, city tax rates in Milton are inflated with the 1994 AS ratio so that they apply to the 1974 assessment.

Mapping Business Establishments

The Delaware DOL data gives the employment, wages, industry, and addresses for most Delaware businesses. Each address was mapped as a point using the Center's GIS software. If the point falls inside a tax parcel, the report treats that entire parcel as the business's physical location. If the software maps the business outside of a tax parcel, the report treats that point as the business's location. This rule is intended to give most businesses physical space.

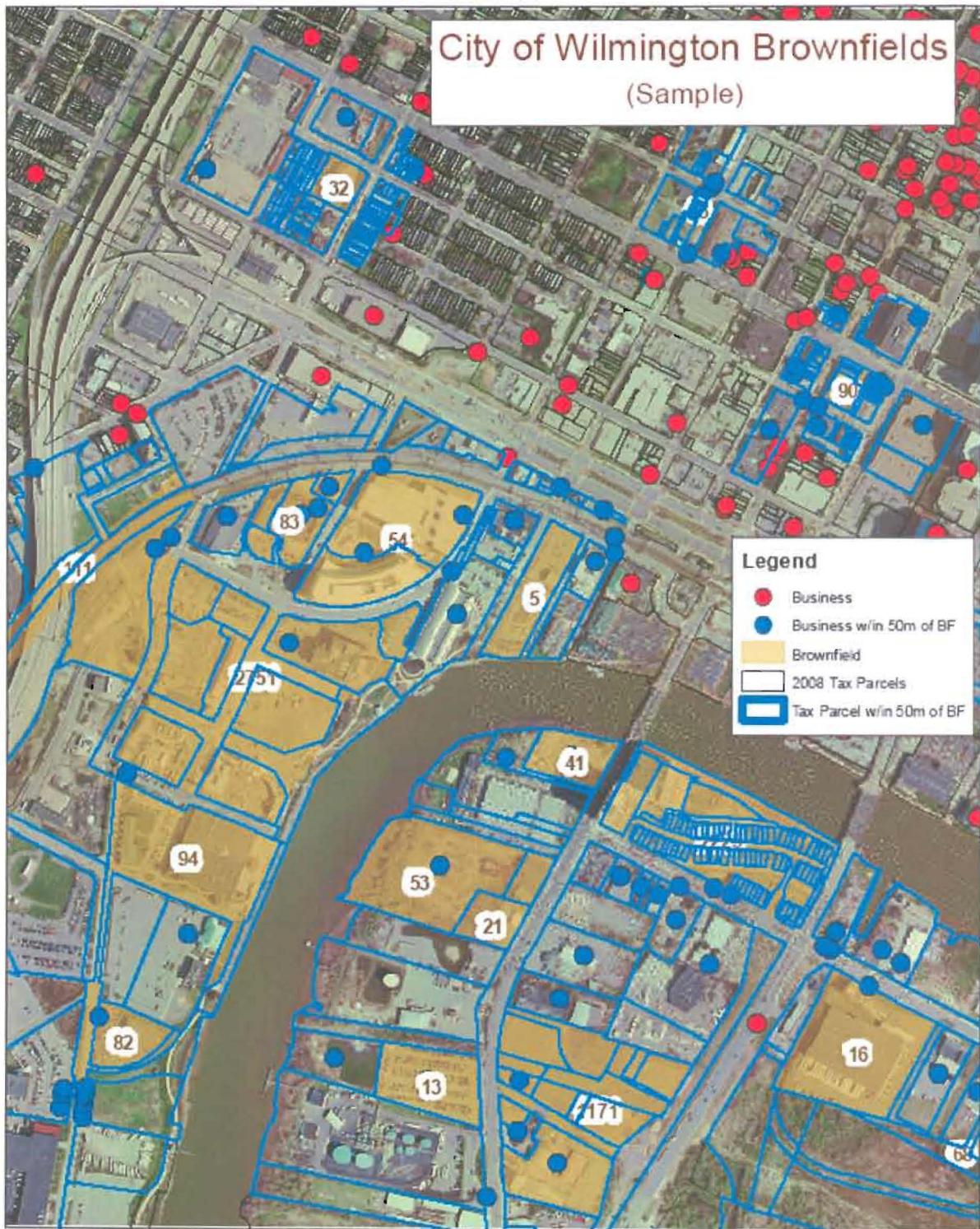
Figure 2 illustrates the mapping of establishments on the Wilmington Riverfront. Brownfields are denoted by the brown shaded areas. The thick blue outlines are tax parcels within 50 meters of a brownfield. The thin black outlines indicate tax parcels that are beyond 50 meters from a brownfield. Each dot represents a mapped establishment. Any establishment falling within a blue tax parcel or within 50 meters of a brownfield is highlighted in blue. All other establishments are highlighted in red.

Defining Brownfield Activity: Local and Countywide Perspectives

Consider again the Del Chapel Place brownfield discussed in the introduction. The new apartment complex directly increased jobs and wages. This increase may certainly be credited to brownfield development. But how should the change in nearby businesses be evaluated? It is reasonable that the apartment complex is partially responsible for some of the changes.

Unfortunately, we do not know what degree of influence it had on the area. Future research may yield important insights into this relationship.

Figure 5 Brownfields and Businesses on the Wilmington Riverfront



• Source: Delaware Department of Labor and Center for Applied Demography & Survey Research

Because the extent of a brownfield's influence on neighboring businesses is unknown, this report describes the changes occurring in four concentric areas around each brownfield. As in the Wilmington Riverfront example (Figure 5), each area includes the brownfield itself, the area within a specified distance to a brownfield, and any tax parcels falling inside of this distance. We adopt this strategy for distances of 50, 250, 500, and 1000 meters. We expect the brownfield's influence falls as distance increases. In addition, if the area around brownfield sites is not too clustered, activity should become less volatile and more closely resemble the county trends at greater distances.

Business relocation is very important. For example, suppose an owner of a business near a brownfield sells her land to a developer and moves operations away from the brownfield (but still in the county). If the owner did not change employment or wages, did brownfield activity fall? From the perspective of state or county employment, the answer is no. From the perspective of more local interests, a job that moved away may be viewed as one less job.

We define "local brownfield activity" as the employment and wages near a brownfield (i.e. in one of the four concentric areas) in any given time. Businesses that move away from a brownfield are no longer local, and are ignored after they move (local displacement effects are considered). Similarly, businesses that move near a brownfield are treated as though a new business has just been created. Local activity is most relevant to the communities immediately surrounding a brownfield.

We define “countywide brownfield activity” as the employment and wages of any establishment that has ever been near a brownfield. By tracking these businesses in every quarter they are in Delaware, the countywide definition distinguishes between businesses that move away from a brownfield and those that shut down or leave the state (local displacement effects are ignored). The definition also distinguishes between new businesses and ones that relocate next to a brownfield. Countywide brownfield activity only increases if these establishments increased employment or wages. Relocation within the state will not affect countywide brownfield activity.

The report first describes historical changes in wages and employment near Delaware brownfields.¹¹ We disaggregate these changes by industry and note any consistent changes in the composition of businesses. This is done for both local and countywide definitions of activity. Next, the empirical relationship between brownfield activity and distance to a brownfield is noted. We finish the section by measuring the average annual wage per brownfield worker in 2000 and 2008. Brownfield growth is measured absolutely and relative to county growth rates.¹²

The Errors of Measuring Brownfield Activity

Unfortunately, mapping the business data creates error in our estimates of brownfield activity. One problem is that an establishment could list an address that is sufficient for correspondence, but does not indicate where activity occurs. For example, a carpenter or general contractor may report a home address while working in multiple locations throughout the quarter. We assume this problem is minor and that the spatial map is approximately correct. Only new data can verify this assumption and correct any errors.

¹¹ The Crozier Center was excluded given the overwhelming effects of large operations in the area.

¹² The county was chosen instead of district for two main reasons. First, businesses only report their county to the DOL, not their district. Second, more bias is generated at higher levels of disaggregation when the spatial density of unmatched observations differs from matched observations. Sectoral decompositions at the district level are far more disaggregate than at the county level.

Another problem is that some establishments could not be mapped. Table 2 lists the total percent of establishments, employment, and nominal wages that successfully mapped in each quarter. Due to irreconcilable address spellings, street changes, and PO box listings, 37.2% of the nearly one million records could not be mapped. Sussex County had the lowest initial matching rate with only 36.3% of establishments matching an address in the first quarter of 2000. These establishments were responsible for 49.5% of Sussex employment and 52.9% of wages. Over time the percent of matched establishments, wages, and employment increased for all counties.

The failure to obtain 100% successful address matches creates different problems for the local and countywide analyses. Local brownfield activity will be underestimated if some businesses are not observed. This implies that observed activity will be higher in later time periods when more addresses match. However, if the spatial density of matched establishments equals unmatched establishments, both problems can be mitigated by dividing the observed wages and employment by the relevant percentage in Table 2.¹³ Every local analysis performs this transformation.

Countywide brownfield activity will also be underreported if an establishment should map near a brownfield and never does.¹⁴ However, as long as an address maps next to a brownfield in any time period, that business will always be included in countywide activity. This means that the increased rate of successful matches imposes substantially less bias in the countywide analysis than it does in the local analysis.

¹³This correction could also create bias if the two densities differ significantly. In particular, the probability that the densities equal each other decreases at higher levels of disaggregation.

¹⁴The local and countywide analyses are compared in percent, so underreporting bias is less detrimental.

Table 2 Percent Total Activity Successfully Mapped

| | | New Castle County | | | Sussex County | | | Kent County | | | Statewide | | |
|------|---|-------------------|-------|-------|---------------|-------|-------|-------------|-------|-------|-------------|-------|-------|
| Time | | Num. Estab. | Empl. | Wage | Num. Estab. | Empl. | Wage | Num. Estab. | Empl. | Wage | Num. Estab. | Empl. | Wage |
| 2000 | 1 | 62.9% | 68.4% | 69.8% | 36.3% | 49.5% | 52.9% | 61.5% | 53.3% | 49.4% | 55.9% | 63.2% | 65.4% |
| 2000 | 2 | 62.1% | 67.9% | 69.6% | 37.1% | 49.0% | 52.6% | 61.5% | 52.3% | 50.2% | 55.1% | 62.0% | 64.3% |
| 2000 | 3 | 62.2% | 67.9% | 69.3% | 37.2% | 49.3% | 52.0% | 61.4% | 52.4% | 49.4% | 55.1% | 62.0% | 63.8% |
| 2000 | 4 | 62.8% | 68.7% | 72.2% | 38.9% | 50.8% | 54.0% | 61.9% | 50.9% | 50.8% | 55.6% | 62.8% | 67.1% |
| 2001 | 1 | 71.0% | 74.2% | 73.9% | 56.8% | 59.5% | 62.4% | 68.3% | 57.1% | 55.6% | 66.4% | 69.2% | 70.2% |
| 2001 | 2 | 62.4% | 67.6% | 69.2% | 42.6% | 50.8% | 52.7% | 62.3% | 53.6% | 52.3% | 55.9% | 62.3% | 64.5% |
| 2001 | 3 | 62.5% | 67.6% | 69.7% | 43.2% | 50.4% | 52.5% | 62.3% | 54.4% | 53.7% | 56.1% | 62.3% | 64.9% |
| 2001 | 4 | 62.5% | 67.7% | 71.4% | 43.8% | 50.8% | 51.2% | 62.8% | 53.8% | 54.4% | 56.2% | 62.5% | 66.6% |
| 2002 | 1 | 63.0% | 68.2% | 67.2% | 46.9% | 54.3% | 55.0% | 64.2% | 54.2% | 52.9% | 57.3% | 63.4% | 63.6% |
| 2002 | 2 | 63.1% | 68.1% | 69.8% | 47.5% | 54.0% | 54.7% | 64.5% | 53.6% | 52.1% | 57.6% | 63.1% | 65.1% |
| 2002 | 3 | 63.9% | 68.6% | 70.1% | 48.4% | 54.7% | 56.0% | 65.2% | 55.5% | 54.5% | 58.6% | 63.7% | 65.6% |
| 2002 | 4 | 64.0% | 68.6% | 70.2% | 48.5% | 55.4% | 56.9% | 65.4% | 54.6% | 55.1% | 58.7% | 63.9% | 66.1% |
| 2003 | 1 | 65.2% | 75.3% | 76.6% | 52.1% | 60.0% | 61.6% | 67.6% | 60.9% | 58.7% | 60.3% | 69.8% | 71.9% |
| 2003 | 2 | 65.9% | 76.6% | 76.8% | 56.0% | 61.0% | 61.5% | 69.4% | 60.8% | 60.5% | 61.7% | 71.2% | 72.3% |
| 2003 | 3 | 66.0% | 77.0% | 77.9% | 56.1% | 61.5% | 62.4% | 69.5% | 61.1% | 59.6% | 61.8% | 71.5% | 73.1% |
| 2003 | 4 | 65.8% | 76.7% | 77.9% | 56.1% | 61.6% | 63.0% | 69.4% | 60.8% | 62.4% | 61.7% | 71.3% | 73.4% |
| 2004 | 1 | 67.0% | 78.4% | 78.4% | 58.3% | 62.7% | 62.6% | 71.1% | 65.5% | 65.6% | 63.1% | 73.2% | 74.4% |
| 2004 | 2 | 67.3% | 78.8% | 78.3% | 59.5% | 63.6% | 63.5% | 71.4% | 67.3% | 68.9% | 63.5% | 73.8% | 74.4% |
| 2004 | 3 | 67.4% | 79.4% | 78.8% | 59.6% | 63.3% | 63.2% | 71.2% | 67.5% | 68.9% | 63.6% | 74.1% | 74.6% |
| 2004 | 4 | 67.6% | 79.4% | 79.8% | 60.0% | 64.2% | 64.4% | 73.3% | 68.6% | 70.6% | 64.1% | 74.5% | 75.8% |
| 2005 | 1 | 68.1% | 81.3% | 83.2% | 61.0% | 64.3% | 64.7% | 73.4% | 69.5% | 70.4% | 64.7% | 76.1% | 78.9% |
| 2005 | 2 | 68.5% | 81.4% | 81.2% | 62.5% | 64.9% | 64.7% | 73.1% | 69.3% | 70.5% | 65.2% | 76.1% | 77.0% |
| 2005 | 3 | 69.0% | 81.4% | 81.6% | 63.1% | 65.1% | 64.5% | 73.4% | 68.5% | 69.6% | 65.7% | 75.8% | 77.0% |
| 2005 | 4 | 68.7% | 81.2% | 83.3% | 62.9% | 65.7% | 65.5% | 72.4% | 67.4% | 70.2% | 65.5% | 75.7% | 78.9% |
| 2006 | 1 | 69.4% | 81.7% | 83.8% | 64.0% | 66.4% | 65.7% | 73.1% | 68.8% | 68.7% | 66.3% | 76.4% | 79.3% |
| 2006 | 2 | 69.5% | 81.6% | 82.9% | 65.4% | 67.0% | 66.4% | 73.3% | 68.5% | 70.1% | 66.6% | 76.2% | 78.4% |
| 2006 | 3 | 69.5% | 81.5% | 82.3% | 65.2% | 66.7% | 66.7% | 73.2% | 69.1% | 69.7% | 66.7% | 76.1% | 77.7% |
| 2006 | 4 | 69.9% | 81.6% | 82.3% | 65.6% | 68.0% | 68.4% | 73.2% | 68.3% | 71.1% | 67.0% | 76.4% | 78.2% |
| 2007 | 1 | 69.9% | 81.7% | 82.8% | 66.3% | 68.6% | 70.3% | 72.8% | 69.3% | 69.1% | 67.2% | 76.8% | 78.8% |
| 2007 | 2 | 70.2% | 81.7% | 81.7% | 66.5% | 68.9% | 70.0% | 72.3% | 69.2% | 70.7% | 67.4% | 76.7% | 77.9% |
| 2007 | 3 | 69.9% | 81.4% | 82.0% | 66.6% | 68.8% | 70.4% | 72.1% | 69.5% | 70.8% | 67.2% | 76.4% | 77.8% |
| 2007 | 4 | 70.4% | 81.8% | 80.9% | 67.2% | 69.2% | 70.4% | 72.3% | 69.0% | 70.0% | 67.4% | 76.8% | 77.2% |
| 2008 | 1 | 70.6% | 81.5% | 82.8% | 67.3% | 69.7% | 72.5% | 72.4% | 69.7% | 71.1% | 66.8% | 76.6% | 79.0% |
| 2008 | 2 | 70.6% | 81.4% | 80.7% | 67.5% | 69.7% | 71.3% | 72.7% | 70.6% | 72.0% | 66.5% | 76.4% | 77.0% |
| 2008 | 3 | 70.1% | 81.7% | 82.3% | 67.5% | 69.6% | 71.1% | 71.9% | 70.1% | 71.4% | 66.0% | 76.4% | 77.9% |
| 2008 | 4 | 68.6% | 81.1% | 81.7% | 65.6% | 68.7% | 70.9% | 69.8% | 68.6% | 71.9% | 64.4% | 75.7% | 77.5% |

Source: Center for Applied Demography & Survey Research

Preview of the REMI PI+ Model

The REMI PI+ software simulates economic activity in Delaware using theoretical modeling. The model adopts a general equilibrium framework to evaluate the direct and indirect effects of policy changes. This approach allows policies to generate multiplier effects like the one described in the introduction (on page 3). More details on the REMI model will be given later in the report.

We now turn to the changes in brownfield property values.

Property Values

This section estimates the changes in brownfield property values using tax assessments. Brownfields in New Castle County are addressed first, followed by Sussex County, and then Kent County. Relative comparisons are made with other properties in each district. We also calculate the impact that assessment changes have had on property tax revenue.

Brownfield Assessments in New Castle County

Table 3 shows the ten year change in assessed values for all New Castle County brownfields that completed remediation. Assessed values are reported in uninflated 1983 dollars and inflated 2008 market value. The federal and state expenditures made by DNREC are also listed.¹⁵ The final column lists what type of development is expected on each brownfield.

The assessed value of brownfields that completed remediation increased \$443 million since 1998. Four of the five largest gains are on the Wilmington Riverfront. Eight assessments did not change and eleven declined. Unchanged assessments could indicate brownfields that only received remediation (i.e. no structural modifications). The declines could reflect unfinished or unassessed projects. For example, the Howard St. Development Project's assessment fell \$421,800 (see Figure 4). This corresponds to a temporary decline of more than \$2,000,000 in 2008 market value.

¹⁵ These figures are not adjusted for the time value of money and therefore underestimate their 2008 dollar value.

Table 3 Change in Assessed Values for Remediated New Castle County Brownfields

| DE - # | Brownfield Name | Δ Assessed Value (1983 \$) | Δ Market Value (2008 \$) | Program & HSCA fund (nom. \$) | Type of Development |
|--------------------|---------------------------------|----------------------------|--------------------------|-------------------------------|---------------------|
| 1228, 1247, & 1224 | Christina Landing | \$36,159,800 | \$177,951,771 | \$0 | Res. |
| 1385, 0131, & 1331 | Christina Crescent | \$15,226,100 | \$74,931,594 | \$185,484 | Bus. |
| 1377 | Justison Landing Project | \$14,667,900 | \$72,184,547 | \$10,478,411 | Bus. & Res. |
| 163 | Del Chapel Place | \$8,885,700 | \$37,673,902 | \$814,444 | Res. |
| 1309 | Riverfront Headquarters/AAA | \$6,475,300 | \$31,866,634 | \$40,000 | Bus. |
| 1310 | Basher Lane | \$5,872,600 | \$22,859,478 | \$225,000 | Bus. |
| 1206 | 920 French St. | \$3,642,500 | \$17,925,689 | \$0 | Bus. |
| 1291 | 320 "A" St. | \$1,638,100 | \$8,061,516 | \$50,000 | Bus. |
| 1347 | Speakman Townhomes | \$1,753,600 | \$6,844,488 | \$2,924,776 | Res. |
| 84 | Dureco | \$895,800 | \$4,040,595 | \$0 | Bus. |
| 1429 | 97 Vandever Property | \$881,800 | \$3,695,725 | \$77,031 | Bus. & Res. |
| 1147 | Peninsula Park | \$728,700 | \$3,286,874 | \$10,000 | Bus. |
| 1281 | Petrillo Property | \$381,500 | \$1,720,794 | \$0 | Bus. |
| 1068 | DE Compressed Steel | \$308,200 | \$1,516,732 | \$0 | Bus. |
| 1372 | Habitat for Humanity-New Castle | \$144,700 | \$412,719 | \$459,929 | Nonprofit Res. |
| 1426 | Dureco Landfill | \$82,300 | \$371,222 | \$225,000 | Bus. |
| 1206 | 900 French Street | \$57,700 | \$283,957 | \$0 | Open |
| 1277 | Former BABS Real Estate | \$17,100 | \$77,131 | \$0 | Bus. |
| 1181 | Cobra Machine | \$0 | \$0 | \$29,385 | Bus. |
| 270 | Budd Metal | \$0 | \$0 | \$71,516 | Bus. |
| 1397 | 1101 East 8th St. | \$0 | \$0 | \$190,554 | Bus. |
| 1418 | Limestone Shopping Center | \$0 | \$0 | \$68,551 | Bus. |
| 1417 | 300 Greenhill Avenue | \$0 | \$0 | \$193,359 | Bus. |
| 339 | Kalmar Nyckel Challenge | \$0 | \$0 | \$78,762 | Nonprofit Bus. |
| 1394 | 0 Miller Road Property | \$0 | \$0 | \$187,866 | Res. |
| 1083 | Sunday Breakfast Mission | \$0 | \$0 | \$75,181 | Nonprofit Res. |
| 1382 | 38 Vandever Avenue | (\$1,700) | (\$5,966) | \$125,864 | Bus. |
| 1450 | A & Townsend St. | (\$8,200) | (\$35,186) | \$12,715 | Nonprofit Res. |
| 1322 | Ion Power | (\$10,300) | (\$40,424) | \$50,000 | Bus. |
| 1237 | Riverfront Office Building | (\$47,500) | (\$233,760) | \$0 | Bus. |
| 1395 | Pavilion Project | (\$63,400) | (\$246,789) | \$432,038 | Res. |
| 1359 | DelSteel | (\$83,600) | (\$353,073) | \$225,000 | Res. |
| 1431 | 1020 Christiana Avenue | (\$199,200) | (\$898,512) | \$82,525 | Bus. |
| 1057 / 1401 | Howard St. Commercial Redev. | (\$421,800) | (\$2,075,787) | \$3,456,859 | Bus. |
| 324 | Wiley Cork | (\$774,500) | (\$3,246,018) | \$713,007 | Bus. |
| 1332 | Madison Garden | (\$1,099,000) | (\$4,180,297) | \$807,718 | Res. |
| 1434 | Delaware Children's Museum | (\$2,395,600) | (\$11,789,370) | \$115,580 | Nonprofit Bus. |
| | New Castle County Total | \$92,714,600 | \$442,600,186 | \$22,406,556 | |

- Source: DNREC, New Castle County Tax Assessment, and Center for Applied Demography & Survey Research

Table 4 reports the change in property values for New Castle County brownfields with remediation in progress. Assessments in this group are expected to not change or to decline. In fact, 35 out of 40 brownfields meet this expectation. The overall market value of these 40 brownfields improved only \$2.1 million since 1998.

Table 5 lists the New Castle County brownfields for which developers have stopped reporting to DNREC. We expect that most of these sites have not finished remediation. The changes in assessed values are consistent with these expectations, but there is one notable exception. The NVF – Newark brownfield increased \$12.5 million in market value. Perhaps the developer realized the actual risk of damages was small and finished the project outside of the brownfield program. Inactive brownfields received much less funding than other sites.

Table 4 Change in Assessed Values for Partially Remediated New Castle County Brownfields

| DE - # | Brownfield Name | Δ Assessed Value (1983 \$) | Δ Market Value (2008 \$) | Program & HSCA fund (nom. \$) | Type of Development |
|-------------------------|-------------------------------------|----------------------------|--------------------------|-------------------------------|---------------------|
| 1087 | Deemer Steel | \$3,040,800 | \$12,547,009 | \$40,000 | Res. |
| 1294 | Peninsula Ventures | \$398,900 | \$1,799,278 | \$175,717 | Bus. |
| 1408 | SIP, Inc. Property | \$31,700 | \$133,054 | \$85,068 | Bus. |
| 325 | Burns & McBride | \$1,500 | \$7,382 | \$209,891 | Bus. |
| 1446 | 829 N. Church Street | \$600 | \$2,282 | \$1,790 | Nonprofit Bus. |
| 197 | Harper Thiel | \$0 | \$0 | \$0 | Bus. |
| 1198 | Wilmington Rolling Mills | \$0 | \$0 | \$60,751 | Bus. |
| 1293 | Christina Marina | \$0 | \$0 | \$570,328 | Bus. |
| 1248 | 5th & Tatnall | \$0 | \$0 | \$99,906 | Bus. |
| 1369 | Naga Foods | \$0 | \$0 | \$83,479 | Bus. |
| 1374 | NVF Wilmington Property | \$0 | \$0 | \$11,718 | Bus. |
| 1384 | Up the Creek Restaurant | \$0 | \$0 | \$132,330 | Bus. |
| 1389 | Schwartz Property | \$0 | \$0 | \$140,922 | Bus. |
| 1376 | Delaware Humane Association | \$0 | \$0 | \$138,602 | Bus. |
| 1367 | Cleveland Heights Development | \$0 | \$0 | \$207,904 | Bus. |
| 1383 | 600 A Street Property | \$0 | \$0 | \$31,294 | Bus. |
| 45 | Deemer Landfill Property | \$0 | \$0 | \$49,463 | Nonprofit Bus. |
| 1412 | Former Milford Fertilizer Property | \$0 | \$0 | \$93,772 | Bus. & Res. |
| 1158 | Former P&C Roofing Property | \$0 | \$0 | \$3,067 | Bus. & Res. |
| 1397 | Former Carney Harris Property | \$0 | \$0 | \$0 | Bus. & Res. |
| 1423 | Panella Ski Shop Property | \$0 | \$0 | \$12,694 | Bus. & Res. |
| 1421 | Former Pack & Processing Property | \$0 | \$0 | \$46,109 | Open |
| 1442 | B Street Pack & processing Property | \$0 | \$0 | \$137,567 | Open |
| 1444 | 605 Vandever Avenue Property | \$0 | \$0 | \$64,257 | Open |
| 281 | Diamond State Salvage | \$0 | \$0 | \$0 | Res. |
| 1153 | Curtis Paper Company | \$0 | \$0 | \$0 | Res. |
| 1428 | Crozier Center Property | (\$1,600) | (\$7,874) | \$45,420 | Bus. |
| 327 | Bell Funeral Home Property | (\$2,000) | (\$8,382) | \$12,782 | Bus. & Res. |
| 328 | 12th and Brandywine Streets Garden | (\$2,700) | (\$13,287) | \$0 | Open |
| 1328 | Marina Overlook | (\$18,100) | (\$81,642) | \$141,329 | Bus. & Res. |
| 1396 | New Castle Avenue and B Street Lots | (\$34,100) | (\$129,707) | \$128,198 | Res. |
| 1329 | 707 S. Market Street | (\$52,800) | (\$259,843) | \$12,876 | Bus. |
| 1304 | Wilmington Piece Dye | (\$96,500) | (\$372,443) | \$0 | Bus. |
| 1430 | Lippincott Project | (\$143,700) | (\$707,185) | \$135,314 | Bus. & Res. |
| 1109 | Brandywine Fibre Property | (\$186,100) | (\$915,846) | \$0 | Bus. & Res. |
| 1345 | Former New Arc Welding | (\$283,900) | (\$1,448,770) | \$128,826 | Bus. |
| 71 | NVF Yorklyn Property | (\$417,300) | (\$1,610,575) | \$0 | Bus. & Res. |
| 1392 | Railroad Crossing Project Property | (\$408,100) | (\$2,008,366) | \$157,310 | Res. |
| 1452 | Ministry Row Property | (\$528,800) | (\$2,011,411) | \$81,697 | Res. |
| 1425 | Former Star Building Property | (\$571,200) | (\$2,811,024) | \$159,454 | Bus. |
| New Castle County Total | | \$726,600 | \$2,102,650 | \$3,399,836 | |

- Source: DNREC, New Castle County Tax Assessment, and Center for Applied Demography & Survey Research

Table 5 Change in Assessed Values for Inactive New Castle County Brownfields

| DE - # | Brownfield Name | Δ Assessed Value (1983 \$) | Δ Market Value (2008 \$) | Program & HSCA fund (nom. \$) | Type Of Development |
|-------------------------|--------------------------------|-------------------------------|-----------------------------|----------------------------------|---------------------|
| 199 | NVF-Newark | \$2,713,300 | \$13,383,586 | \$0 | Bus. |
| 1324 | Riverwalk at Deemers Beach | \$473,700 | \$2,136,671 | \$10,000 | Bus. & Res. |
| 1405 | Heald Street Concrete Plant | \$73,500 | \$331,529 | \$0 | Bus. |
| 1420 | Former Kershaw Construction | \$44,100 | \$198,917 | \$0 | Bus. |
| 1169 & 1203 | Hessler Property | \$0 | \$0 | \$0 | Bus. |
| 1404 | 1000 East 12th Street Property | \$0 | \$0 | \$0 | Bus. & Res. |
| 1410 | 1190 East 7th Street Property | \$0 | \$0 | \$0 | Bus. |
| 1445 | Sears Distribution Center | \$0 | \$0 | \$0 | Bus. |
| 1449 | 2440 Red Lion Road Property | \$0 | \$0 | \$0 | Bus. |
| 1173 | Former Domino Auto Salvage | \$0 | \$0 | \$0 | Bus. |
| 1455 | 4001 New Castle Ave | \$0 | \$0 | \$9,893 | Bus. |
| 1458 | 900 S. Franklin Street | \$0 | \$0 | \$0 | Bus. |
| 1462 | Consolidated Fabrication | \$0 | \$0 | \$0 | Bus. & Res. |
| 326 | 512 South Claymont Ave | \$0 | \$0 | \$0 | Bus. |
| 1464 | Former Classic Image Site | \$0 | \$0 | \$0 | Bus. & Res. |
| 1464 | 925 North Church St | (\$46,800) | (\$200,815) | \$0 | Bus. |
| 1453 | 222 Maryland Ave | (\$72,100) | (\$354,823) | \$0 | Nonprofit Res. |
| 1419 | Delaware and Van Buren Ave | (\$278,800) | (\$1,076,032) | \$0 | Bus. |
| 1300 | Russell-Stanley | (\$931,200) | (\$4,200,271) | \$0 | Nonprofit Res. |
| New Castle County Total | | \$1,975,700 | \$10,218,762 | \$19,893 | |

- Source: DNREC, New Castle County Tax Assessment, and Center for Applied Demography & Survey Research

Table 6 Change in Assessed Values for All Sussex County Brownfields

| DE - # | Brownfield Name | Δ Assessed Value (1974) | Δ Market Value (2008 \$) | Program & HSCA fund (nom. \$) | Type of Development | Status |
|---------------------|----------------------------|-------------------------|--------------------------|-------------------------------|---------------------|-------------|
| 1252 | Cannery Village* | \$1,342,100 | \$9,473,446 | \$50,000 | Bus. & Res. | Complete |
| 1360 | Timmons Marina | \$1,079,800 | \$6,873,797 | \$164,555 | Res. | Complete |
| 149 | Former Jackson Pit | \$90,400 | \$632,168 | \$0 | Res. | In Progress |
| 151 | Donovan Property | \$31,500 | \$465,976 | \$102,098 | Res. | Complete |
| 1167 | Lewes Boat Yard | \$0 | \$0 | \$115,876 | Open | Complete |
| 1460 | Milton Rails to Trails | \$0 | \$0 | \$0 | Open | Inactive |
| 1417 | Wilson Baker Bulk Plant | \$0 | \$0 | \$0 | Open | Inactive |
| 1342 | Sussex Materials | (\$800) | (\$11,182) | \$121,526 | Bus. | Complete |
| 1414* | Pep Up/Calhoun Property | (\$9,600) | (\$63,872) | \$173,671 | Bus. | In Progress |
| 287 | Peninsula Plating Facility | (\$251,300) | (\$2,386,515) | \$129,522 | Res. | In Progress |
| Sussex County Total | | \$2,282,100 | \$14,983,818 | \$857,256 | | |

* Tax parcel acreage changed substantially due to redistricting

- Source: DNREC, Sussex County Assessment Dept., and Center for Applied Demography & Survey Research

Brownfield Assessments in Sussex County

Table 6 shows the change in assessed values (since 2000) for all ten Sussex County brownfields. Five brownfields completed remediation, three are in progress, and two are inactive. As with New Castle County brownfields, the biggest gains are among brownfields that completed remediation. Unfinished brownfields incur most of the losses. The biggest improvements are concentrated in the Cannery Village and Former Timmons Marina brownfields.

Table 7 Change in Assessed Values for All Kent County Brownfields

| List | DE - # | Brownfield Name | Δ Assessed Value (1986 \$) | Δ Market Value (2008 \$) | Program & HSCA fund (nom. \$) | Type of Development | Status |
|-------------------|--------|-------------------------|----------------------------|--------------------------|-------------------------------|---------------------|-------------|
| 69 | 1334 | Chesapeake Supply | \$478,400 | \$1,670,975 | \$17,707 | Bus. | In Progress |
| 47 | 1357 | Lexington Ave Property | \$35,200 | \$125,445 | \$59,982 | Res. | In Progress |
| 24 | 66 | ACE | \$22,000 | \$76,842 | \$81,154 | Bus. & Res. | In Progress |
| 81 | 1424 | Mt. Vernon St. Property | \$15,700 | \$54,838 | \$6,950 | Bus. | In Progress |
| 38 | 1110 | Dover Ice House | (\$32,200) | (\$112,469) | \$225,000 | Bus. | In Progress |
| 19 | 1171 | Capitol Scrap | (\$37,700) | (\$131,680) | \$2,074,089 | Bus. | In Progress |
| 95 | 1438 | Delaware Civic Center | (\$73,000) | (\$254,977) | \$96,626 | Nonprofit Bus. | In Progress |
| 48 | 1427 | Chem-Solv Property | (\$100,800) | (\$352,078) | \$125,636 | Res. | In Progress |
| 112 | 1451 | 680 Forest St. Property | (\$111,700) | (\$390,150) | \$14,849 | Bus. & Res. | In Progress |
| 91 | 1314 | Dover Machine Works | (\$143,500) | (\$501,222) | \$44,101 | Bus. & Res. | In Progress |
| Kent County Total | | | \$52,400 | \$185,524 | \$2,746,093 | | |

- Source: DNREC, Kent County, and Center for Applied Demography & Survey Research

Brownfield Assessments in Kent County

Table 7 shows the change in assessed values for Kent County brownfields between 2001 and 2008. All brownfields in Kent County are currently in progress, so assessments are expected to fall or remain unchanged. Six of the ten brownfields declined in value. Four brownfields increased in value. Total property growth was less than \$200,000 as of 2008.

Table 8 Summary of Changes in Brownfield Assessments (2008 Market Value)

| County | Brownfield Type | Remediation Status | | | Total |
|------------|------------------------|--------------------|---------------|---------------|----------------|
| | | Complete | In Progress | Inactive | |
| New Castle | Business | \$160,157,792 | (\$2,960,240) | (\$2,609,186) | \$154,588,366 |
| | Business & Residential | \$75,880,272 | (\$3,323,630) | \$13,028,763 | \$85,585,405 |
| | Residential | \$217,631,224 | \$8,342,751 | - | \$225,973,975 |
| | Open | \$283,957 | (\$13,287) | - | \$270,670 |
| | Nonprofit | (\$11,411,837) | \$2,282 | (\$200,815) | (\$11,610,370) |
| | Total | \$442,541,408 | \$2,047,876 | \$10,218,762 | \$454,808,046 |
| Sussex | Business | (\$11,182) | (\$63,872) | - | (\$75,054) |
| | Business & Residential | \$9,473,446 | - | - | \$9,473,446 |
| | Residential | \$7,339,773 | (\$1,754,347) | - | \$5,585,426 |
| | Open | \$0 | - | \$0 | \$0 |
| | Total | \$16,802,037 | (\$1,818,219) | \$0 | \$14,983,818 |
| Kent | Business | - | \$1,481,664 | - | \$1,481,664 |
| | Business & Residential | - | (\$814,530) | - | (\$814,530) |
| | Residential | - | (\$226,633) | - | (\$226,633) |
| | Nonprofit | - | (\$254,977) | - | (\$254,977) |
| | Total | - | \$185,524 | - | \$185,524 |

Summary of the Changes in Assessed Values

Table 8 summarizes the changes in the 2008 market value of brownfield assessments. The total assessed value for all New Castle County brownfields increased \$455 million since 1998. The assessed value of Sussex County brownfields improved \$15 million since 2000. Kent County assessments increased \$186,000 since 2001. Almost all of the gains come from those brownfields that completed remediation. In addition, the largest gains occurred to those brownfields intended for business or residential use.

As of January 2009, the brownfield program has spent \$25.8 million (nominal) in New Castle County, \$850,000 in Sussex County, and \$2.7 million in Kent County.¹⁶ Ignoring the effects of present value and base year discrepancies, every dollar spent by the brownfield program has created \$17.61 of property value in New Castle County, \$17.48 of property value in Sussex County, and 7¢ of property value in Kent County as of 2008.¹⁷ These figures will likely increase as more projects finish construction and are reassessed.

Brownfield Growth Compared to District Growth

The report has so far neglected the assessments of non-brownfield properties. This could yield misleading results. For example, if non-brownfield assessments increased 100% and brownfield assessments increased 50%, one could conclude that brownfields experienced a *relative loss*. We use all properties in a brownfield's district for comparison.¹⁸

Table 9 summarizes the change in assessed values for all brownfields in a particular district. The third column reports the sum of brownfield assessments in the first year data was available (1998 for New Castle County, 2000 for Sussex County, and 2001 for Kent County). The fourth column lists the sum of brownfields' assessments in 2008. For example, all brownfields in the Brandywine Hundred district had an assessed value of \$482,100 in 1998 and \$276,500 in 2008. The fifth column calculates the implied percent difference between these assessments (-43%). The next three columns in Table 9 report similar figures for all properties in each district. For example, all properties in the Brandywine Hundred district increased 3% since 1998.

¹⁶ These funds include both state and federal dollars.

¹⁷ The appropriate present value adjustment will lower the reported ratio. Unfortunately, the timing of expenditures is not available.

¹⁸ Brownfield property assessments are compared to total property assessments in each *district*, whereas brownfield employment and wages are compared to total employment and wages in each *county*. This distinction assumes that property values may differ between two districts, but that employment and wages for an establishment in a particular industry will not differ systematically across districts. See footnote 12 (page 15) for a technical justification of this assumption.

Table 9 Comparing Brownfield Assessments with District Assessments

| New Castle County | | Brownfields' 1998 | Brownfields' 2008 | BF | District's 1998 | District's 2008 | District | Weighted % Change | |
|--------------------------|----------------------|---------------------|----------------------|-------------|-------------------------|-------------------------|----------|-------------------|------------|
| District Code & Name | | Assessment | Assessment | % Change | Assessment | Assessment | % Change | Brownfield | District |
| 06 | Brandywine 100 | \$482,100 | \$276,500 | -43% | \$3,658,946,500 | \$3,775,455,000 | 3% | -0.2% | 0.0% |
| 07 | Christiana 100 | \$7,513,800 | \$7,452,900 | -1% | \$1,932,266,677 | \$2,319,146,250 | 20% | -0.1% | 1.7% |
| 08 | Mill Creek 100 | \$4,162,100 | \$9,678,300 | 133% | \$3,055,430,960 | \$4,175,657,120 | 37% | 6.2% | 1.7% |
| 09 | White Clay Creek 100 | \$29,334,900 | \$29,333,300 | 0% | \$1,693,830,100 | \$1,937,445,000 | 14% | 0.0% | 4.7% |
| 10 | New Castle 100 | \$5,271,000 | \$7,085,100 | 34% | \$2,097,390,091 | \$2,395,801,101 | 14% | 2.0% | 0.8% |
| 12 | Red Lion 100 | \$583,100 | \$572,800 | -2% | \$220,676,000 | \$355,036,300 | 61% | 0.0% | 0.4% |
| 13 | St. George's 100 | \$213,700 | \$213,700 | 0% | \$385,564,900 | \$569,723,300 | 48% | 0.0% | 0.1% |
| 18 | City of Newark | \$4,926,800 | \$16,525,800 | 235% | \$1,359,868,200 | \$1,496,454,900 | 10% | 12.9% | 0.6% |
| 20 | Newport | \$130,400 | \$284,300 | 118% | \$52,225,136 | \$61,688,036 | 18% | 0.2% | 0.0% |
| 21 | City of New Castle | \$141,400 | \$3,182,200 | 2150% | \$174,334,350 | \$271,687,350 | 56% | 3.4% | 0.1% |
| 26 | City of Wilmington | \$36,912,500 | \$110,483,800 | 199% | \$3,638,405,110 | \$3,612,712,910 | -1% | 82.0% | -0.3% |
| Total | | \$89,671,800 | \$185,088,700 | 106% | \$18,268,938,024 | \$20,970,807,267 | | 106% | 10% |

| Sussex County | | Brownfields' 2000 | Brownfields' 2008 | BF | District's 2000 | District's 2008 | District | Weighted % Change | |
|----------------------|----------------------|--------------------|--------------------|-------------|------------------------|------------------------|----------|-------------------|------------|
| District Code & Name | | Assessment | Assessment | % Change | Assessment | Assessment | % Change | Brownfield | District |
| 1-32 | Blades & Broad Creek | \$257,000 | \$5,700 | -98% | \$88,079,130 | \$110,369,701 | 25% | -18.3% | 4.7% |
| 1-35 | Georgetown 100 | \$58,300 | \$48,700 | -16% | \$149,064,705 | \$189,395,660 | 27% | -0.7% | 1.1% |
| 2-33 | Dagsboro | \$52,100 | \$1,131,900 | 2073% | \$97,096,830 | \$131,157,514 | 35% | 78.5% | 1.3% |
| 2-35 | Broadkill 100 | \$864,500 | \$2,206,600 | 155% | \$117,157,705 | \$267,245,844 | 128% | 97.6% | 80.5% |
| 3-30 | Milford | \$35,600 | \$34,800 | -2% | \$72,724,283 | \$132,157,749 | 82% | -0.1% | 2.1% |
| 3-34 | Rehoboth 100 | \$40,400 | \$130,800 | 224% | \$867,135,405 | \$1,272,877,660 | 47% | 6.6% | 1.4% |
| 3-35 | Lewes 100 | \$67,100 | \$98,600 | 47% | \$233,895,400 | \$319,790,538 | 37% | 2.3% | 1.8% |
| Total | | \$1,375,000 | \$3,657,100 | 166% | \$1,625,153,458 | \$2,422,994,666 | | 166% | 93% |

| Kent County | | Brownfields' 2001 | Brownfields' 2008 | BF | District's 2001 | District's 2008 | District | Weighted % Change | |
|----------------------|------------------|--------------------|--------------------|-----------|------------------------|------------------------|----------|-------------------|------------|
| District Code & Name | | Assessment | Assessment | % Change | Assessment | Assessment | % Change | Brownfield | District |
| 2-05 | Dover | \$1,002,300 | \$1,104,600 | 10% | \$1,210,415,300 | \$1,328,320,500 | 10% | 4.1% | 7.4% |
| 4-00 | Little Creek 100 | \$159,400 | \$58,600 | -63% | \$104,105,800 | \$159,080,400 | 53% | -8.1% | 6.8% |
| Total | | \$1,242,400 | \$1,294,800 | 4% | \$1,448,418,500 | \$1,773,505,500 | | 4% | 22% |

• Source: Center for Applied Demography & Survey Research

Comparing Column 5 to Column 8 distinguishes brownfield growth and district growth. For example, all assessments in the City of New Castle increased 56%, but the brownfield assessments in that district increased 2,150%. The brownfields in Sussex's Dagsboro district showed a similar disparity with district growth. These district-by-district comparisons are useful to those with local interests.

General statements regarding all brownfields with a county cannot be made using these district-by-district comparisons alone. For example, because there are relatively few brownfields in the City of New Castle, their extraordinary growth applies to just a small portion of brownfields. The final two columns in Table 9 adjust the percent difference by the relative size of brownfields.

Consider the brownfields in the City of New Castle once again. In 1998, they were assessed at \$141,400, while all brownfields in the county were assessed at \$89,671,800. Therefore, the 2,150% growth applies to a small fraction, 0.0016 ($\$141,400/\$89,671,800$), of brownfields. Adjusted for size, brownfields in the City of New Castle contributed only 3.4 percentage points ($0.0016 \times 2,150\%$) to total brownfield growth in the county. The first shaded column in Table 9 indicates the relative contribution of each district's brownfields to total brownfield growth.

The second shaded column lists the hypothetical impact if brownfields grew at the same rate as their respective district. For example, suppose brownfield assessments in the City of New Castle grew 56% (the district's growth rate) instead of 2,150%. If so, their 2008 assessment would be \$220,600 instead of \$3,182,200. In this hypothetical situation, brownfields in the City of New Castle would have contributed 0.1 percentage points ($0.0016 \times 56\%$) to total brownfield growth instead of 3.4 percentage points. This also indicates that the contribution of brownfields in the City of New Castle has been more important to total brownfield growth in the county than the brownfields in the Brandywine, Christiana, White Clay Creek, New Castle, Red Lion, St. George, and Newport districts.

Brownfields in the City of Wilmington constitute 41% (\$36,912,500/\$89,671,800) of total assessments in 1998. Because they constitute such a large part of the total assessment, Wilmington brownfields heavily influence total brownfield growth. In fact, these brownfields contributed 82 percentage points to a growth rate of 106%. Had these brownfield assessments “grown” like other properties in the City of Wilmington (i.e. had they fallen 1%), brownfield growth in the county would be 82.3 percentage points less than it was.

Summing each column's percentages across districts aggregates district growth to county growth. This tells us that New Castle County brownfields would have grown only 10% since 1998 if each one had adopted its district's growth rate. Instead, brownfield assessments actually increased 106%.

In summary, brownfields in New Castle County increased more than ten times what could be expected from their district. Brownfields in Sussex County increased 166% between 2000 and 2008, but growth would have been 93% if district rates applied. Brownfield assessments in Kent County increased only 4% between 2001 and 2008. Had they kept pace with other properties in their districts, assessments would have increased 22%. This growth in brownfield property values is clearly above average in New Castle County and Sussex County, but below average Kent County.

The Impact on Property Taxes

Table 10 estimates the impact of brownfield development on 2008 property tax revenue. Almost all revenue gains are concentrated in New Castle County. New Castle County brownfield properties contributed \$2.7 million to tax revenue in 2008, \$1.2 million of which went to the Christina school district and \$946,000 went to the City of Wilmington. The remainder was disbursed to the county government and to other school districts and municipalities. Sussex County and Kent County brownfields generated much less tax revenue than brownfields in New Castle County because there was less development and because property tax rates are lower. As more brownfields finish development, we expect assessments and tax revenue to increase.

Table 10 2008-2009 Property Tax Revenue Gains, by County

| School District | Municipality | Change in Nonexempt Assessed Values | County Tax | School Tax | City Tax | Crossing Guard Tax | Vo-Tech Tax | Total Taxes |
|--------------------------|----------------|--|------------------|--------------------|--------------------|--------------------------|------------------|--------------------|
| Brandywine | Wilmington | \$877,900 | \$1,711 | \$15,613 | \$12,263 | \$144 | \$1,229 | \$30,961 |
| Red Clay | Wilmington | (\$365,000) | (\$711) | (\$5,928) | (\$5,099) | (\$84) | (\$511) | (\$12,333) |
| Red Clay | unincorporated | \$4,222,100 | \$23,703 | \$68,567 | \$0 | \$972 | \$5,911 | \$99,152 |
| Christina | Newark | \$10,607,000 | \$20,673 | \$160,908 | \$56,567 | \$2,522 | \$14,850 | \$255,523 |
| Christina | Wilmington | \$67,557,400 | \$131,669 | \$1,024,846 | \$943,709 | \$16,065 | \$94,580 | \$2,210,883 |
| Christina | unincorporated | (\$1,600) | (\$9) | (\$24) | \$0 | (\$0) | (\$2) | (\$36) |
| Colonial | New Castle | \$3,040,800 | \$6,152 | \$43,331 | \$34,969 | \$620 | \$4,257 | \$89,330 |
| Colonial | Wilmington | (\$321,200) | (\$626) | (\$4,577) | (\$4,487) | (\$65) | (\$450) | (\$10,205) |
| Colonial | unincorporated | \$1,734,500 | \$9,737 | \$24,717 | \$0 | \$353 | \$2,428 | \$37,236 |
| New Castle County | | \$87,351,900 | \$192,299 | \$1,327,453 | \$1,037,924 | \$20,527 | \$122,293 | \$2,700,511 |

| School District | Municipality | Change in Nonexempt Assessed Values | County Tax | School Tax | City Tax | Library Tax | Vo-Tech Tax | Total Taxes |
|----------------------|----------------|--|----------------|-----------------|----------------|----------------|----------------|-----------------|
| Cape Henlopen | Milton | \$1,342,100 | \$2,673 | \$19,306 | \$17,304 | \$313 | \$1,664 | \$41,260 |
| Cape Henlopen | unincorporated | \$121,900 | \$243 | \$1,754 | \$0 | \$28 | \$151 | \$2,176 |
| Indian River | Georgetown | (\$9,600) | (\$19) | (\$119) | (\$121) | (\$2) | (\$12) | (\$274) |
| Indian River | unincorporated | \$1,079,800 | \$2,150 | \$13,363 | \$0 | \$252 | \$1,339 | \$17,104 |
| Seaford | Blades | (\$251,300) | (\$500) | (\$4,058) | (\$8,377) | (\$59) | (\$312) | (\$13,306) |
| Milford | unincorporated | (\$800) | (\$2) | (\$14) | \$0 | (\$0) | (\$1) | (\$17) |
| Sussex County | | \$2,282,100 | \$4,545 | \$30,231 | \$8,806 | \$533 | \$2,830 | \$46,944 |

| School District | Municipality | Change in Nonexempt Assessed Values | County Tax | School Tax | City Tax | Library Tax | Vo-Tech Tax | Total Taxes |
|--------------------|----------------|--|---------------|---------------|----------------|----------------|----------------|----------------|
| Capital | Dover | \$280,477 | \$120 | \$713 | \$1,221 | \$0 | \$59 | \$2,113 |
| Capital | unincorporated | (\$275,236) | (\$118) | (\$700) | \$0 | (\$17) | (\$58) | (\$893) |
| Smyrna | Smyrna | \$54,838 | \$24 | \$113 | \$210 | \$0 | \$11 | \$358 |
| Smyrna | unincorporated | \$125,445 | \$53 | \$253 | \$0 | \$8 | \$26 | \$339 |
| Kent County | | \$185,524 | \$79 | \$379 | \$1,431 | (\$10) | \$38 | \$1,917 |

* Note: New Castle County increase relative to 1998, Sussex County increases relative to 2000, and Kent County increase relative to 2001.

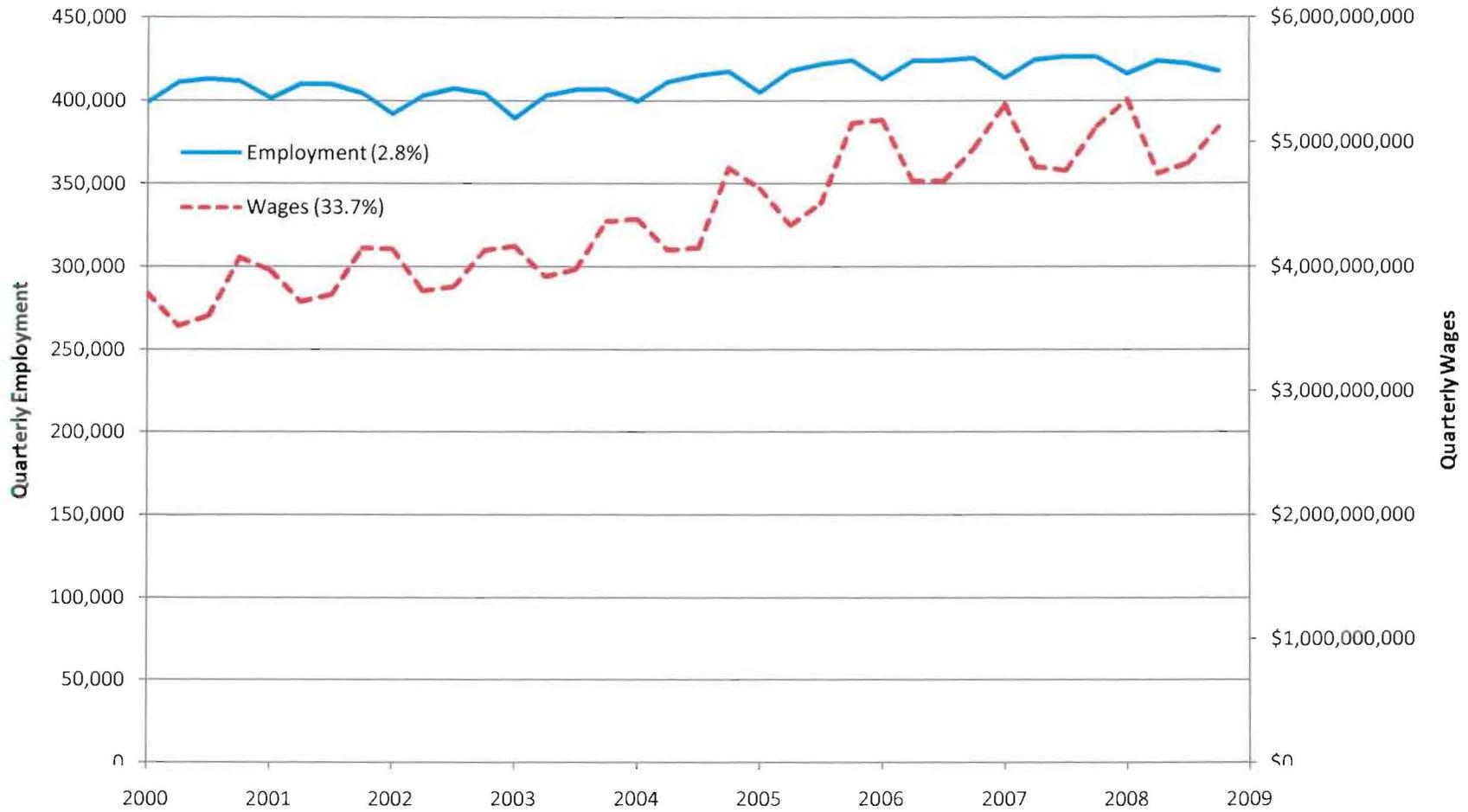
- Source: Delaware Economic Development Office and Center for Applied Demography & Survey Research

Employment and Wages

We maintain that brownfield development likely affects the employment and wages in neighboring businesses. Unfortunately, how brownfields influence nearby businesses is unknown. In light of this uncertainty, the report only describes what changes have occurred in the area surrounding brownfields. How much of this activity can be directly or indirectly attributable to brownfield development remains an open question.

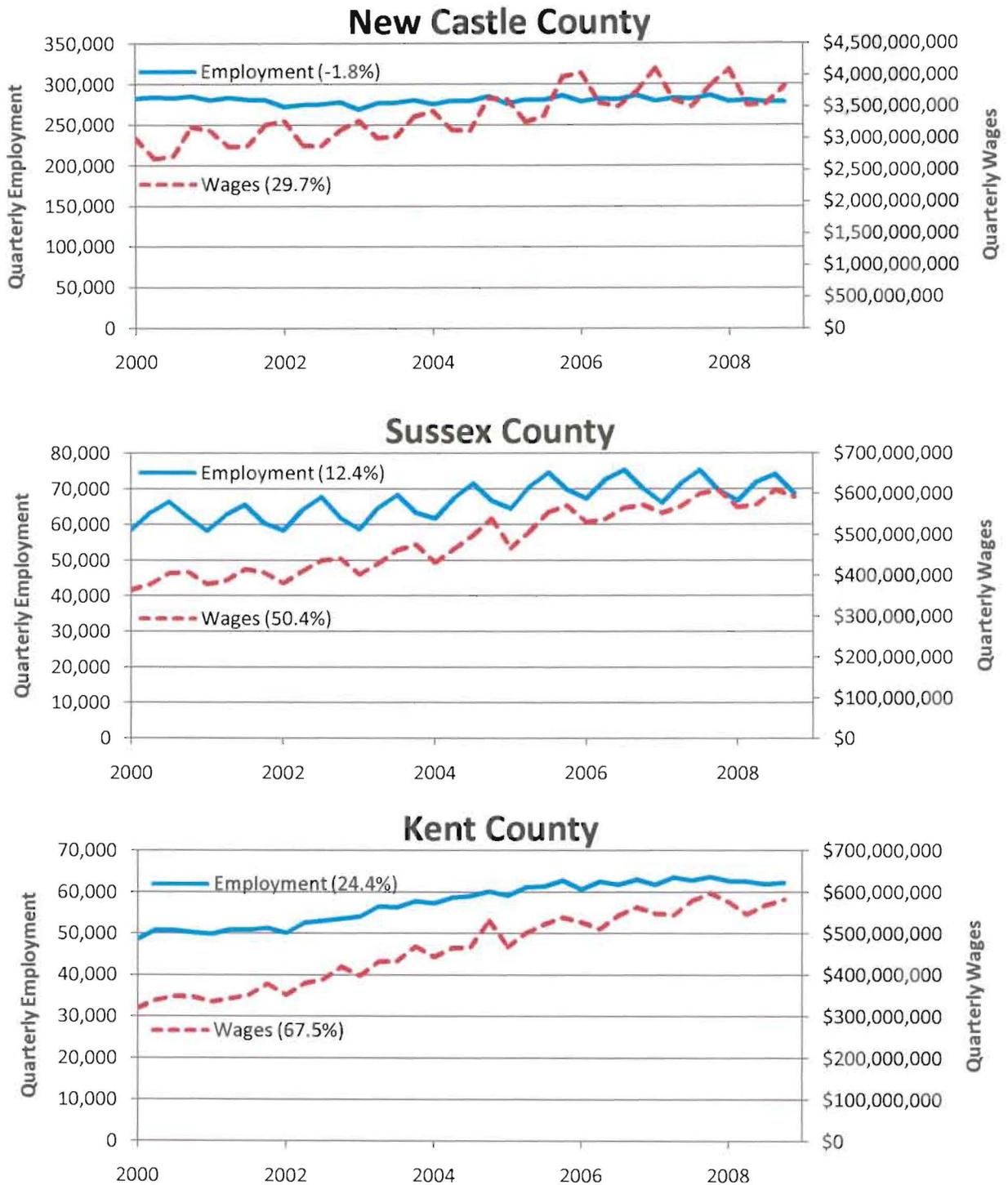
Between 2000 and 2008, state employment and wages increased 2.8% and 33.7% respectively (see Figure 6). Figure 7 shows the activity for each county. Employment in New Castle County fell 1.8% during this period, but rose 12.4% and 24.4% in Sussex and Kent counties respectively. Nominal wages rose 29.7%, 50.4%, and 67.5% in New Castle County, Sussex County, and Kent County respectively. Each series has a distinctive seasonal pattern.

Figure 6 Quarterly Employment and Nominal Wages, Statewide: 2000-2008



Source: Delaware Department of Labor

Figure 7 Quarterly Employment and Nominal Wages, by County: 2000 to 2008



Source: Delaware Department of Labor

Brownfield Activity in New Castle County

Figure 8 reports the percent difference in employment since 2000 for New Castle County establishments.¹⁹ Four graphs are presented. Each one shows the timeline of employment within a specified distance to a brownfield. The dashed blue lines indicate the percent change in local brownfield employment since 2000.²⁰ The solid green lines show the percent change in countywide brownfield employment. The dotted red lines report the percent change in total employment in New Castle County. Because total employment in the county does not depend on the distance that defines a brownfield's vicinity, the dotted red lines are the same in each graph.

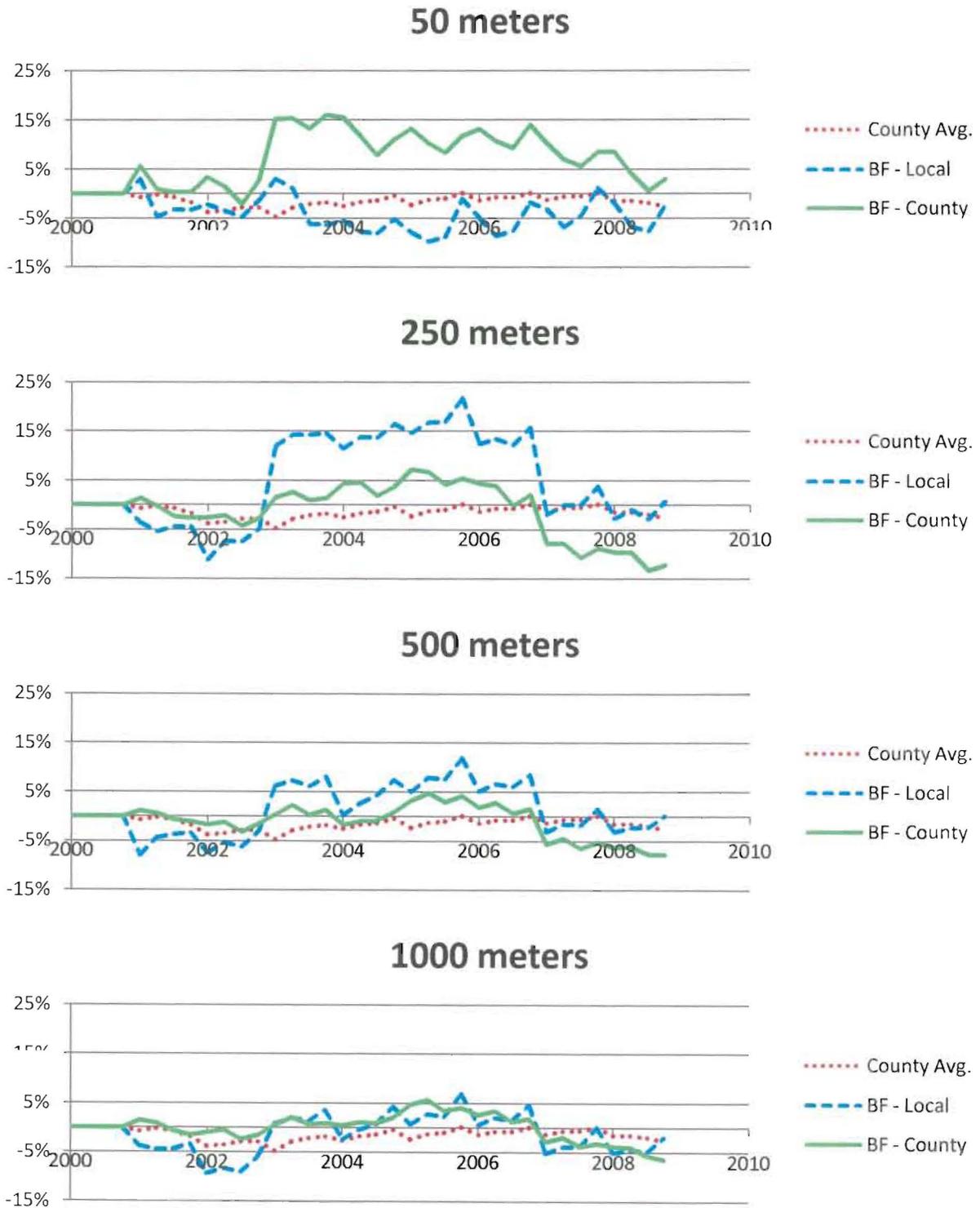
Local employment within 50 meters of a New Castle brownfield dipped in 2003, but later rebounded. By 2008, it had fallen more than the county. At distances of 250, 500, and 1000 meters, local employment experienced a sharp increase in 2003 and an equally sharp decrease in 2007. By 2008, local employment at these larger distances had grown by approximately the same rate as the county.

Countywide employment within 50 meters from a brownfield increased sharply in 2003. The gap has persisted through 2008. There was also a large increase in 2003 for establishments within 250, 500, and 1000 meters from a brownfield. However, employment began declining in 2006. By 2008, brownfield employment at these larger distances decreased much more than employment in the county.

¹⁹ Employment in each time period is compared to employment in 2000 for the same quarter. For example, the last observation compares the 2008 fourth quarter employment to employment in the fourth quarter of 2000. This removes seasonality without dampening the fluctuations with a moving average.

²⁰ Recall that the local perspective ignores any business that was outside of a brownfield's vicinity. The countywide perspective will include such a business if that business moved away from a brownfield in the past or moves near a brownfield in the future.

Figure 8 Percent Change in Employment since 2000 for Businesses near a New Castle County Brownfield

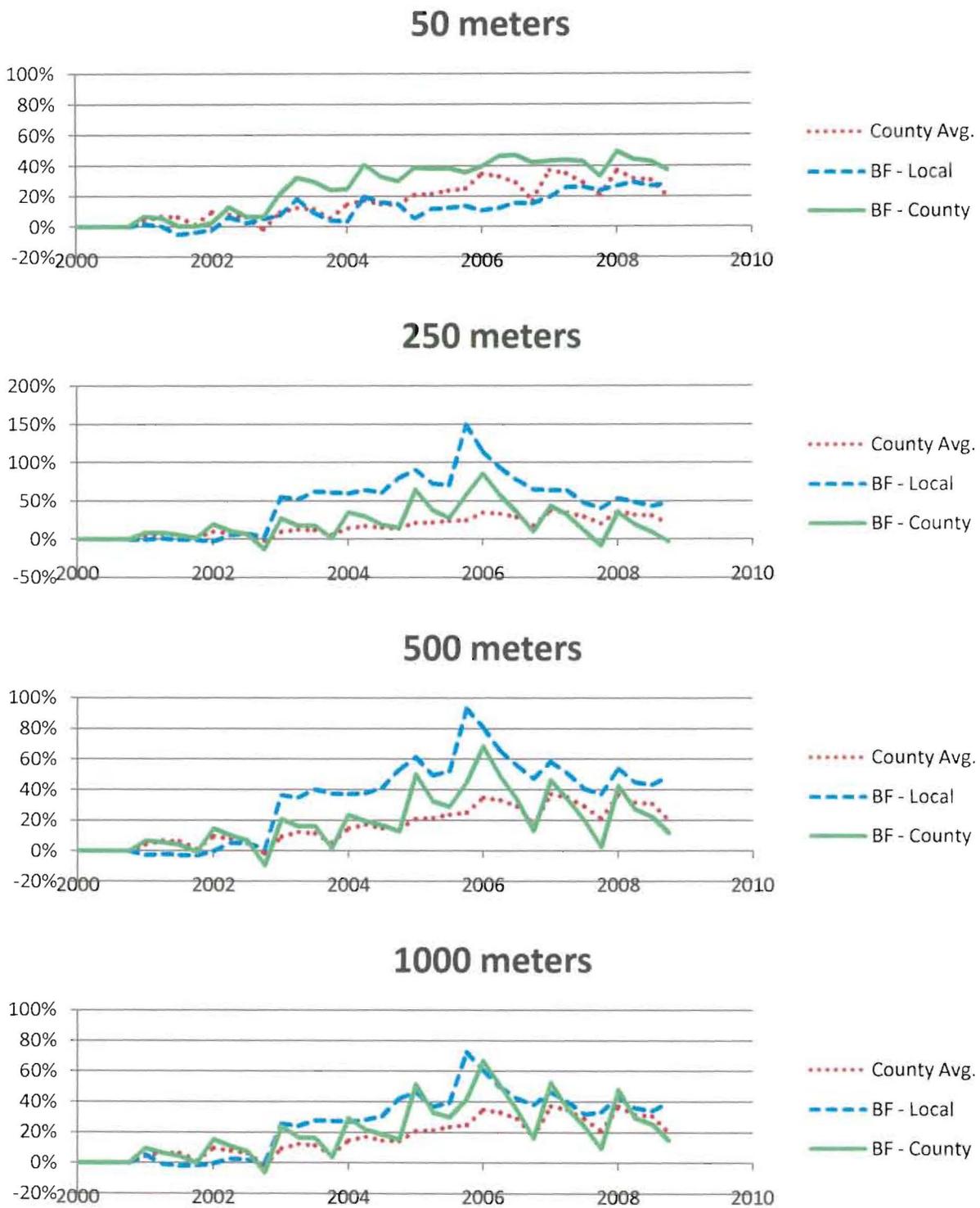


• Source: Center for Applied Demography & Survey Research

Figure 9 shows the percent change in nominal wages since 2000 for businesses near New Castle County brownfields. The dotted red lines in each graph show that total wages in the county rose approximately 30% since 2000. The dashed blue lines report the percent change in local brownfield wages since 2000. The solid green lines indicate these wage changes from a countywide perspective. At a distance of 50 meters, local wages generally followed the overall trends in the county (with a dip in 2005 and 2006). At larger distances, local wage gains outperformed the county in almost every quarter.

Countywide brownfield wages at 50 meters grew substantially faster than total wages in the county. Countywide wages at distances of 250, 500, and 1000 meters also outperformed New Castle County wage growth until 2006. The decline since that time has caused total wage growth in the county to outperform brownfield wage growth. As we expect, the timelines converge to the overall trends in the county as distance to the brownfield increases.

Figure 9 Percent Change in Nominal Wages since 2000 for Businesses near a New Castle County Brownfield



Source: Center for Applied Demography & Survey Research

Table 11 decomposes brownfield employment by the 20-sector NAICS classification system.²¹ The left side indicates the 2000 to 2008 percent change from a local perspective while the right side adopts a countywide perspective.²² The final column lists the change to each sector's employment in the entire county.

The change in each sector's employment sometimes depends on whether the perspective is local or countywide. For example, local employment within 50 meters from a brownfield in the construction sector increased 3%, resulting in a relative gain of 4% when compared to the county. However, countywide brownfield employment fell 10%, resulting in a relative loss of 9%.

Generalizations can be made when the same pattern emerges from both perspectives. For example, brownfield employment in the finance and insurance sector clearly outperformed the county regardless of which perspective one adopts. Employment in the administrative support, waste disposal, and remediation sector also made relative gains to the county, as did the arts, entertainment, and recreation sector. Employment in the retail trade, wholesale trade, and health care sectors declined faster / increased slower near brownfields than in the county.

Table 12 decomposes brownfield wages by industrial sector for New Castle County. The results are qualitatively similar to employment.

²¹ Employment and wage information for classifications with small sample sizes violate confidentiality requirements. This stipulation mostly affects businesses near Sussex and Kent county brownfields.

²² Between 2001 and 2003, the DOL changed how businesses report establishments in the management of companies sector. As a result, large changes are observed in this sector that are unrelated to real activity. We ignore this sector in our analysis.

Table II Percent Change in Brownfield Related Employment in New Castle County, by Industry: 2000 to 2008

| NAICS | Description | Local Employment | | | | Countywide Employment | | | | County Total |
|-------|---------------------------------|------------------|------|------|-------|-----------------------|------|------|-------|--------------|
| | | 50m | 250m | 500m | 1000m | 50m | 250m | 500m | 1000m | |
| 11 | Agric., Forestry, & Fish. | C | C | C | C | C | C | -17% | -7% | -27% |
| 21 | Mining | C | C | C | C | C | C | C | C | C |
| 22 | Utilities | C | C | C | C | C | C | C | C | -17% |
| 23 | Construction | 3% | 3% | -1% | -4% | -10% | -3% | 1% | -3% | -1% |
| 31-33 | Manufacturing | -69% | -64% | -67% | -75% | -57% | -48% | -58% | -69% | -62% |
| 42 | Wholesale trade | -50% | -37% | -31% | -21% | -11% | -14% | -16% | 33% | 7% |
| 44-45 | Retail trade | -37% | -30% | -15% | -12% | -29% | -27% | -15% | -13% | -7% |
| 48-49 | Transp. & warehousing | 29% | -6% | 17% | 19% | -8% | -8% | -3% | -2% | 0% |
| 51 | Information | 33% | 8% | 112% | 92% | -23% | 16% | 91% | 80% | -5% |
| 52 | Finance & insurance | 14829% | 72% | 85% | 78% | 3807% | -41% | -13% | -17% | -7% |
| 53 | Real estate and leasing | 118% | 20% | 18% | -1% | -15% | 1% | 0% | 1% | -11% |
| 54 | Prof., and tech. svc | 51% | 8% | 12% | 60% | -20% | 5% | 5% | 42% | 55% |
| 55 | Mgmt of companies | -42% | -41% | -21% | -21% | -31% | -28% | -3% | -2% | N.R. |
| 56 | Admin., waste, and remed. svc | 140% | -4% | -9% | -9% | 61% | -22% | -37% | -28% | -26% |
| 61 | Educational services | C | 16% | -26% | -20% | 26% | 38% | -12% | -5% | 25% |
| 62 | Health care & social assistance | -3% | -9% | 0% | -1% | 20% | 8% | 21% | 22% | 24% |
| 71 | Arts, entertainment, & rec. | 57% | 39% | 25% | -8% | 5% | 9% | 3% | 2% | 1% |
| 72 | Accomm. & food svc | 13% | -12% | -9% | -7% | -35% | -25% | -18% | -8% | 12% |
| 81 | Other svc (excl. public admin.) | -18% | -8% | -17% | -13% | -12% | -10% | -7% | -6% | 3% |
| 92 | Public Administration | 33% | 59% | 63% | 64% | 130% | 65% | 65% | 69% | 34% |

C – Confidential Figure

N.R. - Figures not relevant due to changes in industrial classification

- Source: Center for Applied Demography & Survey Research

Table 12 Percent Change in Brownfield Related Wages in New Castle County, by Industry: 2000 to 2008

| NAICS | Description | Local Wages | | | | Countywide Wages | | | | County Total |
|-------|---------------------------------|-------------|------|------|-------|------------------|------|------|-------|--------------|
| | | 50m | 250m | 500m | 1000m | 50m | 250m | 500m | 1000m | |
| 11 | Agric., Forestry, & Fish. | C | C | C | C | C | C | -7% | 0% | -11% |
| 21 | Mining | C | C | C | C | C | C | C | C | C |
| 22 | Utilities | C | C | C | C | C | C | C | C | 3% |
| 23 | Construction | 50% | 47% | 33% | 34% | 24% | 36% | 36% | 31% | 33% |
| 31-33 | Manufacturing* | -61% | -58% | -64% | -75% | -49% | -40% | -55% | -70% | -57% |
| 42 | Wholesale trade | -38% | -23% | -38% | -23% | 3% | 2% | -20% | 116% | 62% |
| 44-45 | Retail trade | -26% | -18% | 1% | 6% | -11% | -11% | 5% | 8% | 13% |
| 48-49 | Transp. & warehousing | 132% | 28% | 60% | 65% | 36% | 21% | 29% | 31% | 34% |
| 51 | Information | 61% | 71% | 97% | 77% | -15% | 53% | 77% | 70% | -1% |
| 52 | Finance & insurance | 65211% | 346% | 234% | 224% | 13955% | -14% | 14% | 11% | 25% |
| 53 | Real estate and leasing | 119% | 38% | 63% | 44% | -9% | 33% | 37% | 43% | 27% |
| 54 | Prof., and tech. svc | 71% | 35% | 85% | 184% | 94% | 74% | 79% | 148% | 137% |
| 55 | Mgmt of companies | -19% | -16% | 34% | 35% | -5% | -3% | 58% | 58% | N.R. |
| 56 | Admin., waste, and remed. svc | 149% | 19% | 22% | 18% | 36% | -5% | -14% | -9% | 11% |
| 61 | Educational services | C | 55% | 6% | 13% | 66% | 80% | 22% | 32% | 68% |
| 62 | Health care & social assistance | 34% | 18% | 42% | 27% | 68% | 52% | 79% | 70% | 69% |
| 71 | Arts, entertainment, & rec. | 100% | 89% | 84% | 20% | 30% | 39% | 30% | 31% | 27% |
| 72 | Accomm. & food svc | 35% | 17% | 23% | 21% | -8% | -2% | 11% | 21% | 50% |
| 81 | Other svc (excl. public admin.) | 29% | 25% | 11% | 12% | 36% | 20% | 19% | 19% | 26% |
| 92 | Public Administration | 98% | 106% | 110% | 115% | 174% | 99% | 97% | 106% | 74% |

C – Confidential Figure

N.R. - Figures not relevant due to changes in industrial classification

- Source: Center for Applied Demography & Survey Research

Brownfield Activity in Sussex County

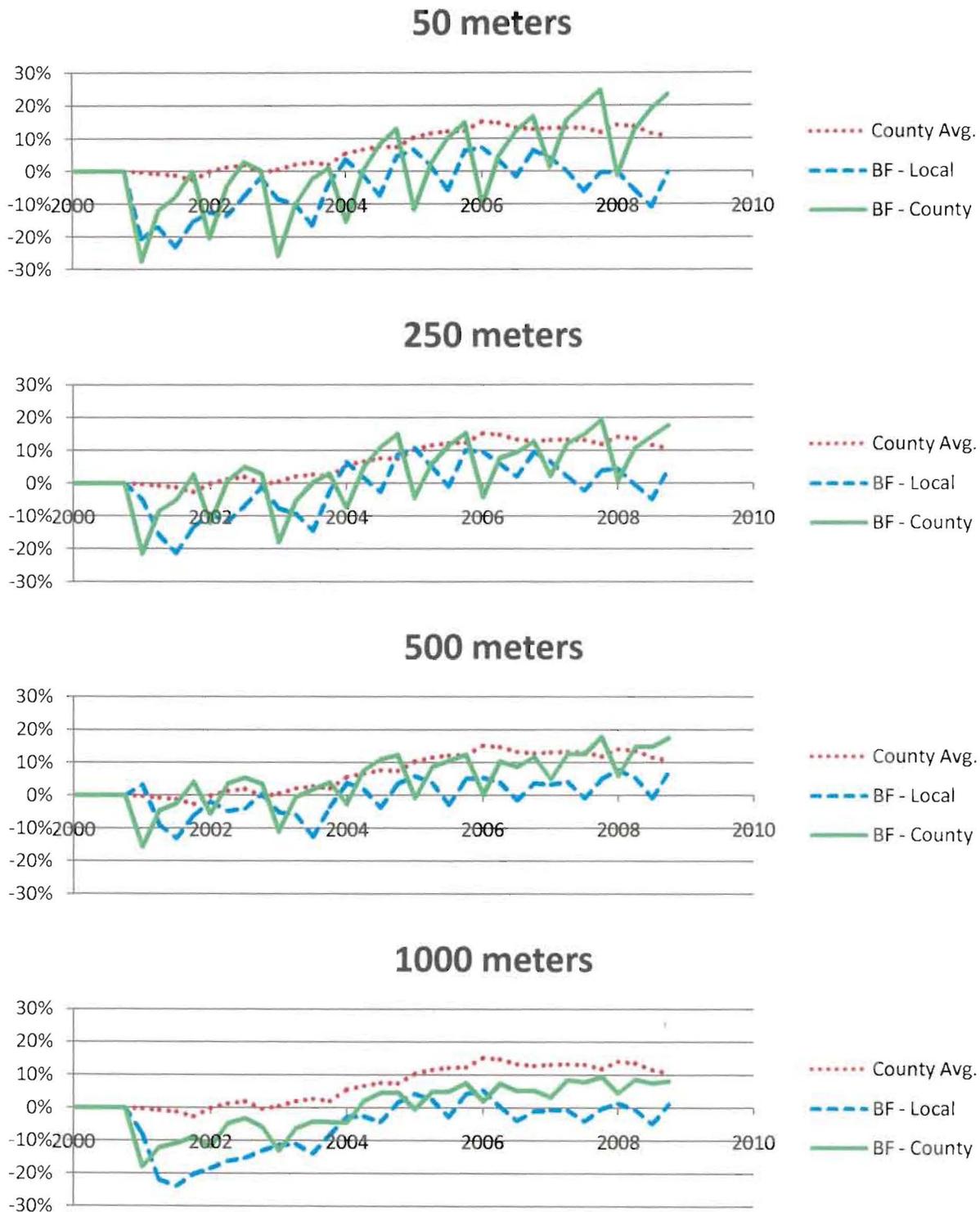
The timelines of brownfield employment in Sussex County are reported in Figure 10. The dotted red lines indicate that total employment in the county has increased substantially between 2002 and 2006. In 2008, Sussex County employment was 10% higher than its 2000 level. As before, the dashed blue lines indicate the trends in local brownfield employment and the solid green lines indicate the trends in countywide brownfield employment.

Local brownfield employment in Sussex County dropped in 2001 for all distances and never increased enough since then to keep pace with the county. Countywide brownfield employment also fell initially, but later recovered and came close to catching up with the county. There is substantial volatility in countywide growth.

Figure 11 shows the corresponding timeline of wages near Sussex County brownfields. Both local and countywide brownfield wages increased faster than wages in the county for nearly every quarter since 2000. Thus, while employment may have fallen near Sussex brownfields, wages increased substantially.

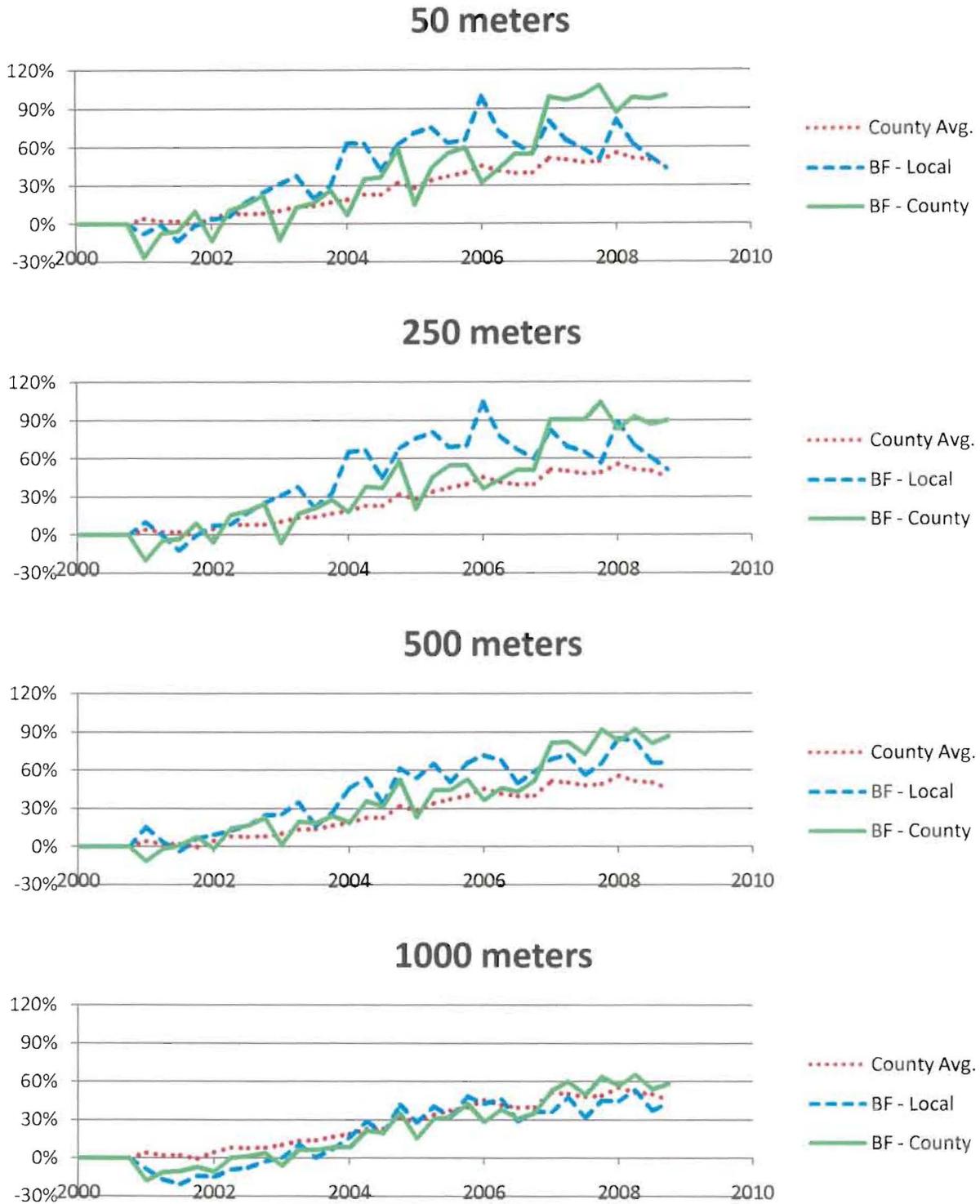
Curiously, brownfield wage growth converges with county wage growth as distance increases, but employment appears to converge well below the county growth rate. This could indicate low business density and/or large cluster effects near Sussex County brownfields.

Figure 10 Percent Change in Employment since 2000 for Businesses near a Sussex County Brownfield



Source: Center for Applied Demography & Survey Research

Figure 11 Percent Change in Nominal Wages since 2000 for Businesses near a Sussex County Brownfield



Source: Center for Applied Demography & Survey Research

Table 13 decomposes the changes in brownfield employment in Sussex County by industrial sector. The educational services sector increased the most in percentage terms. The finance and insurance sector also grew faster near brownfields than in the county. Local employment in construction also had relative gains. As in New Castle County, the wholesale and retail trade sectors declined near brownfields.

Table 14 reports the sectoral decomposition of brownfield wages in Sussex County. The results are similar in many ways to employment. Wages in construction, finance and insurance, and educational services increased from local and countywide perspectives. Wage growth in the wholesale trade, retail trade, and professional and technical service sectors was better in the county than it was near brownfields.

Table 13 Percent Change in Brownfield Related Employment in Sussex County, by Industry: 2000 to 2008

| NAICS | Description | Local Employment | | | | Countywide Employment | | | | County |
|-------|---------------------------------|------------------|------|------|-------|-----------------------|------|------|-------|--------|
| | | 50m | 250m | 500m | 1000m | 50m | 250m | 500m | 1000m | Total |
| 11 | Agric., Forestry, & Fish. | C | C | C | C | C | C | C | -44% | -22% |
| 21 | Mining | C | C | C | C | C | C | C | C | C |
| 22 | Utilities | C | C | C | C | C | C | C | C | 204% |
| 23 | Construction | 32% | 51% | 84% | 260% | 12% | -1% | -11% | 45% | 4% |
| 31-33 | Manufacturing | -19% | -20% | -20% | 39% | 20% | 17% | 19% | 31% | 12% |
| 42 | Wholesale trade | C | -85% | -85% | -43% | -62% | -82% | -66% | -35% | -21% |
| 44-45 | Retail trade | -38% | -32% | 20% | 21% | -27% | -23% | -22% | -26% | 11% |
| 48-49 | Transp. & warehousing | C | 116% | 122% | 108% | 28% | 61% | 21% | 13% | 83% |
| 51 | Information | C | C | C | 58% | 243% | 201% | 211% | -54% | -6% |
| 52 | Finance & insurance | 88% | 341% | 192% | 69% | 113% | 197% | 197% | 115% | -45% |
| 53 | Real estate and leasing | -38% | -55% | -54% | 91% | 35% | -25% | 14% | 27% | 44% |
| 54 | Prof., and tech. svc | 20% | 21% | 20% | 24% | 37% | 36% | 34% | 38% | 57% |
| 55 | Mgmt of companies | -99% | -99% | -99% | -99% | C | C | C | C | N.R. |
| 56 | Admin., waste, and remed. svc | -53% | -53% | -52% | -46% | -16% | -21% | -22% | -19% | 7% |
| 61 | Educational services | 1077% | 991% | 793% | 159% | 96% | 112% | 107% | 143% | 32% |
| 62 | Health care & social assistance | -15% | -15% | -5% | -39% | 8% | 5% | 28% | -13% | 9% |
| 71 | Arts, entertainment, & rec. | C | C | C | 62% | C | 33% | 16% | -3% | 25% |
| 72 | Accomm. & food svc | 8% | 17% | 16% | 15% | 7% | 4% | 9% | 9% | 24% |
| 81 | Other svc (excl. public admin.) | -52% | -51% | -25% | -26% | -38% | -41% | -11% | 69% | 27% |
| 92 | Public Administration | C | C | C | -9% | C | 26% | 26% | 21% | 24% |

C – Confidential Figure

N.R. - Figures not relevant due to changes in industrial classification

- Source: Center for Applied Demography & Survey Research

Table 14 Percent Change in Brownfield Related Wages in Sussex County, by Industry: 2000 to 2008

| NAICS | Description | Local Wages | | | | Countywide Wages | | | | County Total |
|-------|---------------------------------|-------------|-------|-------|-------|------------------|------|------|-------|--------------|
| | | 50m | 250m | 500m | 1000m | 50m | 250m | 500m | 1000m | |
| 11 | Agric., Forestry, & Fish. | C | C | C | C | C | C | C | -5% | 13% |
| 21 | Mining | C | C | C | C | C | C | C | C | C |
| 22 | Utilities | C | C | C | C | C | C | C | C | 394% |
| 23 | Construction | 109% | 135% | 169% | 475% | 68% | 35% | 13% | 98% | 43% |
| 31-33 | Manufacturing | 12% | 11% | 11% | 86% | 137% | 126% | 131% | 127% | 55% |
| 42 | Wholesale trade | C | -82% | -82% | 1% | -55% | -81% | -60% | -25% | 3% |
| 44-45 | Retail trade | 10% | 9% | 117% | 106% | 4% | 6% | 12% | 7% | 45% |
| 48-49 | Transp. & warehousing | C | 113% | 116% | 129% | 41% | 83% | 39% | 32% | 112% |
| 51 | Information | C | C | C | 153% | 534% | 443% | 483% | -39% | 15% |
| 52 | Finance & insurance | -6% | 128% | 132% | 84% | 23% | 138% | 175% | 139% | -33% |
| 53 | Real estate and leasing | -5% | -17% | -13% | 207% | 97% | 40% | 24% | 50% | 81% |
| 54 | Prof., and tech. svc | 40% | 41% | 41% | 47% | 52% | 65% | 63% | 74% | 117% |
| 55 | Mgmt of companies* | -100% | -100% | -100% | -100% | C | C | C | C | N.R. |
| 56 | Admin., waste, and remed. svc | 30% | 31% | 32% | 34% | 93% | 64% | 63% | 67% | 88% |
| 61 | Educational services | 1197% | 1111% | 958% | 182% | 178% | 203% | 194% | 251% | 73% |
| 62 | Health care & social assistance | 50% | 50% | 68% | -5% | 61% | 54% | 99% | 24% | 48% |
| 71 | Arts, entertainment, & rec. | | 109% | 109% | 206% | C | 37% | 22% | 13% | 69% |
| 72 | Accomm. & food svc | 54% | 71% | 68% | 65% | 38% | 40% | 45% | 46% | 54% |
| 81 | Other svc (excl. public admin.) | -29% | -29% | 5% | 16% | -25% | -26% | 6% | 92% | 62% |
| 92 | Public Administration | C | C | C | 20% | C | 42% | 42% | 57% | 72% |

C – Confidential Figure

N.R. - Figures not relevant due to changes in industrial classification

- Source: Center for Applied Demography & Survey Research

Brownfield Activity in Kent County

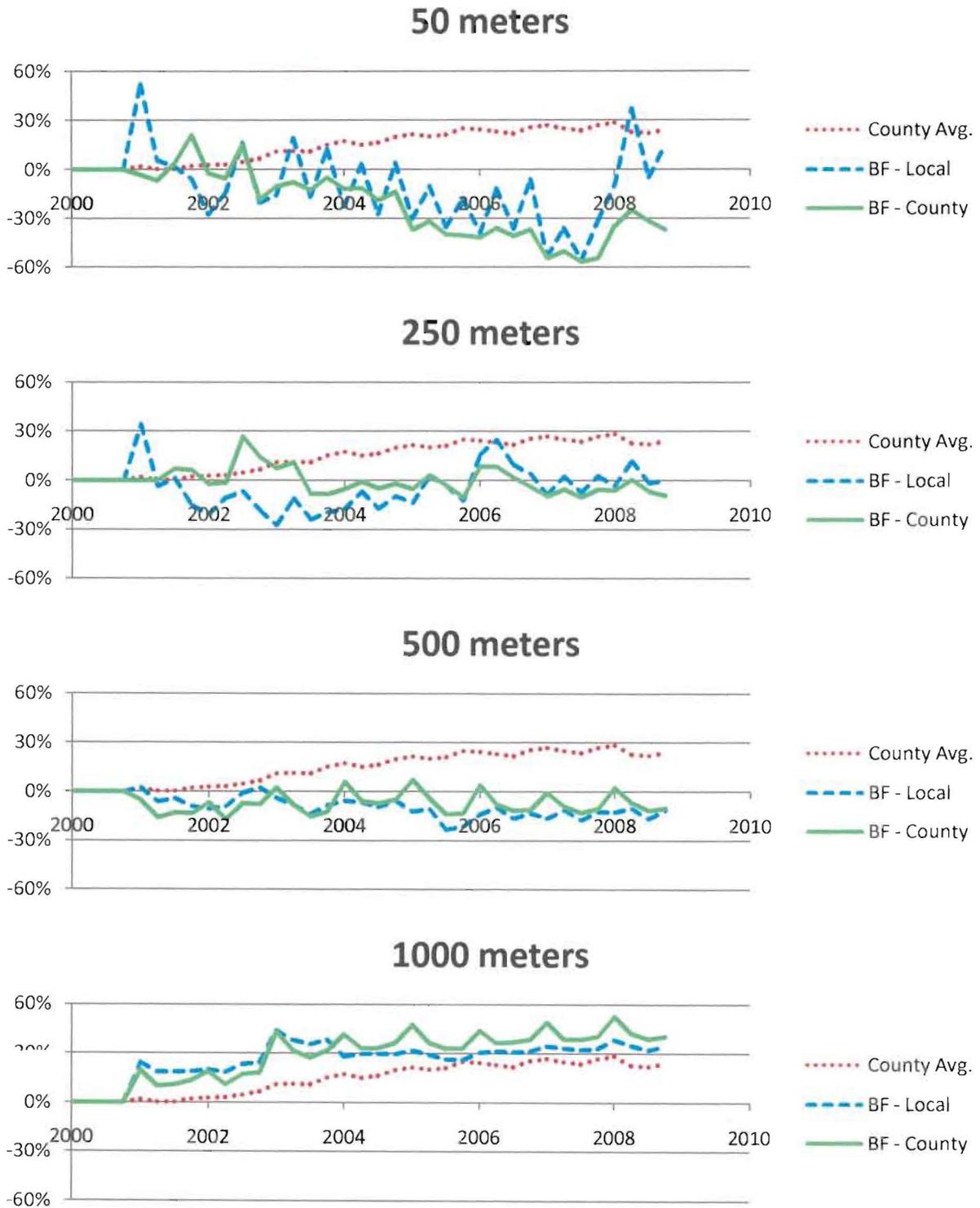
Figure 12 shows the percentage change in brownfield employment for establishments near Kent County brownfields. The dotted red lines indicate that total employment in the county rose steadily between 2000 and 2008, increasing nearly 30% during this time. The local (dotted blue) and countywide (solid green) trends are quite different. Within a distance of 50 meters, both definitions of brownfield employment steadily declined for most time periods. There was a recovery in 2008, but brownfield growth was still much worse than county growth. At distances of 250 and 500 meters, brownfield employment also grew less than county employment.

Figure 13 shows the percent change in wages for Kent County. Similar to employment, total wage growth near brownfields was worse than wage growth in the county. In fact, nominal wages within 50 meters from a brownfield declined since 2000. Recall that no brownfield in Kent County finished remediation in 2008. This could explain why the trends are generally worse than the other Delaware counties.

Table 15 and Table 16 decompose brownfield employment and wages in Kent County. Because few businesses mapped near brownfields in Kent County, the sectoral decomposition left most sample sizes confidentially too small to report.²³ However, we do see that brownfield growth in the retail trade and health care sectors was less than county growth in these sectors. Local construction activity also increased substantially around brownfields, but declined under the countywide definition of activity.

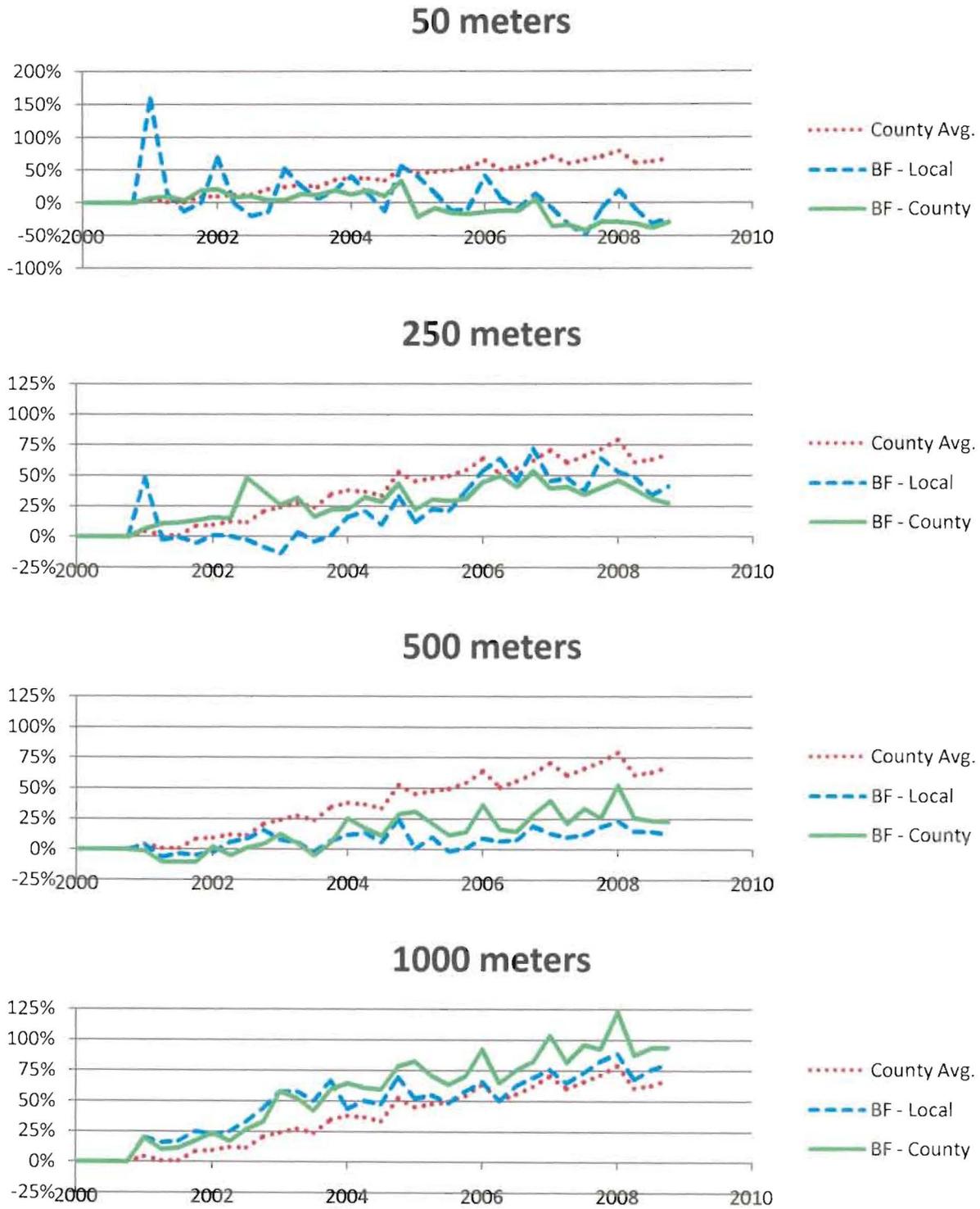
²³Small sample sizes yield volatile and often misleading percentage changes, so these confidentiality requirements do not seriously inhibit the analysis.

Figure 12 Percent Change in Employment since 2000 for Businesses near a Kent County Brownfield



• Source: Center for Applied Demography & Survey Research

Figure 13 Percent Change in Nominal Wages since 2000 for Businesses near a Kent County Brownfield



• Source: Center for Applied Demography & Survey Research

Table 15 Percent Change in Brownfield Related Employment in Kent County, by Industry: 2000 to 2008

| NAICS | Description | Local Employment | | | | Countywide Employment | | | | County Total |
|-------|---------------------------------|------------------|------|------|-------|-----------------------|------|------|-------|--------------|
| | | 50m | 250m | 500m | 1000m | 50m | 250m | 500m | 1000m | |
| 11 | Agric., Forestry, & Fish. | C | C | C | C | C | C | C | C | -21% |
| 21 | Mining | C | C | C | C | C | C | C | C | -66% |
| 22 | Utilities | C | C | C | C | C | C | C | C | -2% |
| 23 | Construction | C | 262% | 65% | 50% | -84% | 6% | 11% | 4% | 32% |
| 31-33 | Manufacturing | C | C | C | -59% | C | C | -11% | -24% | -41% |
| 42 | Wholesale trade | C | C | C | 56% | 289% | 74% | 118% | 64% | 61% |
| 44-45 | Retail trade | C | -45% | -37% | -7% | -49% | -39% | -33% | 15% | 31% |
| 48-49 | Transp. & warehousing | C | C | 33% | 498% | C | -12% | 83% | 533% | 63% |
| 51 | Information | C | C | C | C | C | C | -87% | -82% | -38% |
| 52 | Finance & insurance | C | C | 39% | 51% | 26% | -3% | 54% | 44% | -6% |
| 53 | Real estate and leasing | C | C | 0% | 12% | C | -21% | 1% | -9% | -2% |
| 54 | Prof., and tech. svc | C | 97% | -16% | 11% | C | -43% | -6% | 10% | 38% |
| 55 | Mgmt of companies | C | C | C | C | C | C | C | C | N.R. |
| 56 | Admin., waste, and remed. svc | C | C | 9% | -2% | 60% | 0% | -8% | 25% | 25% |
| 61 | Educational services | C | C | C | C | C | C | C | -4% | 16% |
| 62 | Health care & social assistance | -38% | -33% | -1% | 160% | -23% | -2% | 22% | 199% | 100% |
| 71 | Arts, entertainment, & rec. | C | C | C | C | C | C | C | -26% | 23% |
| 72 | Accomm. & food svc | C | C | -40% | 81% | C | -56% | -46% | 93% | 6% |
| 81 | Other svc (excl. public admin.) | C | -28% | -1% | -3% | -31% | -13% | 6% | 10% | 27% |
| 92 | Public Administration | C | C | -36% | 78% | C | -10% | -15% | 83% | 55% |

C – Confidential Figure

N.R. - Figures not relevant due to changes in industrial classification

- Source: Center for Applied Demography & Survey Research

Table 16 Percent Change in Brownfield Related Wages in Kent County, by Industry: 2000 to 2008

| NAICS | Description | Local Wages | | | | Countywide Wages | | | | County Total |
|-------|---------------------------------|-------------|------|------|-------|------------------|------|------|-------|--------------|
| | | 50m | 250m | 500m | 1000m | 50m | 250m | 500m | 1000m | |
| 11 | Agric., Forestry, & Fish. | C | C | C | C | C | C | C | C | 13% |
| 21 | Mining | C | C | C | C | C | C | C | C | -51% |
| 22 | Utilities | C | C | C | C | C | C | C | C | 30% |
| 23 | Construction | C | 531% | 150% | 123% | -87% | 49% | 59% | 53% | 73% |
| 31-33 | Manufacturing | C | C | C | -45% | C | C | 18% | 0% | -22% |
| 42 | Wholesale trade | C | C | C | 135% | 320% | 114% | 210% | 158% | 149% |
| 44-45 | Retail trade | C | -22% | -20% | -2% | 51% | 18% | 8% | 34% | 60% |
| 48-49 | Transp. & warehousing | C | C | 108% | 789% | C | 18% | 206% | 928% | 143% |
| 51 | Information | C | C | C | C | C | C | -78% | -74% | -3% |
| 52 | Finance & insurance | C | C | 48% | 94% | 19% | -14% | 81% | 95% | 41% |
| 53 | Real estate and leasing | C | C | 20% | 29% | C | 59% | 48% | 22% | 50% |
| 54 | Prof., and tech. svc | C | 207% | 6% | 31% | C | -26% | 39% | 50% | 80% |
| 55 | Mgmt of companies | C | C | C | C | C | C | C | C | N.R. |
| 56 | Admin., waste, and remed. svc | C | C | 94% | 134% | 181% | 91% | 74% | 200% | 111% |
| 61 | Educational services | C | C | C | C | C | C | C | 45% | 54% |
| 62 | Health care & social assistance | -4% | -25% | 51% | 268% | 5% | 34% | 78% | 325% | 178% |
| 71 | Arts, entertainment, & rec. | C | C | C | C | C | C | C | -50% | 77% |
| 72 | Accomm. & food svc | C | C | -25% | 111% | C | -66% | -28% | 128% | 26% |
| 81 | Other svc (excl. public admin.) | C | -19% | 30% | -6% | -11% | 10% | 33% | 31% | 65% |
| 92 | Public Administration | C | C | -18% | 128% | C | 32% | 19% | 152% | 114% |

C – Confidential Figure

N.R. - Figures not relevant due to changes in industrial classification

- Source: Center for Applied Demography & Survey Research

Table 17 Employment and Wage Changes Surrounding Brownfields, by County: 2000-2008

| County | Distance to Brownfield | Employment | | Wages | |
|------------|------------------------|------------|------------|--------|------------|
| | | Local | Countywide | Local | Countywide |
| New Castle | Within 50 m of BF | -4.7% | 4.1% | 27.9% | 43.7% |
| | Within 250 m of BF | -1.4% | -11.1% | 48.9% | 14.5% |
| | Within 500 m of BF | -1.8% | -6.9% | 48.0% | 25.2% |
| | Within 1000 m of BF | -4.0% | -4.8% | 38.5% | 28.9% |
| | County Total | | -1.8% | | 29.7% |
| Sussex | Within 50 m of BF | -4.3% | 12.8% | 58.9% | 95.5% |
| | Within 250 m of BF | 0.9% | 10.7% | 66.5% | 88.2% |
| | Within 500 m of BF | 4.8% | 13.3% | 74.5% | 85.8% |
| | Within 1000 m of BF | -0.7% | 7.3% | 44.6% | 58.7% |
| | County Total | | 12.4% | | 50.4% |
| Kent | Within 50 m of BF | 6.8% | -32.0% | -14.3% | -31.1% |
| | Within 250 m of BF | 1.7% | -5.4% | 44.5% | 35.7% |
| | Within 500 m of BF | -12.5% | -6.7% | 16.5% | 30.4% |
| | Within 1000 m of BF | 35.2% | 43.9% | 78.6% | 99.0% |
| | County Total | | 24.4% | | 67.5% |

- Source: Delaware Department of Labor and Center for Applied Demography & Survey Research

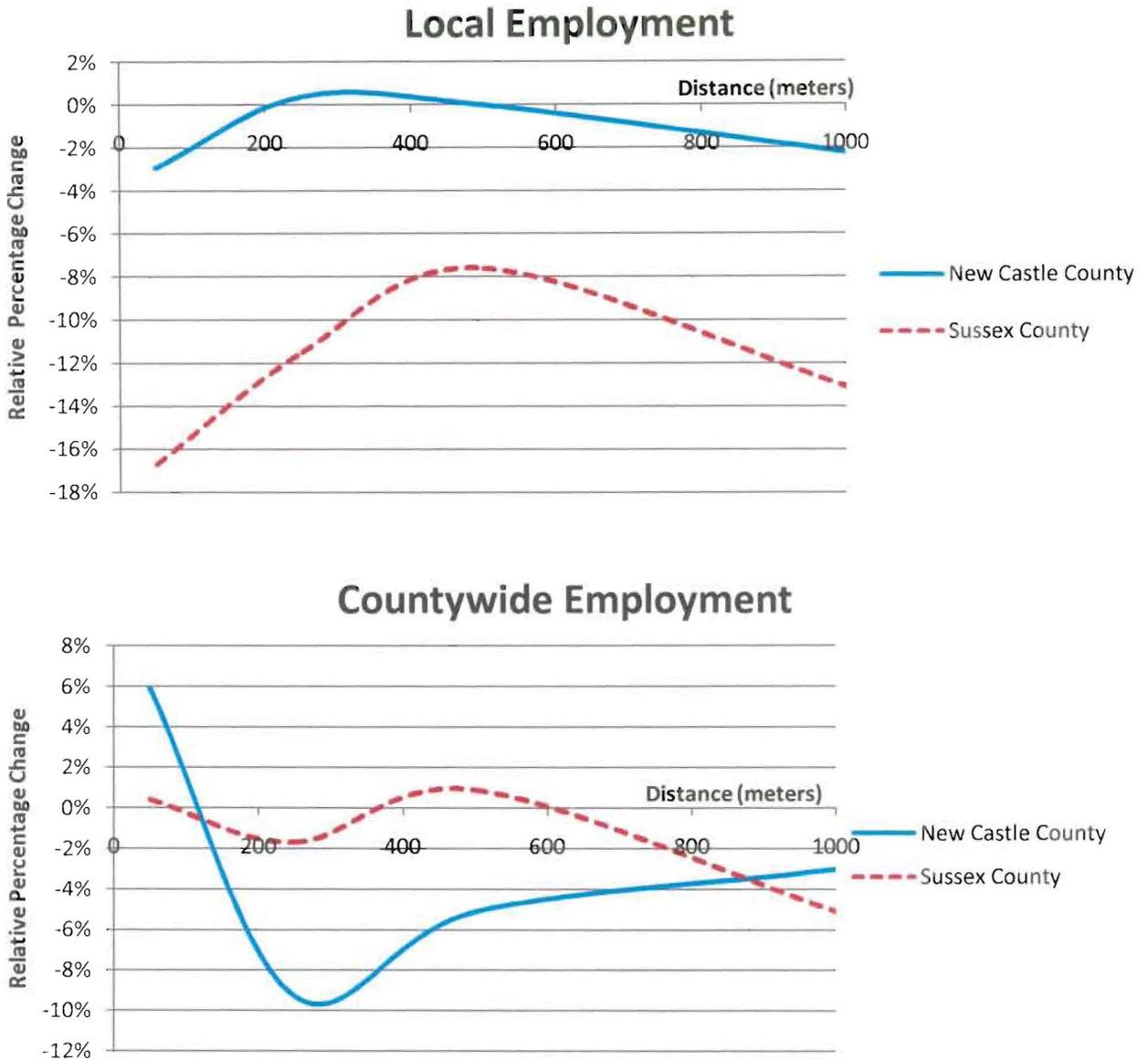
The Empirical Relationship between Distance and Brownfield Activity

Admittedly, the information presented thus far has been detailed and is not easy to retain. Table 17 summarizes this information by reporting the percent change between 2000 and 2008. Activity occurring between 2001 and 2007 is ignored. Each unshaded row reports the change in activity at a specific distance to a brownfield. Each shaded row reports the total change occurring in the county. For example, the first unshaded row indicates that local employment within 50 meters from a New Castle County brownfield fell 4.7% between 2000 and 2008. The first shaded row indicates that overall employment decreased 1.8 percent.

Countywide brownfield employment and wages increased substantially near brownfields. In New Castle County, countywide brownfield employment within 50 meters increased 4.1% and wages increased 43.7%. In Sussex County, countywide brownfield employment increased 12.8% and wages increased 95.5%. These gains diminish as distance to a brownfield increases. Curiously, local brownfield activity may improve as distance increased.

Figures 14 and 15 show the relationship between relative growth and brownfield distance for New Castle and Sussex counties. The relationship for Kent County is not plotted, since it has such a qualitatively different mix of brownfields and because the sample sizes are much smaller (see Table 18 for sample sizes). Distance to the brownfield is plotted on the x-axis. The y-axis plots brownfield growth *relative to the county*. For example, at a distance of 50 meters, local brownfield employment in New Castle County declined 4.7% while total employment declined 1.8%. Therefore, local brownfield wages grew 2.9 percentage points less than the county. Figure 14 plots -2.9 at a distance of 50 meters. Each figure fits a smooth polynomial function through four observations.

Figure 14 The Relationship Between Relative Employment Growth and Distance to a Brownfield: 2000 to 2008

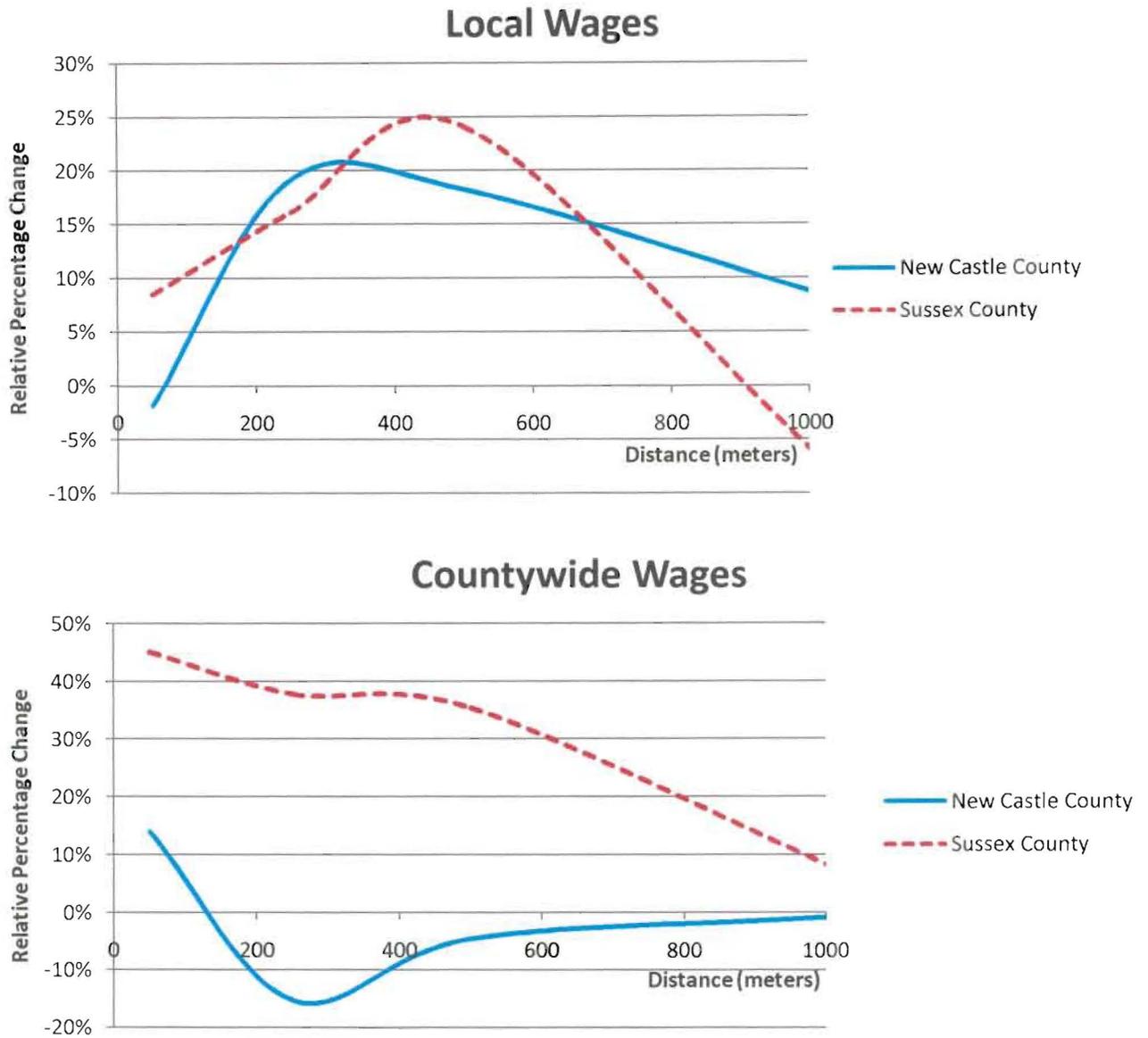


• Source: Center for Applied Demography & Survey Research

Figure 14 suggests possible evidence of an inverted-U relationship between distance and local employment growth. The countywide relationship may be more complex.²⁴

²⁴ Smaller distances will necessarily include fewer businesses and will contain more variation. Similarly, the Sussex County relationship is likely more variable than the New Castle County relationship due to fewer brownfields.

Figure 15 The Relationship Between Relative Wage Growth and Distance to a Brownfield: 2000 to 2008



- Center for Applied Demography & Survey Research

Figure 15 shows possible evidence of another inverted-U relationship between distance and local wage growth. The relationship between distance and countywide wage growth is more complex, but generally negative. Future research should explore this relationship.

The Average Annual Wage per Employee

Given the changes in total employment and wages, the average annual wage per employee near Delaware brownfields has changed.²⁵ Table 18 reports the average annual wage per employee in 2000 and 2008. Both local and countywide perspectives are presented. Each unshaded row calculates the average annual wage at different distances to a brownfield. The shaded row lists the average wage in each county.

From a local perspective, the average annual wage within 50 meters from a New Castle County brownfield was nearly \$4,500 above average in 2000. At larger distances, the annual wage was slightly below average. From a countywide perspective, brownfield businesses paid an above average wage in 2000 at all distances. Regardless of which definition one uses, annual wage near brownfields was well above average in 2008.

By contrast, the annual wage in Sussex County was initially below average using both perspectives, but it improved tremendously. For example, the average wage paid by local businesses within 50 meters of a brownfield was \$19,923 in 2000, or nearly \$5,000 below average. The average wage in the county increased \$8,400 over the next 8 years, but increased nearly \$13,000 within 50 meters from a brownfield. In 2008, the brownfield average wage was only \$200 below average.

²⁵ We calculate average wage by dividing total wages paid with total employment. We are not averaging each employee's wage.

Table 18 Average Annual Wage of Brownfield Businesses, by County: 2000 and 2008

| County | Distance to Brownfield | Avg. Annual Wage, 2000 | | Avg. Annual Wage, 2008 | | Avg. # Establishments | |
|--------------|------------------------|------------------------|------------|------------------------|------------|-----------------------|------------|
| | | Local | Countywide | Local | Countywide | Local | Countywide |
| New Castle | Within 50 m of BF | \$45,123 | \$42,624 | \$60,520 | \$58,886 | 411 | 676 |
| | Within 250 m of BF | \$40,056 | \$46,456 | \$60,481 | \$59,860 | 1,432 | 2,192 |
| | Within 500 m of BF | \$39,655 | \$44,380 | \$59,740 | \$59,703 | 3,578 | 4,649 |
| | Within 1000 m of BF | \$39,443 | \$43,267 | \$56,899 | \$58,632 | 4,878 | 6,368 |
| County Total | | \$40,653 | | \$53,714 | | 18,227 | |
| Sussex | Within 50 m of BF | \$19,923 | \$22,450 | \$33,071 | \$38,934 | 162 | 242 |
| | Within 250 m of BF | \$19,389 | \$21,762 | \$32,016 | \$37,009 | 227 | 386 |
| | Within 500 m of BF | \$21,999 | \$23,983 | \$36,638 | \$39,349 | 267 | 500 |
| | Within 1000 m of BF | \$24,753 | \$25,520 | \$36,058 | \$37,736 | 447 | 822 |
| County Total | | \$24,887 | | \$33,292 | | 5,063 | |
| Kent | Within 50 m of BF | \$25,640 | \$25,062 | \$20,562 | \$25,368 | 20 | 52 |
| | Within 250 m of BF | \$24,856 | \$25,508 | \$35,316 | \$36,574 | 83 | 176 |
| | Within 500 m of BF | \$28,683 | \$28,320 | \$38,195 | \$39,584 | 209 | 352 |
| | Within 1000 m of BF | \$29,284 | \$28,410 | \$38,677 | \$39,292 | 501 | 742 |
| County Total | | \$27,052 | | \$36,432 | | 3,183 | |

* The count of local establishments is not adjusted for unmatched observations. The average number of establishments in 2000 and 2008 are reported.

- Source: Delaware Department of Labor and Center for Applied Demography & Survey Research

Consistent with previous results, Kent County brownfield activity underperformed non-brownfield activity in its own county and brownfield activity in other counties. Table 18 shows the average local wage within 50 meters *decreased* \$5,000 between 2000 and 2008. The third column indicates this may partly be due to small sample size.

Summarizing Brownfield Activity

In summary, the report has tracked employment and wages for businesses near Delaware brownfields. Using a local perspective, we find that employment grew relatively less than it did in the county, but wages grew relatively faster. Much of this growth occurred in high wage sectors, such as finance and insurance. Activity declined in low wage sectors, such as retail and wholesale trade. This has led to significant improvements in the average wage paid per employee.

The results were similar under a countywide definition of brownfield activity. Brownfield employment and wages experienced above average growth. As distance increased from a brownfield, these gains diminished. The average wage of workers improved both absolutely and relative to the average wage in the county. Finally, brownfield growth in New Castle County and Sussex County has been considerably better than brownfield growth in Kent County. We caution again that development in Kent County is unfinished, so these county-to-county comparisons are temporary.

While employment and wages are both important components to economic activity surrounding brownfields, other factors play a role. For example, expenditures must be made to give each worker the appropriate tools to do her job. Some of these expenditures will circulate back into the Delaware economy and create more jobs. Given the complexity of an economy, every job created or lost near brownfields will have a multiplier effect on businesses elsewhere. The next section explores this process in greater detail.

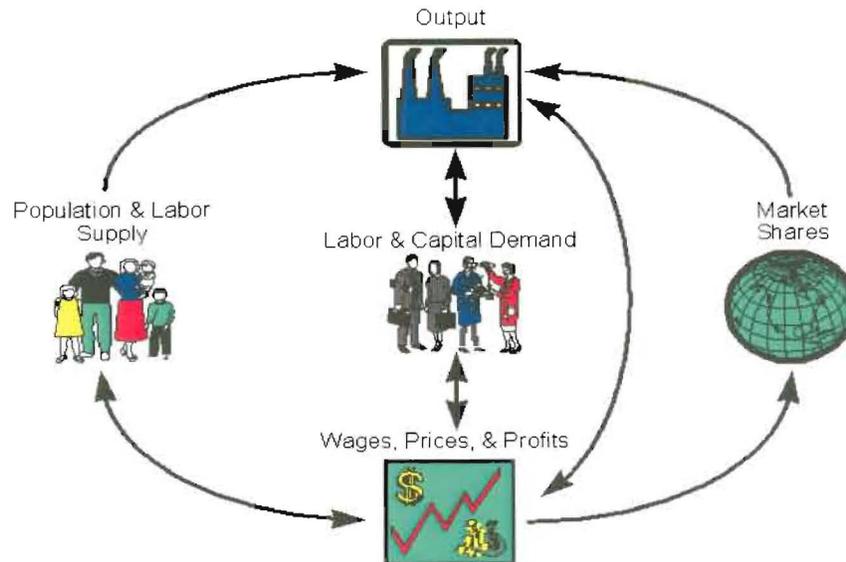
Regional Simulation

Overview of the REMI PI+ Model

This section estimates the total economic activity generated by brownfield establishments with a simulation. The REMI PI+ software is a dynamic and structural model of Delaware's economy that is capable of estimating causal relationships. It is a regionalized version of a benchmarked national model. Six sub-regions, including the three counties in Delaware, Cecil County MD, Delaware and Chester counties in PA (combined), and the balance of the Delmarva Peninsula are included. Each sub-region is treated as an independent, fully functioning economy that interacts with every other sub-region specifically and with the nation in general.

The model is founded on conventional economic assumptions, such as households maximize utility and firms maximize profits. Hundreds of equations have been developed over the last 25 years to describe the economy's structure mathematically. These equations can be organized into five major components: Output and Demand, Labor and Capital Demand, Population and Labor Force, Wages-Prices-Costs, and Market Shares. Figure 16 illustrates REMI's main structure and components.

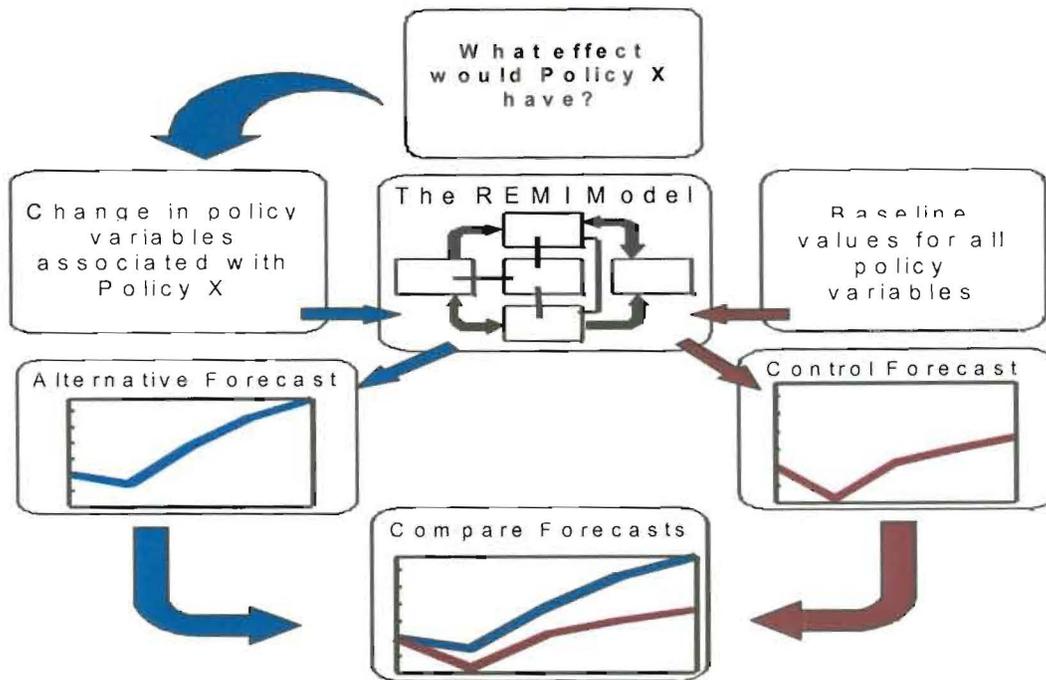
Figure 16 Illustration of the REMI PI+ Model



The equations assume that businesses use labor, capital, and fuel as inputs to supply goods and services as output. Households (and some businesses) supply the inputs of production and generate the demand for goods and services. Wages, prices, and profits adjust to form equilibriums in each market, but the equilibrating process might take time. High market shares can generate cluster effects that influence factor productivity and input prices.

REMI PI+ is a general equilibrium model with feedback. This means that the model describes the entire economy as it changes over time. For example, changes in population, demographics, and wages each influence the labor supply at any moment, but are themselves influenced in the future by changes in the labor supply. Adjustments happen gradually, so the economy does not statically jump from one equilibrium to another. This is one main advantage of using REMI versus other economic simulation models (RIMS II, IMPLAN).

Figure 17 Illustration of a Policy Forecast in REMI



A second advantage of using a general equilibrium model is it can capture the multiplier effect from other parts of the economy. In a sense, the multiplier effect is the cumulative impact of any single change to the economy. For example, as demand generates additional demand, one dollar of retail sales will increase sales in construction 0.28¢, sales in fabricated metal product manufacturing 0.30¢, sales in utilities 1.1¢, etc. The total impact from the multiplier effect can be quite large.

Figure 17 illustrates how REMI estimates the effects of a policy. First, the REMI model is calibrated and a standard future scenario is predicted. This is called the control forecast. A policy is then proposed that impacts the economy. A modeler adapts this policy into REMI by changing appropriate input variables and simulating the outcome. This alternative forecast is then compared to the control forecast. Differences between the two forecasts are attributed to the policy.

Adapting REMI to Brownfield Activity

Before implementing the REMI model, three important issues must be addressed. First, we must predict what would have happened without the brownfield program.²⁶ This report assumes that brownfield activity would have grown at the same rate as the county. Thus, any deviation in employment or wage growth will be attributed to the program. Because brownfields are characterized by a lack of economic activity, one might argue that this assumption is too conservative. On the other hand, it may be too liberal if development would have occurred without the program. Estimating this hypothetical scenario is an important area for future research.

The second issue is determining how the brownfields influence nearby businesses. This report assumes that the program completely influences any establishment within 50 meters.²⁷ On the one hand, 50 meters may overstate the brownfield's effect if additional exposure does not help adjacent establishments. On the other hand, 50 meters may understate the influence if the exposure greatly increases business activity or population density. This assumption should also be explored in future research.

²⁶Econometric techniques typically control for this hypothetical situation, known as the counterfactual. However, these methods are not without their own problems. Data limitations largely complicate econometric methods in this project.

²⁷The GIS software occasionally maps addresses close to their physical location. Therefore, a buffer size of 50 meters also decreases the possibility of missing businesses inside brownfields due to GIS coordinate error. Typically, the 50 meter buffer includes only the brownfield and adjacent tax parcels.

Finally, the employment and wages must be adjusted to act as REMI inputs. Because the county is the smallest region of analysis in REMI, a countywide perspective is adopted. In addition, the model uses a 70-sector decomposition of business activity. This is much more disaggregated than the 20-sector decomposition reported earlier. Unfortunately, increased disaggregation creates many confidentially small sample sizes, so inputs cannot be reported. However, the following example demonstrates how the inputs are constructed.

The administrative support services industry listed twenty-eight establishments that mapped within 50 meters of a New Castle County brownfield between 2000 and 2008. These businesses employed 738 persons in 2000 and 1,127 persons in 2008. Thus, employment grew 53%. However, that industry's employment fell 26% in the county. Had these brownfield establishments followed the county trend, they would have reduced their workforce to 543 employees (a 26% decline). Therefore, the difference of (1,127-543) 584 employees is the "extra" employment associated with the brownfield establishments.²⁸ Employment enters the REMI framework as a shock to each industry's labor demand. A similar analysis was performed for all 70 sectors in each county.

²⁸ An adjustment was made to account for differences in the observed wage and the default wage of each industry.

Table 19 Estimated Impact of Brownfield Businesses on Delaware's Economy (millions of 2008 \$)

| Category | New Castle | Sussex | Kent | Delaware |
|--|------------|--------|-------|----------|
| Total Employment | 769 | 421 | -495 | 695 |
| Private Non-Farm Employment | 565 | 272 | -432 | 405 |
| Population | 149 | -5 | -66 | 78 |
| Gross Domestic Product | \$260 | \$157 | -\$23 | \$394 |
| Total Wage and Salary Disbursements | \$90 | \$62 | -\$17 | \$135 |
| Personal Income | \$69 | \$63 | -\$10 | \$121 |
| Disposable Personal Income | \$60 | \$54 | -\$9 | \$105 |
| Disposable Personal Income per Capita* | \$104 | \$291 | -\$44 | \$120 |
| Personal Consumption Expenditures | \$51 | \$46 | -\$7 | \$90 |

* Figures in 2008 \$

Figures exclude the management of companies sector due to a definitional change.

- Source: Center for Applied Demography & Survey Research

Results of the REMI Model

The output of the REMI model is listed in Table 19. The table reports the difference from a hypothetical economy in 2008 in which all businesses within 50 meters of a brownfield grew at the same rate as the respective county trends. REMI predicts that businesses near brownfields made a very positive contribution to the state economy. Approximately 695 additional jobs and \$394 million²⁹ in state gross domestic product (GDP) can be attributed to brownfield businesses. Disposable personal income was \$105 million larger, giving each Delawarean \$120 more disposable personal income. The model also attributes \$90 million dollars of 2008 consumption expenditures to the “extra” growth of brownfield businesses.

²⁹ All figures are reported in 2008 \$ unless otherwise noted.

Table 19 indicates that benefits were greatest in New Castle County. Extra growth has added more than a quarter billion dollars to county GDP and raised disposable personal income by nearly \$60 million. It also contributed 769 jobs to the county. Sussex County also benefited from brownfield activity, but by less than New Castle. Above average brownfield growth created 421 more jobs in Sussex County and increased county GDP by \$157 million. Unlike the other two counties, the activity associated with Kent County brownfields was below average. Had brownfield growth matched county growth, REMI predicts that Kent would have had 495 more jobs in 2008.

Table 20 decomposes REMI's predictions by the 20-sector NAICS classification. Benefits from the extra brownfield activity stem largely from New Castle County establishments in the finance and insurance sector and the administrative support, waste management, and remediation services sector. Activity in manufacturing and professional and technical services sectors declined in New Castle County, but gained in Sussex County. Retail trade, transportation and warehousing, and the accommodation and food services sectors declined across all three counties.

In summary, the above average growth from brownfield activity is quite large. Most benefits occurred in New Castle and Sussex counties, while Kent County has suffered relative losses thus far. Some "white collar" industries clearly gained, while other sectors had mixed results.

Table 20 Estimated Impact of Brownfield Businesses on Delaware, by Sector (millions of 2008 \$)

| Sector | Employment | | | Output | | | Wage and Salary Disbursements | | |
|---------------------------------|------------|--------|------|------------|--------|-------|-------------------------------|--------|------|
| | New Castle | Sussex | Kent | New Castle | Sussex | Kent | New Castle | Sussex | Kent |
| Agric., Forestry, & Fish. | 0 | -3 | 0 | \$0 | \$0 | \$0 | \$0 | \$0 | \$0 |
| Mining | 0 | 0 | 0 | \$0 | \$0 | \$0 | \$0 | \$0 | \$0 |
| Utilities | 1 | 4 | 0 | \$1 | \$2 | \$0 | \$0 | \$0 | \$0 |
| Construction | -58 | 74 | -159 | -\$7 | \$5 | -\$11 | -\$4 | \$2 | -\$4 |
| Manufacturing | -160 | 244 | -1 | -\$25 | \$284 | \$0 | -\$3 | \$46 | \$0 |
| Wholesale trade | -100 | 13 | 24 | -\$27 | \$2 | \$4 | -\$5 | \$1 | \$1 |
| Retail trade | -234 | -84 | -85 | -\$21 | -\$7 | -\$7 | -\$12 | -\$2 | -\$5 |
| Transp. & warehousing | -169 | -48 | -3 | -\$20 | -\$6 | \$0 | -\$9 | -\$2 | \$0 |
| Information | 14 | -22 | 0 | \$5 | \$2 | \$0 | \$2 | \$0 | \$0 |
| Finance & insurance | 1530 | 16 | 3 | \$566 | \$6 | \$0 | \$146 | \$1 | \$0 |
| Real estate and leasing | 36 | 21 | -4 | \$11 | \$7 | -\$1 | \$1 | \$0 | \$0 |
| Prof., and tech. svc | -671 | 14 | -52 | -\$106 | \$1 | -\$4 | -\$56 | -\$1 | -\$2 |
| Mgmt of companies | 28 | 4 | 0 | \$6 | \$1 | \$0 | \$2 | \$0 | \$0 |
| Admin., waste, and remed. svc | 753 | -159 | 41 | \$66 | \$7 | \$3 | \$20 | \$2 | \$1 |
| Educational services | 49 | 314 | 5 | \$2 | \$6 | \$0 | \$3 | \$12 | \$0 |
| Health care & social assistance | 68 | -42 | -132 | \$7 | -\$1 | -\$10 | \$3 | -\$1 | -\$4 |
| Arts, entertainment, & rec. | 129 | 14 | -6 | \$4 | \$1 | -\$1 | \$3 | \$0 | \$0 |
| Accomm. & food svc | -578 | -12 | -42 | -\$35 | -\$1 | -\$2 | -\$11 | \$0 | \$0 |
| Other svc (excl. public admin.) | -73 | -77 | -20 | \$4 | -\$4 | -\$1 | -\$1 | -\$4 | \$0 |

- Figures exclude the management of companies sector due to definitional change.
- Source: Center for Applied Demography & Survey Research

Limitations

This report has important practical and theoretical limitations that should be acknowledged. The first practical issue is that some of the brownfield definitions had to be enlarged because tax parcels changed over time. This may have increased the changes in property values and the number of establishments falling within any specified distance. Secondly, data quality is always a concern. Businesses may report incorrect or aggregate data, addresses could be incorrectly mapped, differences could exist between companies with and without matching addresses, etc. Thirdly, the REMI model offers sophisticated, but imperfect estimates. Finally, many brownfields have not completed remediation or development, so the 2008 impact is premature.

The first theoretical limitation is that the report does not address important elements like crime, poverty, and urban sprawl. Second, brownfields do not completely influence all neighboring businesses within 50 meters. It is theoretically possible that the surrounding activity influences brownfields. Future work should examine the reach and causal direction of brownfield influence. Thirdly, the analysis cannot isolate program benefits from development benefits. Of course, if the program acts as a lynchpin to development, this may be a minor point. Finally, the analysis is primarily a description of activity. It does not show that the program *caused* these changes. Causation is a difficult issue in the social sciences and requires clarification.

The program's true impact should be measured by the difference between what has happened and what would have happened without the program. The latter scenario, called the counterfactual, is difficult to estimate since it never actually happens. For example, developers might have remediated the property anyway if DNREC refused certification. If so, the program benefits no one except land developers. As another example, expanding businesses might have relocated near a brownfield or performed better than the county average regardless of brownfield development. If so, the program should not be credited with these gains. Unfortunately, the counterfactual is never known with certainty and could not be predicted with the available data. Instead, average county trends acted as the counterfactual in this analysis and the assumptions concerning causal direction are implicit.

Summary and Conclusions

The goal of DNREC's brownfield program is to encourage remediation and development of underutilized land that has real or perceived environmental damage. The program offers financial assistance and liability exemption for anyone who sufficiently remediates a brownfield. This report indirectly analyzes the impact of this program by measuring changes in property assessments and nearby business activity. It finds many positive changes have occurred around Delaware brownfields.

Approximately 85% of Delaware's brownfields are in New Castle County. They have overwhelmingly had the greatest impact on the state. Brownfield property values in New Castle County increased \$455 million (2008 \$) since 1998 with most gains occurring to properties on the Wilmington Riverfront. In Sussex County, assessment values increased \$15 million since 2000, while values in Kent County increased less than \$200,000 since 2001. Every nominal dollar spent through the brownfield program is currently associated with approximately \$17.50 of additional property value in New Castle and Sussex counties, but only \$0.07 in Kent County.³⁰ These are conservative estimates.

The growth of brownfield property values has been substantially better than non-brownfield properties. In New Castle County, brownfield property values increased 106% since 1998. This is more than ten times district growth. Property values in Sussex County increased 166% since 2000, while the relevant district growth rate was 93%. However, brownfield property values in Kent County increased (4%) less than the district (22%).

³⁰ These figures have not been adjusted for present value, which will decrease the ratios. On the other hand, as more brownfields complete development, the ratio is expected rise.

The increase in property values has meant substantial gains in tax revenue for New Castle County. We estimate that brownfields brought in \$2.7 million of tax revenue in 2008. Most of this revenue benefited the Christina School District and the City of Wilmington. Because property values and tax rates will most likely increase, so too will the tax revenue attributable to brownfields.

The report also analyzed business activity associated with brownfields. The distinction was made between local brownfield activity and countywide brownfield activity. Local activity refers to the transformation underway within a brownfield's vicinity. Countywide analysis refers to the change occurring to those firms that had been in the brownfield's vicinity at some point. The two analyses mostly differ by how they address business relocation. Both analyses generally find that the average annual wage improved more near brownfields than in the entire county. The effect on employment and wages depends on the definition being used.

Local brownfield employment grew less than total employment in the county. For example, local employment within 50 meters of a New Castle County brownfield declined 4.7%, despite total employment in the county falling only 1.8%. Similarly, local employment within 50 meters of a Sussex brownfield declined 4.3% while county employment increased 12.4%. Adopting a countywide perspective reverses this conclusion; businesses within 50 meters of New Castle County and Sussex County brownfields increased employment more than the average business in the county.

The industrial decomposition of brownfield activity shows patterns consistent with high wage employment replacing low wage employment. In particular, employment in retail and wholesale trade declined, while jobs in finance and insurance and the administrative support, waste management, and remediation services sectors increased absolutely and relative to the county. We cannot be certain why this shift occurred or what would have happened without the brownfield program. But assuming the brownfield program was a lynchpin to development, it may be able to take credit for some of this activity.

The final part of this report employed the REMI model to simulate the direct and indirect economic impact in greater detail. REMI predicts that there would be 695 fewer jobs in 2008 if the brownfield businesses simply followed the expected county trend. Similarly, Delaware's GDP would be \$394 million less in 2008, personal income would be \$121 million less, and personal consumption would be \$90 million less in 2008 if brownfield growth had not differed from county growth.

There are many relationships listed in this report that should be explored in the future. The economic activity occurring around Delaware brownfields is well above average. However, the full impact can only be known when brownfields finish development. As they do, the economic benefits are expected to rise.