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FORMER CHESAPEAKE SUPPLY BROWNFIELD REVITALIZATION: RAPID HEALTH IMPACT ASSESSMENT

U.S. Environmental Protection Agency
Office of Research and Development
Region 3 (Mid-Atlantic)
Office of Brownfields and Land Revitalization

NOTICE

The U.S. Environmental Protection Agency (EPA) through its Office of Research and Development (ORD) partially funded and collaborated in the research described here. It has been subjected to the Agency's review and has been approved for publication as an EPA document. Former Chesapeake Supply Brownfield Revitalization Rapid Health Impact Assessment (HIA) was led by EPA staff and contractors with technical assistance from the City of Dover, Downtown Dover Partnership, Kent County, State of Delaware, Delaware State University, and U.S. Department of Agriculture. The contents of this report are solely the responsibility of the authors and do not necessarily represent the views or policies of the EPA.

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SUMMARY

The City of Dover, Delaware, and Kent County are interested in redeveloping a vacant and formerly contaminated property, or brownfield, to stimulate economic revitalization and increase food access in the Downtown Dover area. As a part of this effort, local and state officials sought assistance from EPA with examining a cleaned brownfield site for food production with a focus on aquaponics, a type of farming that grows fish and plants together in an integrated system. A rapid Health Impact Assessment (HIA), an abbreviated form of HIA, was piloted in partnership with EPA Region 3; EPA Office of Research and Development; EPA Office of Brownfields and Land Revitalization; City of Dover, Kent County, and Delaware State governments; and Delaware State University. EPA staff guided the HIA process and utilized a mixed methods approach, including qualitative and quantitative data, geographic information system (GIS), and scientific literature review, to evaluate the potential health impacts of a proposed food production project. The following HIA report documents the HIA analyses, findings, and recommendations for the City of Dover to consider health in decisions around its revitalization plans and outlines opportunities for further development and future assessments.

ABOUT THE HEALTH IMPACT ASSESSMENT (HIA)

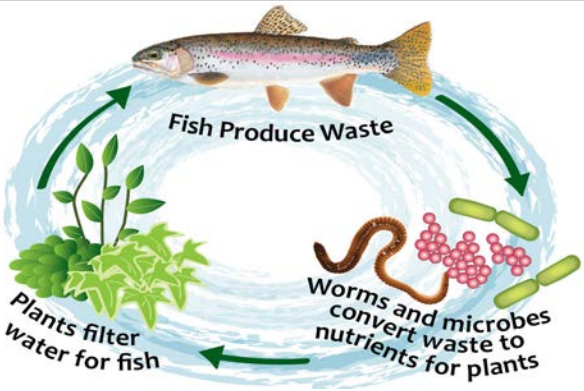
INTRODUCTION

Old State House, Dover, DE (Source: www.cityofdover.com)

The City of Dover, Delaware, and Kent County seek to redevelop a vacant and formerly contaminated property, or brownfield, to spur revitalization in the Downtown Dover area. They will be working with the Downtown Dover Partnership (DDP), a key partner in revitalization efforts of Downtown Dover. Activities to reuse properties and revitalize Downtown Dover intend to advance economic development and address community needs, including increasing community access to fresh and affordable food, local jobs, and employment opportunities, accelerating brownfield and downtown revitalization, reducing crime, and improving household and community economics. Given a desire to increase food access in this and other parts of the City within Kent County's Food Innovation District, this project sought to examine a brownfield site for economic development through food production; of particular interest is an integrated fish and plant farming option known as aquaponics.

AQUAPONICS

Aquaponics is a system of farming that combines hydroponics (growing plants without soil using nutrients in water) with aquaculture (growing and harvesting fish and aquatic plants) (US EPA, 2016).



The EPA's Office of Brownfields and Land Revitalization (OBLR), worked with EPA Region 3 staff, community partners and contractors in 2015-2016 to review and explore developing an Aquaponics project on brownfields in Delaware. The project resulted in the development of EPA's Aquaponics Business Plan User Guide and accompanying worksheets (US EPA, 2016).

In response to that effort and continued community interest, EPA's OBLR and EPA Region 3 staff agreed to work with local and state officials, community partners and contractors and EPA's Office of Research and Development (ORD) to evaluate the

potential public health impacts of an aquaponics project on a brownfield site in Downtown Dover through a Health Impact Assessment (HIA). The goal of an HIA is to provide decision-makers and the public with a set of evidence-based recommendations intended to inform the health-related issues associated with a given plan. The recommendations provide practical solutions that seek to magnify positive health impacts and minimize the negative impacts. The City of Dover is the main decision-maker regarding the proposed project considered in this HIA.

WHAT IS AN HIA?

A Health Impact Assessment, or HIA, is "a systematic process that uses an array of data sources and analytical methods and considers input from stakeholders to determine the potential effects of a proposed policy, plan, program, or project on health of a population and the distribution of those impacts within the population. HIA provides recommendations on monitoring and managing those effects" (National Research Council, 2011).

Five core values are integral to the HIA: democracy, equity, sustainable development, ethical use of evidence, and a comprehensive approach to health (World Health Organization, 1999). An HIA typically consists of 6 steps: screening; scoping; assessment; recommendations; reporting; and monitoring and evaluation (Table 1). The depth and extent of these steps is informed by project needs and resource and time limitations.

Table 1: Steps of the Health Impact Assessment process

1. SCREENING	Determine whether an HIA is feasible, timely, and useful to the decision-making process.
2. SCOPING	Create a plan for conducting the HIA, including identification of timeline, participant roles, and potential health risks and benefits.
3. ASSESSMENT	Describe baseline health of affected communities and assess the potential health impacts of the decision.
4. RECOMMENDATIONS	Develop practical strategies for promoting positive health impacts and/or mitigating adverse health impacts.
5. REPORTING	Communicate progress and findings to decision-makers, affected communities, and other stakeholders.
6. MONITORING AND EVALUATION	Evaluate the HIA process and its impacts on decision-making. Monitor changes in health in affected communities.

The three main types of HIAs, rapid, intermediate, and comprehensive, are based on the amount of effort, complexity, and duration (Ison, 2000; Figure 1). This project is a rapid HIA, or desk-based assessment, and is primarily based on existing information and data. It provides a broad overview of potential

health impacts with limited data collection and stakeholder engagement; it is intended to outline opportunities for further development and future assessment.

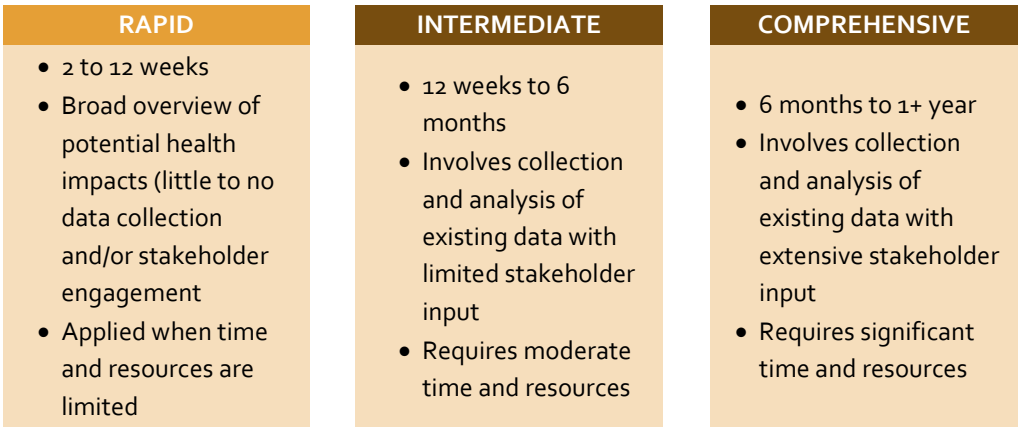


Figure 1. Types of Health Impact Assessment

PROPOSED STUDY SITE

The City of Dover has identified the property at 238 Railroad Avenue as the target site for potential revitalization and the focus of this rapid HIA; it is one of five brownfield properties in the area where EPA grant funds were directed or targeted brownfield assessments have occurred. This property is the location of the Former Chesapeake Supply (Delaware Dept. of Natural Resources and Environmental Control (DNREC) Project No. DE-1334) and includes two tax parcels totaling 1.75 acres (DNREC, 2017a). It is currently owned by the Downtown Dover Development Corporation. Figure 2 below uses a data layer from the "Cleanups in my Community (CIMC)" web application (www.epa.gov/cleanups/cleanups-my-community) and illustrates the location of the target brownfield site, the 0.5-mile and 1.0 mile radii around the study site, and the five other brownfields that fall within the 0.5-mile radius.

As part of past assessment activities, the Former Chesapeake Supply site was recognized to have fill materials and a range of previous uses, including fruit processor, basket manufacturer, creamery, plumbing/heating supply warehouses and construction equipment sales facility between 1910 and 2004 (DNREC, 2013). Groundwater at this target site has historically been impacted by tetrachloroethene (TCE) and chromium above DNREC groundwater standards (DNREC, 2013).

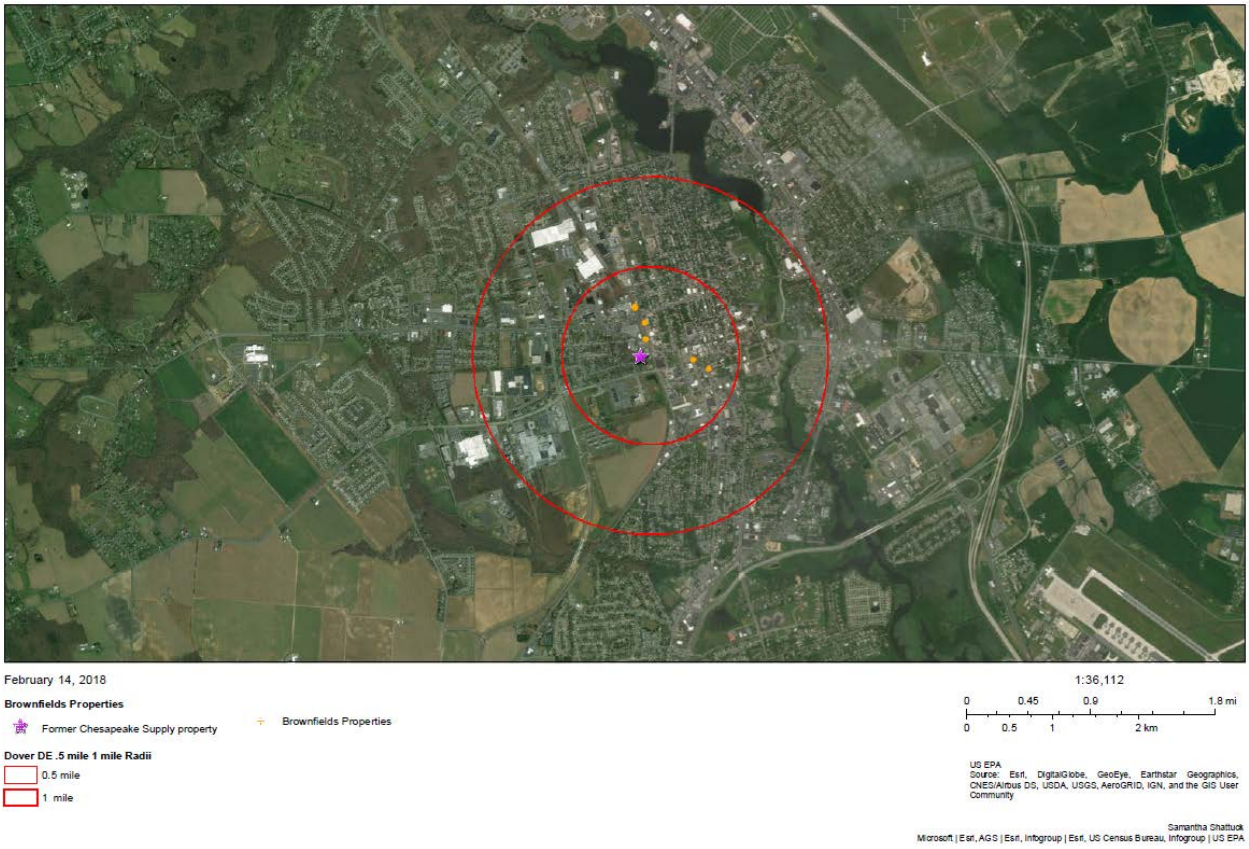


Figure 2. Map of Former Chesapeake Supply target site and surrounding brownfields (Source: ESRI). See Appendix 1 for full page map.

Suspected chromium soil contamination under site buildings prompted DNREC to better quantify potential exposure risks. Subsequent testing documented in the 2013 plan found no soil contamination (DNREC, 2013). DNREC files from 2013 document remediation requirements needed for a certificate of completion which include ground water monitoring for total and dissolved chromium and total and dissolved hexavalent chromium for a period of two years and the development and compliance with a Contaminated Materials Management Plan that describes handling and disposal for all soil and groundwater at the site to protect worker health and the environment (DNREC, 2013). The State of Delaware placed restrictions on land disturbance at the site and land use restrictions to prevent exposure to groundwater contamination, including prohibitions against the installation of groundwater wells or use of groundwater at the site (DNREC, 2013). A second amended remedial plan, signed June 1, 2017, updates earlier site documentation; documents demolition, remediation and development plan changes; and highlights results indicating no soil contamination (DNREC, 2017a). Two years of quarterly groundwater monitoring suggested TCE and chromium groundwater contamination is generated from off-site sources (DNREC, 2017a). The final plan, however, restricts on-site groundwater access without DNREC written permission.

THE SURROUNDING COMMUNITY

This target area has a majority low-income, minority residential population, including 13% who are children under the age of five years old, which is higher than the state average of 6% (US Census Bureau, American Community Survey, 2011-2015). Moreover, there are other indicators, such as poverty, unemployment, environmental degradation, and a lack of access to healthy foods which may suggest environmental justice concerns in the focus area. The City of Dover and Kent County are working with federal, state, local, non-profit and university partners to revitalize this part of Downtown Dover.

This site is adjacent to a rail line that is used mainly for the transportation of goods. Next door is a mechanic shop and other industrial businesses. Nearby is the Interfaith Mission for Housing, a former brownfield, which is a homeless shelter that provides services including "education opportunities, addiction counseling, employment training, mental health resourcing, and safe and affordable housing placement" (GuideStar, 2018). Delaware State News reported in November 2016 that the shelter had assisted 248 homeless men since opening in 2008, and 179 of those, or 72%, acquired jobs before leaving the shelter (Gronau, 2016). Also within downtown, there are banks, churches, municipal buildings, restaurants, shops and discount shops in addition to several vacant businesses and homes.

ENVIRONMENTAL JUSTICE

Environmental Justice (EJ) is defined by the EPA as "the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies" (US EPA, 2017a).

WHY WAS AN HIA PERFORMED?

The EPA's Office of Research and Development (ORD) considers HIA as one of the many tools to provide science-based resources and information for community-driven initiatives. This rapid HIA, an abbreviated form of HIA, is informing the City of Dover, Kent County and State of Delaware on development of a food production facility located on a former brownfield as they move forward in their planning process. Health impacts of different revitalization choices to support food production on brownfields in Dover could be associated with changes in:

- Risk reduction from brownfield site cleanup for revitalization.
- Employment prospects and job creation impacts for brownfield reuse and food production construction and operation.
- Public health and environmental impacts of a brownfield revitalization resulting in a food production reuse choice.
- Improved food access and local food market access.
- Increased food production training, employment, and job creation.

Other outcomes not fully explored that may be included in future efforts are health impacts associated with changes in traffic patterns, including foot traffic; impacts that result from increased construction in the area; health impacts based on location and proximity to the rail line; and other areas of community interest.

WHO PERFORMED THIS HIA?

Staff in EPA Region 3 (Mid-Atlantic), EPA Office of Brownfields and Land Revitalization (OBLR), and EPA Office of Research and Development (ORD) in Cincinnati and their contractor, Pegasus Technical Services, partnered to lead the HIA. These partners established the HIA Dover Project Team, which was made of EPA staff and contractors, and representatives from the following organizations: City of Dover (the primary decision-maker), Kent County, Delaware Office of State Planning Coordination, Delaware State University Department of Agriculture/Department of Finance and Accounting, Delaware Department of Agriculture, Delaware Department of Natural Resources and Environmental Control (DNREC), Delaware Division of Public Health, and U.S. Department of Agriculture (USDA). The HIA Project Team conducted the rapid HIA with the assistance of other local organizations, such as the Downtown Dover District Partnership and the National Council on Agricultural Life and Labor Research Fund, Inc. (NCALL).

WHAT METHODS WERE USED IN THIS HIA?

Following the *Minimum Elements and Practice Standards for Health Impact Assessments*, this HIA followed the established, six-step process: 1. screening, 2. scoping, 3. assessment, 4. recommendations, 5. reporting, and 6. monitoring and evaluation (Table 1; Bhatia, 2014).

Prior to the HIA process, EPA Region 3, through a Memorandum of Understanding with Delaware State University and technical assistance provided by EPA's Office of Brownfields and Land Revitalization, fostered a partnership with state, local and nonprofit organizations in and around the City of Dover and Kent County. The partnership flourished beyond the scope of a single project, which led to the exchange of ideas and the discussion of environmental tools that would cultivate a practical learning experience for university students, as well as assist with identifying issues that are important to the Dover community. This relationship was crucial in motivating the subsequent HIA.

The first step, screening, began at an HIA training workshop hosted by ORD and EPA Region 3 for interested parties from Delaware State University, City of Dover, Kent County, and Delaware State governments in June 2016. Consequently, it was determined that an HIA of the proposed brownfield revitalization project could be feasible, timely, align stakeholder interest, and add value to the decision-making process for the City of Dover. Thus, EPA ORD, EPA OBLR, and EPA Region 3 staff collaborated to pilot a rapid HIA in July 2017.

This rapid HIA utilized:

- ✓ Pre-existing and publicly available data (e.g., brownfield site-specific information from DNREC site data sources, food sales and access, employment and household income and job creation from past brownfield revitalization activities in Delaware, US Census and American Community Survey data, US Department of Justice crime data, reports, etc.).
- ✓ Standardized and rigorous analysis methods (geographic information systems (GIS) support for mapping and visualizations).
- ✓ Review of empirical, science-based literature and other HIAs. Although scientific literature is useful and informative, it may be limited in its generalizability and broad applicability and therefore may not relate specifically to Dover.
- ✓ Expertise from local environmental, planning, agriculture, economic development, public health professionals, researchers, and other stakeholders.
- ✓ Qualitative characterization of impacts using established HIA approaches (Pope et al., 2016).

WHAT WAS THE SCOPE OF THIS HIA?

At the scoping step, this HIA evaluated how the proposed project would influence five determinants of health (i.e., factors that affect health) selected by stakeholders to meet community interest, including 1) accessibility to goods and services, specifically fresh and affordable food; 2) job creation; 3) brownfield revitalization impacts on downtown economic development, specifically business performance; 4) crime, including both personal and property crime; and 5) household and community economics, specifically household income and employment (Figure 3). In addition, the focus of the study area was established to include a one-mile radius around the proposed project site (238 Railroad Ave, Dover, DE; Figure 2) in which data were examined and the health impacts were appraised; particular attention was paid to the demographics of the half-mile radius as this population has lower levels of income, employment, and housing security compared to the one-mile radius (Table 2).

The community planned a focus on food production, which may include an aquaponics project, a hydroponics facility, a combination of the two, or other viable food production options. Although the type of food production facility at the proposed brownfield site is yet to be determined, this HIA frequently provides information specific to an aquaponic option due to the growing interest in urban aquaponic farms as a sustainable method to provide a source of healthy, fresh, and cost-effective protein and vegetables to the local community, while providing job and educational opportunities for citizens.

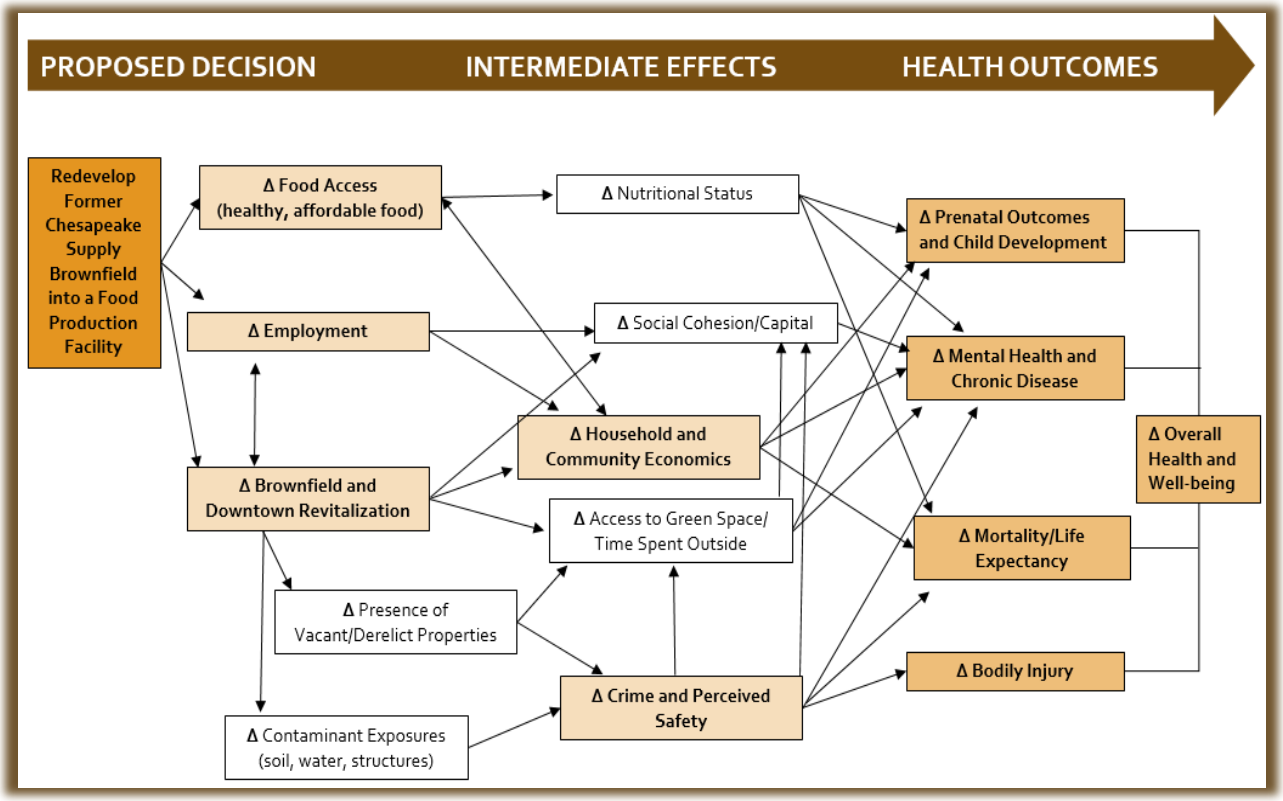


Figure 3. Pathway diagram used at scoping step to prioritize which health determinants to include in the HIA.

MAIN FINDINGS AND RECOMMENDATIONS OF THE HIA

WHO COULD BE AFFECTED BY THE PROPOSED PROJECT?

According to the 2011-2015 US Census Bureau American Community Survey (ACS) Five-Year Estimates, the City of Dover has a population of 37,144, while the one-mile radius surrounding the proposed project site is home to 8,580 residents (Table 2). The City of Dover has 14,362 housing units, with 13.0% vacancy (US Census Bureau American Community Survey, 2011 – 2015). See Table 2 below for more information.

Table 2. Demographic indicators of target site at 238 Railroad Ave., Dover, DE and surrounding areas (US Census Bureau American Community Survey, 2011 - 2015)

Indicator	0.5-mile radius around target site	1.0-mile radius around target site	City of Dover	State of Delaware
Total population	2508	8580	37,144	926,454
Population density	4789	2262	1581	443
Land area (sq mi)	0.52	3.79	23.5	1982
% Minority[a]	67%	54%	57%	36%
Age: % under 5 yrs	13%	9%	7%	6%
Age: % under 18 yrs	23%	18%	22%	22%
Age: % over 64 yrs	10%	14%	14%	16%
% Low income[b]	61%	48%	41%	28%
% Educational attainment (less than high school graduate)[c]	18%	15%	13%	12%
% Renter-occupied housing	64%	58%	50%	29%
% Employed[d]	61%	58%	60%	64%
% Unemployed[d]	4%	5%	9%	8%

[a]Percent minority is a fraction of the total population, where minority is defined as all but "Not Hispanic or Latino White Alone;" calculated from the US Census Bureau American Community Survey, 2011 – 2015.

[b]Percent of individuals whose ratio of household income to poverty level in the prior 12 months was less than 2; calculated from the US Census Bureau American Community Survey, 2011 – 2015.

[c]Percent of individuals age 25 and over with less than high school degree; calculated from the US Census Bureau American Community Survey, 2011 – 2015.

[d]Employment status estimates based on population age 16 and over; calculated from the US Census Bureau American Community Survey, 2011 – 2015.

HOW COULD THE PROPOSED PROJECT AFFECT HEALTH IN THE COMMUNITY?

Table 3: Health impact characterization criteria

DIRECTION
• Indicates whether the effect is harmful, beneficial, unclear • Values include "benefit to health," "detract from health," "no change," or "unsure/both benefit(s) and harm(s)"
LIKELIHOOD
• Indicates the chance or probability that the effect will occur • Values include "highly likely," "possible," or "not likely"
MAGNITUDE
• Indicates the expected size of the effect • Values include "high" (if thousands of people affected), "moderate" (if hundreds of people affected), or "low" (if few to none are affected)
DISTRIBUTION
• Delineates the spatial and/or socioeconomic boundaries of various groups that are likely to bear differential effects • Values include "all groups affected relatively equally" or "disproportionate effects," with disproportionately affected identified
SEVERITY (INTENSITY)
• Indicates the severity of the effect • Values include "severe" (fatal or disabling), "moderate" (needs medical treatment or intervention to resolve), or "minor" (does not need medical treatment or intervention to resolve)
PERMANENCE (TIMING AND DURATION)
• Indicates at what point of the proposed activity the effect will occur, how long it will last, and how rapidly the changes will occur • Values include "immediate" (effect occurs within 1 year) or "long-time" (effect takes 1 to several years); "short-term" (duration of impact is limited) or "long-lasting" (impact is expected to persist for an extended period of time or be permanent)
STRENGTH OF EVIDENCE
• Indicates the strength of the scientific evidence used to verify or refute proposed health pathways and to characterize the potential health impacts of the decision • Values include "strong," "limited," "lacking," or "insufficient"

The five health determinants included in the HIA scope were 1) food access; 2) crime; 3) household and community economics; 4) job creation and 5) brownfield redevelopment and urban revitalization (Figure 3). Once the potential impacts were identified, the extent of the effects was evaluated based on six criteria: likelihood, direction, magnitude, permanence, distribution, and strength of evidence (Table 3).

Table 4 provides a summary of the potential health impacts of the proposed project. It should be noted that development of the proposed food production business may contribute further to urban revitalization if it attracts future development in the area, provides employment opportunities to local community members, and helps to reduce crime in the area so workers and customers feel safe. Similarly, food access could increase as a result of this development if efforts are made to serve local needs and partner with local organizations and experienced food service providers. Community engagement may build local support for a food production reuse that meets local needs. Furthermore, a public-private partnership may be most effective in engaging the community and maximizing positive impacts on food access, joblessness, and poverty in the area, as well as serving food access needs in and beyond the target area.

Table 4: List of characterized health impacts of the Dover Brownfield Revitalization Project HIA

Health Determinant	Likelihood	Direction	Magnitude	Permanence	Distribution	Evidence
Food Access	Highly likely	Positive	Limited	Long lasting	Most vulnerable populations, including low income and food insecure households and those with limited transportation	Strong
Employment	Plausible	Positive	Limited	Long lasting	Those unemployed, underemployed or employed, but living below the poverty line	Strong
Brownfield Redevelopment & Urban Revitalization	Plausible	Positive	Moderate	Long lasting	Most vulnerable populations, including those living nearest the target site	Sufficient
Crime	Plausible	Positive	Limited	Long lasting	Most vulnerable populations, including the elderly, disabled, and children	Limited
Household and Community Economics	Plausible	Positive and Negative	Moderate	Long lasting	Including, but not limited to, most vulnerable populations, such as those with low food access and fewer job opportunities	Sufficient

WHAT CAN THE DECISION-MAKER DO TO MANAGE THESE IMPACTS?

The City of Dover is the main decision-maker in this HIA, and the recommendations target city efforts to select and support a successful reuse of the site. The HIA Leadership Team identified recommendations to maximize the potential positive health impacts and mitigate and/or avoid the potential negative health impacts identified in the rapid assessment. The recommendations support brownfield revitalization of this and other sites to introduce alternatives that can safely reuse properties, improve food access options, expand employment and improve and strengthen the local economy and household economies. Continued attention and support will help stakeholder coordination and/or collaboration, and opportunities for advocacy. A comprehensive list of both site-specific and more general urban revitalization recommendations is provided in the conclusion section of this rapid HIA report (Tables 13 and 14).

ASSESSMENT OF THE DETERMINANTS OF HEALTH

The following pages summarize how the proposed project and brownfield revitalization for food production could potentially affect the health of individuals in the community directly or indirectly through changes in the five health determinants. Each pathway includes a review of the literature-based evidence, description of existing conditions, an outline of the predicted health impacts, and examples of management strategies. Recommendations for community discussion can be found in Tables 13 and 14 at the end of the document.

FOOD ACCESS

REVIEW OF LITERATURE-BASED EVIDENCE

Limited access to fresh, healthy and affordable food is a challenge facing many communities which has health, economic and even broader consequences at the individual and community levels (USDA, 2009). Reduced food access and food insecurity can have a permanent impact on childhood development and can add to individual and family stress.

The Double Up Food Bucks Program (in Michigan and now elsewhere) is an example of a program that doubles the value of federal nutrition (Supplemental Nutrition Assistance Program [SNAP] or food stamps) benefits when used to purchase fruits and vegetables at participating markets and grocery stores, extending a low-income family's access to healthy foods. Established in 2009 in Detroit, the Double Up program has grown to more than 150 sites across Michigan and has served more than 300,000 low-income families and over 1,000 farmers (Fair Food Network, 2016). In 2016, Double up Food Bucks expanded to 16 states and included farmers' markets, farm stands, community supported agriculture (CSAs), grocery stores, and other retail locations (Fair Food Network, 2016).
info@doubleupfoodbucks.org

ACCESS TO HEALTHY FOODS IN DISADVANTAGED COMMUNITIES

Food security is defined by the US Department of Agriculture as "access by all people at all times to enough food for an active, healthy life" (USDA, 2009). Access to food, the quality of neighborhood food environments, and affordability of food as a contributor to disease and adverse health outcomes is an area of growing research with mixed results. Research has shown that neighborhoods with lower incomes have fewer chain supermarkets than those with middle and higher incomes; this pattern bears out when race and ethnicity is factored in as well (Powell, et al., 2007). When stores, such as corner stores and convenience stores, do sell groceries, they often carry food of lower nutritional value and rarely offer a range of fresh vegetables and fruits.

Transportation can be a consideration when evaluating a community's access to healthy foods. Supermarkets may require transportation to get there and without a sufficient public transport system or access to personal vehicles, many community members may be unable to reach these stores. Low income communities are disproportionately affected by limited numbers of supermarkets and limited transportation options to travel to supermarkets, and are therefore left with sparse healthy choices in the few stores that offer groceries in their neighborhoods. Even when a community has transportation to supermarkets or nearby farmers' markets,

affordability may also be a deterrent to accessing healthy foods. Farmers' markets across the country are implementing programs that enable the public to use government benefits and receive supplemental food income at food retail and farmers' market through electronic benefits transfer (EBT) and other program investment such as Double Up Food Bucks (USDA, 2017).

Aquaponics farming may be a sensible option for addressing food insecurity issues in communities because fish are an important part of a healthy diet. According to the Harvard T.H. Chan School of Public Health, fish are a great source of long-chain omega-3 fats as well as vitamin D, selenium, and protein. Research has shown that eating fish can reduce the risk of heart disease, stroke, depression, Alzheimer's disease, and other chronic conditions (Harvard School of Public Health, 2018). Moreover, an urban aquaponics farm can be a sustainable approach to providing communities with healthy, fresh, and cost-effective protein and vegetables which does not rely on surrounding soil and/or groundwater; this is especially valuable at brownfield sites where possible or perceived contamination may be of concern.

COMMUNITY GARDENS AND FOOD HUBS

Other communities utilize community gardens to increase access to healthy foods, create an environment for social cohesion and community building, and provide opportunities for the public to engage in healthy, active behavior like gardening (CDC, 2010). In brownfield areas, where use of soil or water resources for food production may be of concern, EPA and State partners offer technical assistance and brownfield grant resources to encourage site testing, ensure safe site selection and use of safe soil amendments. (US EPA, 2017b).

Another way to help build and strengthen a local food system is through the use of a food hub, which is defined by the USDA as "a centrally located facility with a business management structure facilitating the aggregation, storage, processing, distribution, and/or marketing of locally/regionally produced food products" (USDA, 2010). Food hubs can broaden access to institutional and retail markets for small to mid-sized producers; they can also increase consumer access to fresh and healthy foods, which can be particularly important in underserved areas and food deserts (USDA, 2010). One example is La Montanita, which buys from over 700 local farmers and producers, and warehouses and processes over 1,100 local products that are sold through the La Montanita retail co-op locations and other retail markets in New Mexico (USDA, 2010). Another example is the Detroit Eastern Market, a food hub which offers warehouse, storage, processing, marketing and retail functions to hundreds of producers, allowing them participation in Michigan's largest market (USDA, 2010).

OBESITY AND CHRONIC DISEASE

Limited access to healthy, fresh food can contribute to dietary diseases associated with obesity. The CDC defines adult obesity as having a body mass index (BMI) of 30.0 or greater, while being overweight for an adult is classified as a BMI of 25.0 or 29.9 (CDC, 2017). For children and young adults ages 2-20, BMI-for-age is determined using an age- and sex-specific percentile for BMI rather than the BMI categories used for adults (CDC, 2017). Poor dietary choices can contribute to obesity and chronic disease, and are often a result of limited food access and few healthy food choices in the built environment. Obesity is associated with Type 2 diabetes and other chronic diseases like heart disease, stroke and cancer (National Research Council, 2010; CDC, 2017). The built environment contributes to the development of these diseases when there are limited choices and access to full service grocery stores, affordable healthy food, and safe places to exercise (National Research Council, 2010; Salois, 2012). Some studies have found that increasing access to healthy foods can decrease obesity rates; Powell et al. (2007) found that the availability of large supermarkets was related to lower BMI, while higher BMI is related to the presence of corner or convenience stores which may have limited fresh food offerings (National Association of Counties, 2009; Franco, et al., 2008).

EXISTING CONDITIONS

ACCESS TO HEALTHY FOODS IN DISADVANTAGED COMMUNITIES

Access to healthy foods varies by location in Dover. For purposes of this project, conditions within the half to one-mile radius of the former Chesapeake Supply site were evaluated. Based on the Delaware Plan4Health initiative, there is one supermarket and one convenience store (which does not sell fresh foods) in the half mile surrounding the target site (Figure 4). The Dover Farmer's Market is also within a half mile on the Loockerman Plaza, but it operates weekly on Wednesday during the summer and fall months only. Again, the market does not sell a large amount of fresh fruits and vegetables, as it is more of a bazaar with food truck vendors. There are several transit stops in this study area for those with no vehicle access to allow transport to other grocers. There are also several areas where bicycle routes along major roads may put cyclists at risk of traffic accidents or injuries, so alternative proposed bicycle routes on smaller streets may increase mobility and access to residents if these are routes to local food stores or farmers' markets.

Furthermore, there are few nearby sources for residents to purchase fish for food consumption, making aquaponics an appealing food production alternative. In addition, many of the streams near but outside of the study area are impaired and restricted for finfish consumption due to the

presence of several contaminants (polychlorinated biphenyls [PCBs], dioxins and furans and dieldrin) (DNREC, 2017b).

The Delaware Plan4Health initiative produced a Retail Food Environment Index (RFEI) by zip code. The RFEI ranks, by zip code, where healthy food access is most needed. The study area is in the 75th percentile, which scores the area as having a high unhealthy-to-healthy food ratio. Moreover, Figure 4 shows market opportunity for grocery stores by census block in the study area. Market opportunity was calculated based on 2016 data using Esri's Leakage/Surplus Factor indexing, where values range from -100 to + 100, with a value of 0 representing a balanced market. The area immediately surrounding the Former Chesapeake Supply site indicates that the grocery market demand greatly exceeds its supply and may highlight an opportunity for new retailers to enter the area.

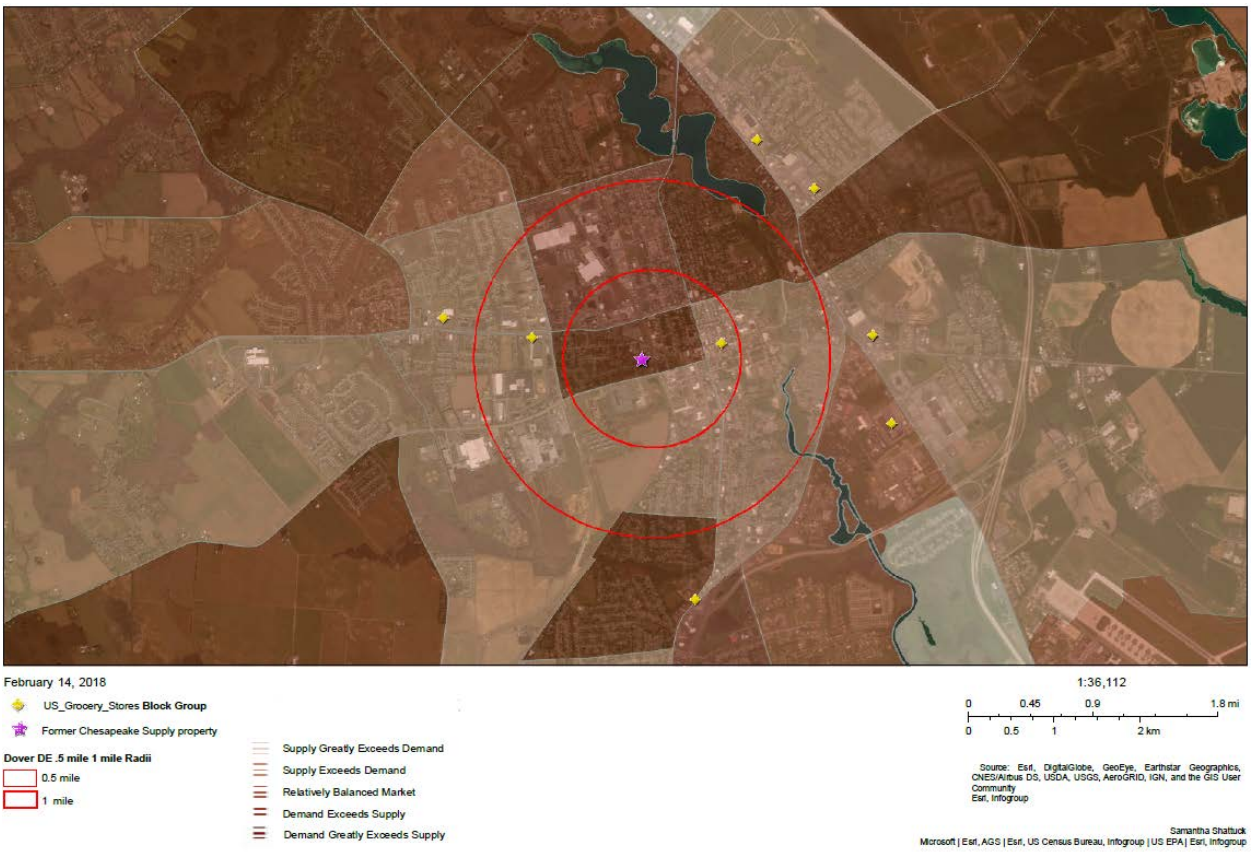


Figure 4. Map of the Former Chesapeake Supply target site, nearby grocery store locations, and market opportunity (Source: Esri). See Appendix 2 for full page map.

KENT COMMUNITY GARDEN COLLABORATIVE

The Kent County Garden Collaborative (KCGC) is a network of gardeners and community members who install and maintain community gardens throughout Kent County. The KCGC has expanded its partnership and efforts in community gardening. There are four within three miles of the Former Chesapeake Supply site, one of which is located on the property adjacent to the site. The Dover Interfaith Mission for Housing (684 Forest Street) previously had an active community garden that was maintained and used by the shelter's residents; concerns about soil conditions led to the closure of this garden

Childhood obesity rates are also high in Delaware. In 2015, adolescents from grades 9-12 were found to be overweight and obese at rates of 15.8% each (compared to 16.0% overweight and 13.9% obese at national levels) (CDC, n.d.). In 2014, Women, Infants, and Children (WIC) program participants aged 2-4 years had overweight and obesity rates of 17.2% and 16.2%, respectively, which ranked Delaware 3rd among all states. (CDC, n.d.).

NUTRITION QUALITY AND AVAILABILITY IN SCHOOLS

Information from the USDA Food Environments Atlas from 2012 suggests that 16.9% of the population of Kent County receives Supplemental Nutrition Assistance Program (SNAP) benefits. In 2016, an estimated $346,384 was redeemed in benefits from SNAP authorized stores within Kent County (USDA, 2018).

Making Connections:

Public-Private Initiatives

in Dover

There are several studies and public-private initiatives in Delaware and Dover that seek to address access to healthy foods in local schools as well as national examples to inform practice.

Several organizations work in tandem and with local schools to address healthy foods in schools. More research and dialogue on this topic should be considered; several resources are provided below:

- https://www.nemours.org/content/dam/nemours/www/filebox/service/preventive/nhps/inthenews/obesitybattle.pdf
- https://www.benefits.gov/benefits/benefit-details/1956
- http://deschoolnutrition.org/index.php?bypassCookie=1
- http://www.actionforhealthykids.org/in-your-state/delaware/welcome

Many of the residents within the study area are considered low income and may be taking advantage of SNAP. An additional program, SNAP – Education (Ed), is designed to assist people eligible for SNAP in leading healthier lives by teaching about good nutrition, efficient spending on healthier foods, and having an active lifestyle. SNAP-Ed works with community organizations to have a greater impact; for example, one of the program's partners is local schools.

A school eligible for SNAP-Ed must have 50% of the students considered low-income or receiving free or reduced lunches. The Former Chesapeake Supply site is within the Capital School District; this district includes

two eligible schools located less than a half mile from the proposed project site: Booker T. Washington Elementary School (901 Forest Street) with 62.9% low-income (2016-2017) and William Henry Middle School (65 Carver Road) with 53.3% low-income (2016-2017). Although these schools are eligible for SNAP-Ed programming, the program is not currently conducted at either school.

In addition to school lunch programs and SNAP-Ed to support healthy food availability in schools, the KCGC has a network of gardens at local schools. For example, Towne Point Elementary School has a garden, which is grown, maintained and distributed by students as part of their curriculum. This allows students to eat fresh food they have grown and gives them skills in growing food and food handling that they can take back to their communities; all of which can provide a new appreciation for healthy foods.

BRASS CITY HARVEST
OUR FUTURE IS GROWING

Brass City Harvest is a 501(c)(3) nonprofit urban agricultural organization that makes fresh food accessible to the population in Waterbury, CT. With the support of several funders, Brass City has transformed vacant, brownfield land into productive urban agriculture space, constructed greenhouses, created hydroponic (soil-less growing) lettuce and vine crop programs, as well as aquaculture in Waterbury. The mission of Brass City Harvest is "to encourage self-sufficiency and healthy lifestyle choices for low-income, at-risk populations through collaborative partnerships, supportive services, and a sustainable community food system." Brass City Harvest accomplishes this by working with more than 12 local farms and dairies to provide them with Connecticut grown produce, beef, poultry, and dairy to satisfy the needs of their patrons and clients. They also provide outreach, healthy cooking and nutrition classes in schools and senior centers and senior housing sites.

https://www.brasscityharvestwtby.org/

PREDICTED HEALTH IMPACTS

DOES THE BROWNFIELD REVITALIZATION PROJECT HAVE THE POTENTIAL TO INFLUENCE FOOD ACCESS IN THE COMMUNITY?

A brownfield revitalized for fresh food production targeted to local residents can increase healthy food access to the Dover community, particularly if there is coordination and collaboration with KCGC, local schools and state/county/city planning (Table 5). This site, as part of a hub for fresh foods, could significantly improve food access to residents living within one-mile of the site if designed and planned to meet that purpose. It might also contribute to hunger prevention and food safety net services in and around the study area (Food Bank of Delaware, n.d.).

It is **highly likely** that the proposed project will increase fresh food access to residents in the study area as it will be an alternative or supplement to food bought at the local convenience store. Further, the redevelopment of a brownfield site for food production could increase residents' health and may help decrease community obesity and morbidity, thereby causing a **positive impact**. In addition, the discussion around the brownfield conversion to food production might support future campaigns around food access, choosing and cooking healthy food, dietary disease prevention and disease management, and the importance of physical activity for health.

Increased access to fresh food will directly affect a **limited number** of people in the immediate community due to the low number of residents within the half-mile radius, but may have farther reaching effects if targeting a broader underserved market area. The effects may increase as the area is revitalized and more people move to the area and/or visit nearby businesses. The impact on access to fresh food will be **long-lasting** and **permanent** if the site reuse succeeds and local partners work to assist in its expansion and outreach. The increase in access to healthy foods will benefit the entire population in the area, but **susceptible sub-populations** may benefit most. These include minorities, low-income, and those most vulnerable to a lack of access to healthy affordable food and increased risk for obesity; this includes both adult and child populations. Affordability of healthy foods should be prioritized to ensure access to these populations. There is **strong evidence** that supports the relationship between increased healthy food access and reduced obesity, chronic disease, and morbidity associated with unhealthy eating habits.

Table 5. Impact characterization and management strategies for Food Access

Criteria	Scale	Potential Impact Management Strategies
Likelihood	Highly likely	Establish a varied produce/fish selection to create appropriate nutritional balance of foods.
Direction	Positive	Incorporate ease of access planning, such as green spaces, well-lit streets and sidewalks for walkability to site.
Magnitude	Limited	Conduct appropriate outreach and advertising within the one-mile radius. Establish plan of expansion for greater reach and impact. Evaluate the feasibility of a "food hub" or similar system in Kent County to appropriately link small food producers to a larger market for the products to be grown.
Permanence	Long term	Strong business plan and apply the use of the Aquaponics Business Plan User Guide for operating strategies (see Appendix 7).
Distribution	Most vulnerable populations	Define customer and type of distribution, to manage food quality, safety and understand actual community impact. Create a workgroup with local partners and faculty from Delaware State University to discuss and research how to introduce hydroponics/aquaponics to the local market.
Strength of Evidence	Strong	None.

EMPLOYMENT

REVIEW OF LITERATURE-BASED EVIDENCE

EMPLOYMENT AND HEALTH

Health and employment are interconnected, as employment provides an income to help fulfill basics like food and housing, education, transportation, health insurance and other health-promoting expenses (Krieger and Higgins, 2002; Krieger, et al., 2011). Access to health insurance and a stable income can also reduce the risk for chronic disease, communicable disease, and poor mental health. Additionally, employment provides psychological and social benefits by promoting a more stable lifestyle, fulfilling a desire to work, and reducing stress of financial insecurity (Gilman, et al. 2003; Bhatia and Guzman, 2004; Keene and Geronimus, 2011).

Employment is the most common way for the public to collect an income to provide for their necessities. Non-employment related income such as investments, properties, and Social Services income account for a much lower percentage of overall income and represent vastly different sectors of the population. Lack of access to employment, under-employment, or jobs which do not pay a living wage (sufficient income to meet minimum standards given the local cost of living) or provide sufficient benefits can contribute to stress, depression, malnourishment or obesity, homelessness, and many other negative outcomes. The CDC reports that those living nearer at or below the poverty level report greater percentages of adults with fair or poor health (CDC, 2013).

EMPLOYMENT RELATED TO BROWNFIELDS

Brownfield redevelopment and downtown revitalization present both direct and indirect opportunities for job growth in Dover. The investment leveraged in a brownfield project can provide opportunity throughout the city; and laws, policies and negotiated agreements tied to such funding can include provisions for ensuring jobs for residents to multiply those impacts (Bartik, 2009). Cumulative national brownfield reporting through 2016 to EPA suggests 8.5 jobs were leveraged for each $100,000 in EPA brownfield assessment, revolving loan fund, and cleanup grant funds (US EPA, 2017c).

Transportation, both public and private, may be limited in low income communities, and brownfield revitalization planning (depending on the proposed reuse) can highlight improvements needed for complete streets. Limited transportation services in areas can directly impact the ability of these communities to obtain and maintain employment and development prospects. By increasing the amount of job opportunities in a neighborhood, the burden of transportation is reduced (Probst, et al., 2007).

Depending on the size and scale of the project and the nature of the reuse, a brownfield revitalization project may provide only a limited number of positions in the construction or environmental cleanup activities. However, the subsequent reuse, depending on the type, will likely require employees. As proposed, a new food production site will also require employees based on the operation. If employees are hired locally, household economics can improve, benefiting the community and tax base. Income taxes from these positions will be generated and the community tax base may rise as downtown revitalization increases and more employment becomes available for community members.

An increased tax base and increased foot traffic in an area can bring greater health by increasing the potential for more businesses, employment, and economic growth. If fish or other produce will be sold locally through farmer's markets, subscription through local community support agriculture (CSA) or aquaculture cooperatives may also increase income.

EMPLOYMENT RELATED TO AQUAPONICS/HYDROPONICS AND FOOD

In 2011, the EPA produced the Urban Farm Business Plan Handbook to support business development in the startup and operation of an urban farm. Aquaponics is only one aspect of this field, and subsequently, an Aquaponics Business Plan User Guide specifically for strategies specific for an aquaponics farm was produced in 2016 through a partnership between EPA Region 3, Delaware State University, Kent Economic Partnership, Kent Community Gardens Collaborative and Delaware Division of Public Health.

Aquaculture is a growing part of the United States economy. The 2013 Census of Agriculture showed a 26% increase in the industry from 2005 to 2013, when the sale of aquaculture products totaled $14 billion (USDA, 2014). However, Delaware was one of only two states not listed in the agriculture census, either for a lack of reporting or record keeping.

The Bureau of Labor and Statistics indicates an average hourly wage of approximated $17 per hour, but may range from $12 to $28 per hour for jobs in food manufacturing (US Dept. of Labor, 2018a). Individuals interested in pursuing a career in agriculture and food science may earn up to $64,000 per year, but require a bachelor's degree (US Dept. of Labor, 2018b).

EXISTING CONDITIONS

The area has a high unemployment rate, but even employed residents may fall under the poverty line. According to the US Census Bureau American Community Survey, 2011 - 2015, the poverty rate in Dover is 20%, while the poverty rate within a half mile radius and one-mile radius is 61% and 48%, respectively. The city's employment rate was estimated at 60%, compared to

the target area, 61% in the half-mile radius and 58% in the one-mile radius (US Census Bureau American Community Survey, 2011 – 2015).

Educational attainment also influences an individual's access to employment, sufficient income, health insurance, and other necessities. The US Census Bureau American Community Survey, 2011 – 2015, reports that within the half-mile radius, 19% of the community lacked a high school diploma, while in the one-mile radius, that number was 16%.

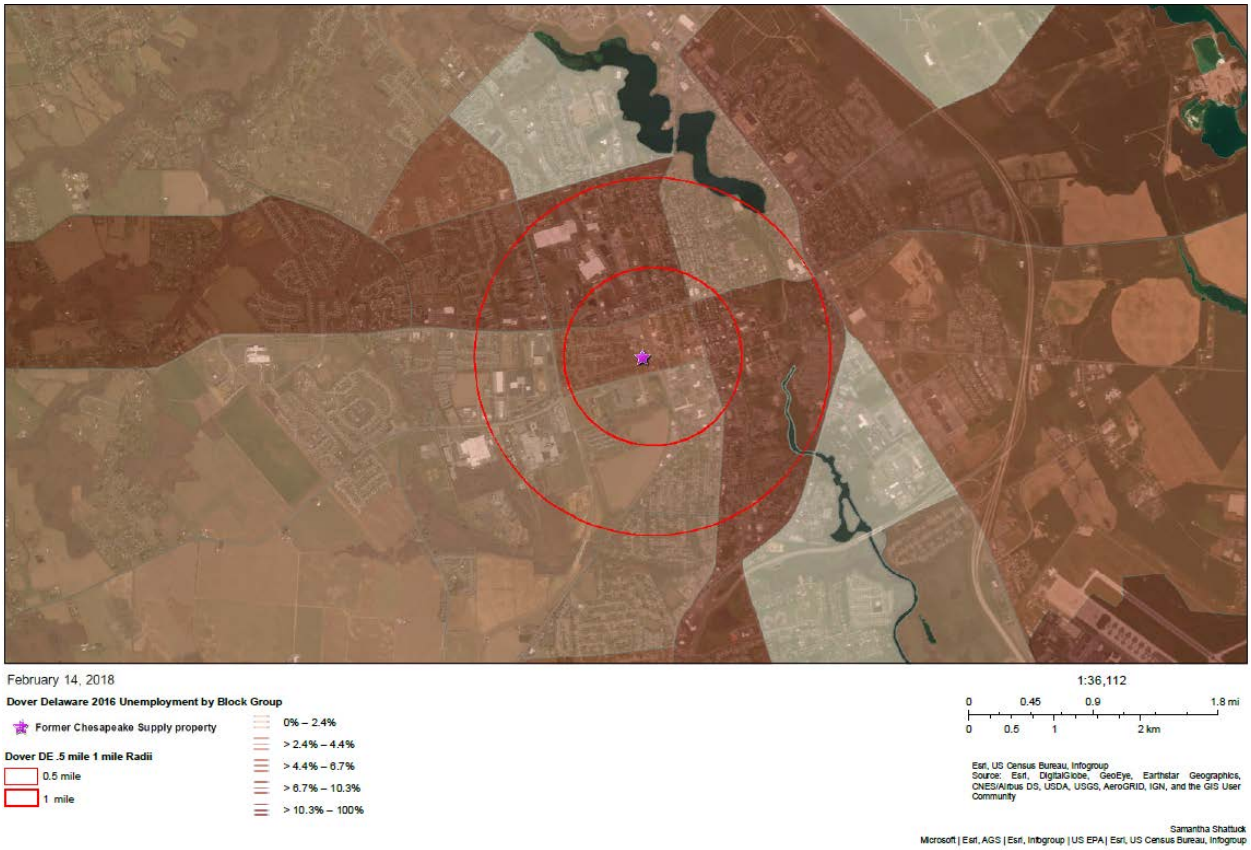


Figure 5: Map of Former Chesapeake Supply target site and percent unemployment (Source: Esri). See Appendix 3 for full page map.

American FactFinder, from the US Census Bureau, provides employment data by sector from the 2011-2015 American Community Survey (Table 6). The largest employer in Delaware, and in Dover, is the state government ranging over multiple sectors. Kent County and the Dover Air Force Base are also significant employers in the city, as are BayHealth Medical Center, Delaware State University, and Delaware Tech and Community College. The unemployment rate in Dover in 2011-2015 was an average of 9%, while within the target area, the unemployment rate was just 4% in the half-mile radius and 5% in the one-mile radius. (US Census Bureau American Community Survey, 2011 - 2015).

Table 6. 2015 Employment rates by sector for Dover (US Census Bureau American Community Survey, 2011 - 2015)

Sector	Number	Percent
Civilian employed population 16 years and over	15,527	-
Agriculture, forestry, fishing and hunting, and mining	34	0.02%
Construction	543	3.5%
Manufacturing	861	5.5%
Wholesale trade	220	1.4%
Retail trade	2,371	15.3%
Transportation and warehousing, utilities	744	4.8%
Information	171	1.1%
Finance and insurance, and real estate and rental and leasing	668	4.3%
Professional, scientific, and management, and administrative and waste management services	899	5.8%
Educational services, and health care and social assistance	4,783	30.8%
Arts, entertainment, and recreation, and accommodation and food services	2,16	13.9%
Other services, except public administration	701	4.5%
Public administration	1,366	8.8%

PREDICTED HEALTH IMPACTS

DOES THE BROWNFIELD REVITALIZATION PROJECT HAVE THE POTENTIAL TO INFLUENCE EMPLOYMENT IN THE COMMUNITY?

It is **plausible** that redeveloping this brownfield site into an aquaponics facility or other food production will create job opportunities, but it is uncertain as to whether the local residents will be hired for these positions (Table 7). The employment opportunities at this site, including in construction, food processing, distribution, and retail, would have a **positive impact** on the community and employment levels. The economic activity that may be spurred by the revitalization of this site may lead to even more employment in the area.

The additional employment opportunities would affect a **limited number of people** given the limited number of positions at the site, but as the aquaponics or associated food production expands and economic activity grows in the area, there may be more employment opportunities. The impact on employment would be **long lasting**, dependent on continued successful operations and the site remaining in use.

The employment opportunities would **benefit those without jobs or who are working in positions under the poverty line** if they are the ones hired for the positions. Requirements for resident hiring and job training opportunities may be necessary to maximize this impact. There is **strong evidence** that greater employment opportunities can improve the health of the individuals and the community. Other downtown revitalization efforts and ongoing maintenance of improved areas might also benefit the local labor force.

Table 7. Impact characterization and management strategies for Employment

Criteria	Scale	Potential Impact Management Strategies
Likelihood	Plausible	Explore with Interfaith Mission management the possibility of entry level employment for Mission clients. Incorporate employment opportunities for residents during maintenance and construction. Develop and incorporate urban farming and green infrastructure training for residents and community groups.
Direction	Positive	Provide a living wage to all employees.
Magnitude	Limited	Provide funding opportunities for local entrepreneurs (e.g. small business grants, foundation matching, matching grants for job creation, etc.) aimed at creating jobs.
Permanence	Long lasting	Use green infrastructure to stimulate job creation through maintenance of the site's greenspace.
Distribution	Unemployed or those below the poverty line	Target job training and hiring towards these community members. Investigate community programs that could assist families experiencing unemployment, such as job training, job search resources through the libraries, connections to aid groups (such as churches or United Way), local hiring initiatives, and even select types of financial assistance, such as deferred property taxes for unemployed residents participating in a job preparation program.
Strength of Evidence	Strong	None.

BROWNFIELD AND DOWNTOWN REVITALIZATION

REVIEW OF LITERATURE-BASED EVIDENCE

BROWNFIELDS AND HEALTH

Proximity to brownfields, known or suspected contaminated sites and structures, has been shown to have a significant relationship with increased sickness and disease (Litt and Burke, 2002; Solitare and Greenberg, 2002). In addition, brownfield sites in a community can become havens for criminal activity and centers of neighborhood neglect (Greenberg, et al., 1998). However, brownfield redevelopment, which entails a remediation of the site to acceptable health standards, can cause positive health impacts on the community by reducing the health risks associated with the contamination and mitigating the overall negative impact of brownfields on the community (Solitare and Greenberg, 2002).

BROWNFIELD REVITALIZATION AND HEALTH

Brownfields are of increasing interest as settings which, once cleaned and redeveloped, can reduce environmental exposures to land and structural contaminants and hazards. Revitalization of brownfields can also meet a range of community needs for economic development, employment, access to services and environmental and public health improvements. Research has examined brownfield redevelopment as an infill alternative to conventional suburban or ex-urban sprawl development, thereby reducing the environmental and public health impacts associated with air pollution and stormwater impacts from traffic, vehicle miles travelled and impervious surfaces (Greenberg, et al., 2001; Nagengast, et al., 2011; Mashayekh, et al., 2012). Some research has examined chronic disease and adverse health outcomes in brownfield lands and developed areas in England (Litt and Burke, 2002; Bambra, et al., 2014); however, limited attention has been directed at health impacts of brownfield revitalization.

Redevelopment and conversion of brownfields to greenspace is an emerging trend. Greenspace is widely defined as open public space with natural elements that can be used for recreation, relief, or social interaction (Maas, et al., 2006; Comber, et al., 2008; Lee and Maheswaran, 2011). Greenspace provides an opportunity to experience nature in a sea of buildings and concrete structures (Wilson, 1984; Frumkin, 2001). DeSousa (2004, 2006) has estimated that up to 5% of brownfields are being restored for green space reuse, while other researchers have highlighted the opportunities and benefits of brownfield conversion to greenspace (Dorsey, 2003; Schilling and Logan, 2008). Access to greenspace has the potential to lead to multiple positive health outcomes, such as increased well-being, reduced fear and anxiety, increased cognitive functioning, increased self-discipline, better impulse control, improved mental health, increased stress relief, higher neighborhood satisfaction, increased social cohesion, increased physical

activity, lower BMI and reduced violence (Kuo, 2001; Bell, et al., 2008; Sugiyama, et al., 2008; van den Berg, et al. 2010; Stigsdotter, et al. 2010; Maas, et al., 2009a). In addition, researchers have identified benefits in improved social capital from community garden and greening efforts (Jennings, et al, 2016; Alaimo, et al, 2016).

Access to greenspace and parks is increasingly seen as an equity issue due to reduced availability in low income and racial and ethnic minority communities. The National Housing Federation found that those in less affluent areas had only one-fifth the access to local parks than those in more affluent areas (Wheeler, 2011). In addition to access, the quality of greenspace can also influence the utilization of that space (Lee and Maheswaran, 2011); this is important since the relationship between access to green space and health has been found to be stronger in children, the elderly and those with lower incomes, most likely because they spend more time closer to home and in their neighborhoods (Maas, et al., 2009b). It is imperative to consider this issue because those who would stand to benefit the most from high access to greenspace are typically those who also have the least access (Lachowycz and Jones, 2014). The conversion of brownfields to green space may assist in addressing some of the disparities in park access if located in areas where green space creation is an option.

EXISTING CONDITIONS

In 2004, the Delaware Brownfields Development Program (BDP) was established within the Site Investigation and Restoration Section (SIRS) of the Division of Waste and Hazardous Substances at DNREC (Delaware Code Title 7 Chapter 91 subchapter II). The BDP supports the remediation and revitalization of properties that are vacant, abandoned, or underutilized by providing financial assistance and liability protections to eligible applicants. In addition, the Delaware Brownfield Marketplace was created to provide online access to information on market-ready brownfields. The benefits of the BDP to Delaware's economy have been significant; for example, an economic impact study conducted by the University of Delaware Center for Applied Demography & Survey Research (UD CADSR) indicated that every dollar spent by the BDP generates a $17.50 return on the state's initial investment (Merriman-Nai and Sargent, 2013). Statewide, nearly 700 jobs were created due to ensuing remediation and development activities (Merriman-Nai and Sargent, 2013). Through 2008, the total assessed value of state-certified brownfields in nearby New Castle County increased by more than $455 million (Merriman-Nai and Sargent, 2013).

As of October 2017, 273 brownfields have been certified in Delaware; there are five brownfield properties within the half-mile area surrounding the target location for the proposed project described in this HIA (DNREC, 2017a). As indicated in the description of the proposed study site above, the target property consists of two tax parcels, totaling approximately 1.75 acres. The

northwestern parcel is a vacant grassy lot; the other parcel had five commercial buildings, which have been demolished. Although currently owned by the Downtown Dover Development Corp., it is the site of the Former Chesapeake Supply Co. (DNREC, 2017a).

As mentioned previously, groundwater at the site has been impacted by tetrachloroethene (TCE) and chromium above DNREC groundwater standards. Conversely, risk assessment showed that the risk associated with vapor intrusion to indoor air from groundwater is below DNREC standards. Recent groundwater monitoring concluded that chromium in groundwater was due to an offsite source to the north or northwest of the target location and not due to onsite soil contamination. However, it is not permissible to use water from wells onsite. (DNREC, 2017a).

PREDICTED HEALTH IMPACTS

DOES THE BROWNFIELD REVITALIZATION PROJECT HAVE THE POTENTIAL TO INFLUENCE HEALTH IN THE COMMUNITY?

It is **likely** that the brownfield revitalization project could influence health in the community if residents are accessing the vacant site for illegal or harmful activities (Table 8). Perceived risks from the brownfield can be addressed through public engagement and communication with community residents and neighbors. In addition to the environmental health risks of actual exposures to contaminants and fears of potential exposures, brownfields may be associated with crime or fear of crime and perceptions of personal safety that affect health of neighbors and nearby residents.

The redevelopment of the Former Chesapeake Supply could have a **positive** impact and improve health by reducing contaminant exposures and fears regarding contaminant exposures, refocusing local business and residents to other health threats posed by vacant businesses or structures, and placing greater attention on addressing poorly maintained residential or commercial structures as well as public places. Renewed attention to the aesthetics of the downtown area may increase upkeep and resident pride in their community.

While the total property acreage is 1.75 acres, only a small portion of the site has a frontage on Main Street that is visible to the street, motorists, pedestrians and consumers. This may be advantageous for certain operations but may only have a **moderate** impact on block aesthetics or built environment improvements. However once redeveloped, the positive impacts of revitalization from environmental improvements, reduction in fear and stigma, increased aesthetic appeal and greater attention to the streetscape are expected to have **long-lasting** effects.

Community residents near the property, which includes several **disadvantaged community members** and households, are likely to reap the greatest benefits of an improved property and

employment prospects. The benefits can be multiplied with the establishment of local incentives or protections that encourage local hiring, meet identified community needs and contribute to building local capacity for neighborhood revitalization. An important safe guard to ensure that community residents and neighbors are not displaced by revitalization is to pass local policies or ordinances that minimize displacement.

There is a body of research that has generated **sufficient** documentation of the opportunities and the benefits of brownfield revitalization on property values and reduced risk of environmental exposures and employment (Haninger and Timmins, 2012; Sullivan, 2017). The return of tax foreclosed or vacant properties to the tax rolls can have local impacts as a stronger tax base and growth in local revenue allows communities to afford local services which can range from early childhood vaccinations to disaster preparedness depending on level of locally supported services.

Table 8. Impact characterization and management strategies for Brownfield Revitalization

Criteria	Scale	Potential Impact Management Strategies
Likelihood	Likely	Inform and educate residents and local businesses about the site history, cleanup, land use restrictions and proposed reuse plans. Outline ways exposure risk reduction is incorporated into revitalization plans as part of a public meeting, site tour and other outreach methods to ensure residents are aware past hazards are addressed. Invite community organizations, residents and students to identify potential brownfields to advance food innovation district efforts.
Direction	Positive	Work with local students, researchers and leaders to track local resident, business and developer perceptions on impacts of brownfield revitalization. Document target area resident and worker food access status and invite local organizations and researchers to commit to HIA updates, evaluation or track project progress and food access trends. Consider constituting a community advisory council to advance brownfield identification for other food production ventures.
Magnitude	Moderate	Work with community partners and local leaders to review and participate in visioning or design charrettes to identify site design and other downtown revitalization improvements valued by residents. Solicit local artists and organizations in other beautification efforts.
Permanence	Long lasting	Continue design charrette and other visioning efforts to address other vacant or abandoned parcels or identified brownfields. Solicit local artists and organizations in other beautification efforts and area schools in design competitions for design that meets community needs.
Distribution	Most disadvantaged to benefit most	Consider constituting a community advisory council to help educate residents and community service about brownfields and advance brownfield identification for other food production or community ventures.
Strength of Evidence	Sufficient	Expand work with local universities, students, researchers and leaders to track brownfield revitalization impacts and state and county approaches that can include brownfield revitalization in longer term strategies.

CRIME AND PERCEIVED SAFETY

REVIEW OF LITERATURE-BASED EVIDENCE

CRIME AND HEALTH

Being a victim of crime can have a range of effects on victims' physical health, employment and education prospects, and emotional wellbeing. In addition, crime can have long-term impacts on individuals and a community; the experience can be a lasting trauma for the neighborhood and the subsequent reputation may negatively affect development. Crime and stress from crime in the neighborhood has been linked to increased risk of mental health disorders and worsened severity of depression in adults (Ross, 2000; Kim, 2008). Moreover, adolescents can be especially affected by crime in their community; this experience has been tied to mental illness that can carry into adulthood (Aneshensel and Sucoff, 1996). Furthermore, research has found that stress caused by crime or even perception of crime in a neighborhood can cause chronic health problems, such as hypertension, cardiovascular disease, and immune dysfunction in its residents (Latkin and Curry, 2003; McEwen, 2008; Glaser and Kiecolt-Glasier 2005).

Perception of crime and safety can affect the public's general health and well-being because they may be less willing or able to participate in physical activity like exercise, play, or active transportation options (Yang, et al. 2012). These impacts may not be equally felt by every member of the community, however; individual factors, such as age, gender, and socio-economic status, effect the level of perceived safety and therefore the impacts that crime may have on these community members (Bracy, et al., 2014; Latkin, et al., 2009). It is also important to note that being the victim of crime makes an individual more likely to be affected by perceived safety/security and crime. Likewise, community cohesion can be impacted by crime and perceived safety, as the less active the community is in public, the less interaction may occur between individuals, families, and members of neighboring communities (Snelgrove, et al., 2004).

BROWNFIELD REVITALIZATION AND CRIME

Vacant or blighted properties can be a significant issue associated with brownfield sites. Abandoned homes, vacant lands, and neglected natural elements in urban environments are vulnerable to crime (Garvin, et al., 2013). Studies have demonstrated that the presence of vacant homes has been associated with higher levels of crime and illegal activity, such as prostitution, drug sales, and drug use by adolescents (Cohen, et al., 2000; Furr-Holden, et al., 2011; Spelman, 1993). Securing abandoned buildings appears to be a highly cost-effective crime control tactic for distressed neighborhoods (Spelman, 1993). Greening of vacant lots, reduction in blight, and routine landscaping of brownfield sites may also prevent opportunities for crime (Branas, et al., 2011).

Brownfield revitalization can help to reduce the potential for crime in an area and may help alleviate the perception of crime or danger in an area. Crime Prevention Through Environmental Design (CPTED) provides many great examples of how to construct green spaces, streetscapes, and other development that can enhance the pedestrian environment and limit opportunities for crime (Carter, et al., 2003). Furthermore, CPTED can increase the opportunity for "eyes on the street" from residents, businesses, and consumers to maximize visibility of private and public space; this increases risk of detection of criminal and other undesirable activities, but also fosters positive social interaction among users of the space (Jacobs, 1961). Reduced crime can improve health by reversing these limitations on time spent outside. As the rate of crime and the perception of risk are reduced, the public will be more willing to recreate and socialize outside (Snelgrove, et al., 2004).

Crime Prevention Through Environmental Design (City of Portland, 2015)

Surveillance – Design and maintenance can support the observation of space around people on the site and limit hiding places for crime to occur. This can include the use of appropriate lighting, see-through fencing and landscaping, and the placement of windows, doors, and walkways.

Territorial Reinforcement – Designating space for public, private, and semi-private areas help the public know and participate in an area's intended use, which can discourage the perception that crime can occur without notice or consequences. This can include displaying security system signage at access points, placing amenities, such as seating or refreshments, in common areas to attract larger numbers of desired users, and scheduling activities at common areas to increase proper use of space.

Access Control – Limiting the opportunity for crime by controlling access to public and private space. This can be achieved by creating an entry way or highly visible gate which all users of a property must enter; posting signage and use of window and door locks can limit unwanted access into private space or unmonitored areas, as well.

According to the 2014 Uniform Crime Reporting Program from the US Department of Justice Federal Bureau of Investigation, Dover has elevated violent and property crime rates compared to state and national averages (Table 9).

Table 9. Crime rates per 100,000 population in Dover, Delaware, and US (US DOJ, 2014).

Crime rate (per 100,000 population)	City of Dover	Delaware State	US National Average
Violent	637	489	376
Property	4,969	2,982	2,596

Much of the crime that takes place in Dover is property crime, including burglary, motor vehicle theft, and larceny-theft; the chance of becoming victim of a property crime is as much as one in 18 in Dover according to NeighborhoodScout (2017). Figure 6, below, shows the 2017 national property crime index created by Esri by census block, where an index value of 100 representing the national average, and an index value of 120 implies that property crime is 20 percent higher than the national average. The chance of becoming a victim of a violent crime, which includes murder, rape, robbery, and assault, is as much as one in 124 in Dover, according to realty statistic website NeighborhoodScout's analysis of FBI data (NeighborhoodScout, 2017). Figure 7, below, shows the Esri 2017 national personal crime index by census block, using the same index as Figure 6, on property crime.

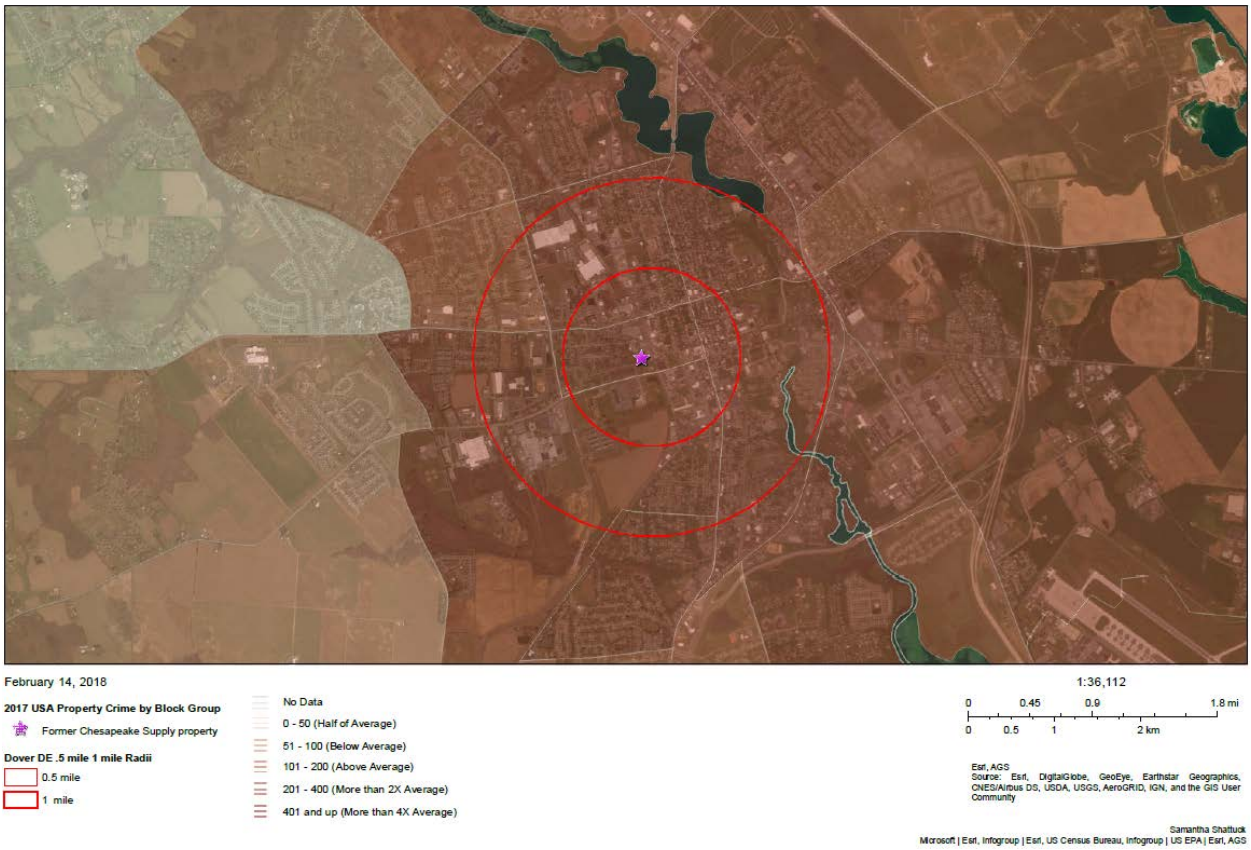


Figure 6: Former Chesapeake Supply target site and property crime index (Source: Esri). See Appendix 4 for full page map.

The Dover Strategic Plan states that police calls related to narcotics, domestic violence, trespassing and assault have decreased since 2002 (Dover Community Partnership, 2009). Recent efforts have been made to address gang violence in Dover in response to a string of shooting incidents in in Spring 2017. Fifty-five people were arrested, 28 of them arrested on gang related charges after a seven-week investigation (Parra and Smith, 2017).

As discussed previously, where crime and perceived safety issues are present the presence of abandoned properties and blight in a neighborhood may contribute to the existing problems. The Downtown Dover Development area has a disproportionate number of vacant and neglected buildings and lots, with 15.5% of housing units vacant (City of Dover, 2014). In addition, the Downtown Dover Development area has the highest concentration of violent crimes, property crimes, and drug crimes in the city (City of Dover, 2014). Renting and low-income households are also correlated to higher crime rates; in the Downtown Development District, 84.4% of households are rentals and only 15.5% are owner-occupied (City of Dover, 2014). This is compared to a citywide homeownership rate of 55.1% (City of Dover, 2014).

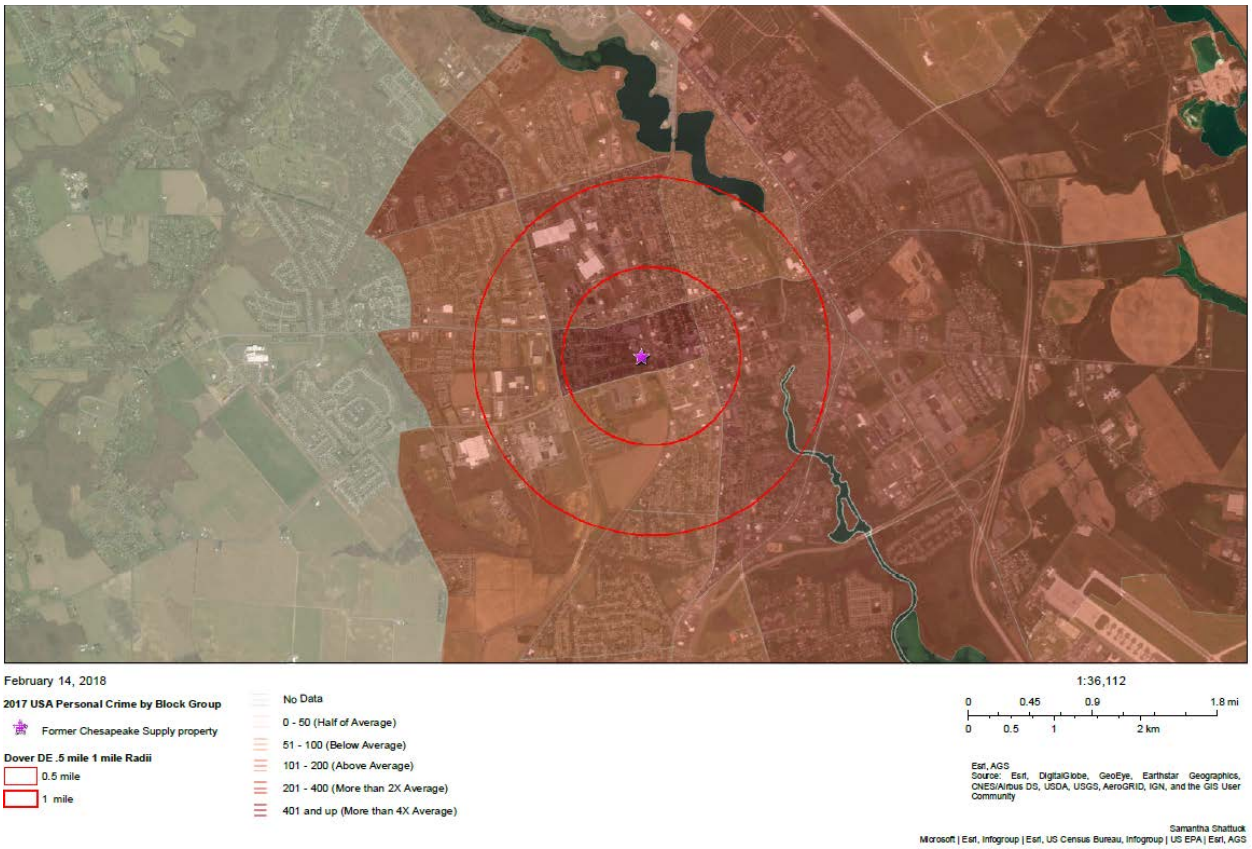


Figure 7: Former Chesapeake Supply target site and personal crime index (Source: Esri). See Appendix 5 for full page map.

PREDICTED HEALTH IMPACTS

DOES THE BROWNFIELD REVITALIZATION PROJECT HAVE THE POTENTIAL TO INFLUENCE CRIME IN THE COMMUNITY?

Implementing brownfield revitalization can contribute to other activities to reduce crime, but a single redevelopment project may not be sufficient to address issues in the area. This site, as part of a trend of downtown revitalization, can help shift the area towards greater economic stability and less crime (Table 10).

It is **plausible** that the proposed project will reduce crime in the area, as it may increase the foot and vehicle traffic in the area; increase employment, the economic and community value of the area; and increase interest in the area through real estate and business development. This is particularly true for property crime after implementation of revitalization projects, such as installation of green spaces. Further, the revitalization of a brownfield site reduces blight and a space for crime to occur, causing a **positive impact** because it reduces the risk of injury, stress from a lack of perceived safety, and helps reduce the challenges to outdoor recreation and interaction.

Less crime and increased perceived safety will affect a **limited number** of community residents due to the lower residential population in the 1-mile area surrounding the proposed project site. However, reduced crime and increased safety may improve the local business environment and willingness of businesses or investors to locate in the target area, bringing other benefits. The effect may increase as the area is revitalized and more people move to the area or visit nearby businesses. The impact on crime will be **long lasting** unless the site is not maintained. If it is maintained, occupied, and surveilled, it may contribute to a shifting pattern of greater economic redevelopment in the area. The reduction in crime will **benefit the population most vulnerable** to crime, such as the elderly, young women, children, and the physically disabled. There is **limited evidence** that supports the relationship between brownfield redevelopment and crime reduction. However, many brownfield communities have noted anecdotal information about brownfield revitalization reducing crime which EPA is further pursuing.

Table 10. Impact characterization and management strategies for Crime and Perceived Safety

Criteria	Scale	Potential Impact Management Strategies
Likelihood	Plausible	Increase street lighting along the proposed project site and install sufficient lighting on the site. Utilize the CPTED (Crime Prevention through Environmental Design) elements in the Green Street Project design. Create security measures in the buildings, including surveillance, that may limit crime at the location. Consider other community crime prevention measures such as community policing and community organization willingness to participate in crime prevention efforts.
Direction	Positive	Monitor crime and forge community partnerships with law enforcement to ensure crime does not extend to other areas that result in greater community impact (such as movement of criminal activity to parks or playgrounds).
Magnitude	Limited	By using increasing lighting along the proposed site, on the street, this project can contribute to overall reduced crime in the area.
Permanence	Long lasting	Maintain the site and ensure it is occupied and surveilled.
Distribution	Most vulnerable populations	None.
Strength of Evidence	Limited	None.

HOUSEHOLD AND COMMUNITY ECONOMICS

REVIEW OF LITERATURE-BASED EVIDENCE

HOUSEHOLD ECONOMICS

As discussed above, household economics are greatly affected by employment, which provides an income to meet necessities. Households which are already cost burdened by their housing costs (spending more than 30% of their income on housing) may still have difficulty affording their basics like food, clothing, transportation, and healthcare (US HUD, 2011). Financial insecurity, caused by a lack of sufficient income can jeopardize a household's ability to live in safe and stable housing, thereby pushing households to substandard housing conditions or even homelessness. Homelessness, or displacement, can lead to a series of health outcomes, both physical and psychological (Gilman, et al.,2003; Bhatia and Guzman,2004; Keene and Geronimus,2011).

Research shows that low income and lower education can have permanent impacts on an individual's health. Adler and Newman (2002) found that individuals in lower socioeconomic status experience higher incidence rates of low birth weight, cardiovascular disease, hypertension, arthritis, respiratory illness, diabetes, and cancer.

As downtown revitalization continues, property values may eventually begin to increase (California Association for Local Economic Development, 2017). It is important to acknowledge the eventual risk of displacement if the local economy continues to improve. This project may threaten the existing community members' housing security, as well as local small businesses and community organizations, who all may face displacement as rents increase in residential and commercial properties. Policies or other actions to protect tenants, low income home-owners, small business and community organizations can minimize this threat. This serious concern may also be tempered with increased job opportunities and other supports. With just 15% of the households in the area being owner-occupied, only a limited number of households would directly benefit from the increase in property values.

COMMUNITY ECONOMICS

As household economics improve as a result of greater access to employment through revitalization and redevelopment, the community will experience a greater economic stimulus that will provide a positive feedback loop of greater economic growth (Andersen and Hall, 2014).

Gentrification can be a part of all urban development projects, and is defined by the Center for Disease Control and Prevention as "the transformation of neighborhoods from low value to high value" (CDC, 2009). Policies and ordinances can be used to prevent displacement and some research suggests that the relationship between improved environmental conditions and

gentrification and displacement may be weaker than previously thought (Eckerd, 2011). An increased cost of living can improve the standard of living for some residents and increase home values for homeowners, but many low-income renters may be priced out of the area as the cost of living increases.

EXISTING CONDITIONS

At the time of publication of Downtown Development District Application (City of Dover, 2014), there was a high level of poverty, homelessness, and low-income population in the Downtown Development District, which includes the target area. The census block groups that make up the Downtown Development District had a rate of 55.7% of households that are low to moderate income. This rate is compared to the City of Dover's census block groups, which show that 44.4% of households were low to moderate income. The rates from the 2011-2015 American Community Survey follow this trend: the city's rate of low to moderate income (under $50,000 annual income and benefits) was estimated at 53.3%, while the half-mile radius and one-mile radius around the target site were reported at 66% and 59%, respectively (US Census Bureau American Community Survey, 2011 – 2015). These high rates demonstrate an economically depressed area, even further pronounced by the rate of those making less than $15,000 a year, at 30% and 24% for the half-mile and one-mile radii around the target site, respectively. Figure 8 shows the median household income in 2016 by census block; the half-mile radius has a much lower median income ($0 to $35,383) than even the one-mile radius (less than $35,383 to $45,505), which is lower still than the surrounding areas (greater than $45,505). The low unemployment rate in the area (4-5%) suggests that the

OLIVERIO'S PEPPER PROCESSING PLANT

The cleanup of the former Quality Foundry in Clarksburg, West Virginia, created 10 jobs while the Oliverio's Pepper Plant managed to leverage property investment up to 3 million dollars allowing for 30 retained and new employment opportunities throughout the expansion. The former Quality Foundry gave Oliverio's the opportunity to strengthen their 40-yearlong legacy to provide to local customers and schools expertise in food processing and entrepreneurship. It has thrived in its West Virginia roots, leading the U.S. Small Business Administration to recognize Oliverio's Italian Style Peppers as one of the state's best businesses in 2011.

https://www.epa.gov/sites/production/files/2015

population should be considered working poor; their jobs do not provide a sufficient income to support themselves and their families.

The study area falls under several revitalization plans, including the Dover Development District and Restoring Central Dover Plan. The Downtown Dover Partnership leads in its commitment to development in the downtown area and is comprised of Main Street Dover, Downtown Dover Development Corporation, and Greater Dover Organization and.

The business and industry base of the city ranges from manufacturing facilities operated by General Mills (now Kraft Heinz), Playtex Corporation, and Proctor & Gamble to public institutions like the Dover Air Force Base, Delaware State University, and state and city government buildings.

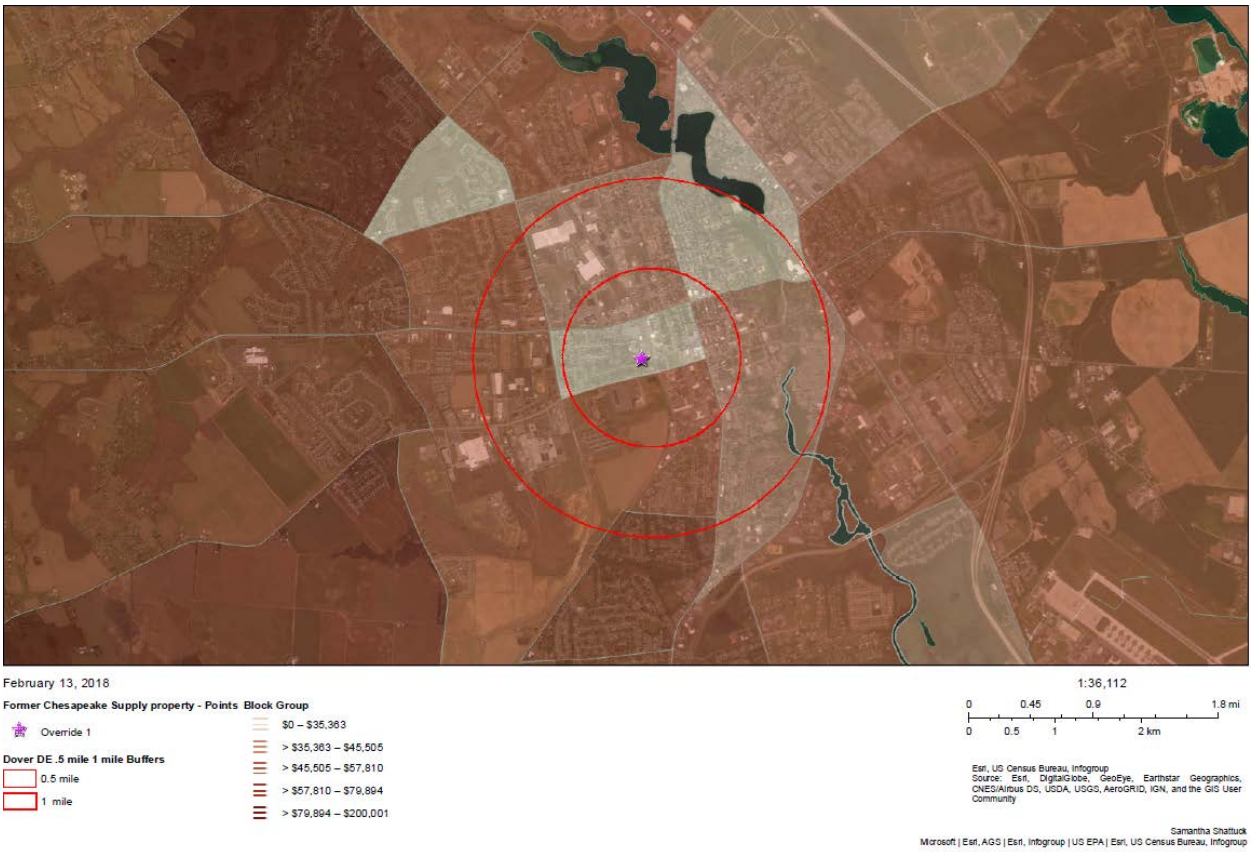


Figure 8. Map of Former Chesapeake Supply target site and median income (Source: Esri). See Appendix 6 for full page map.

The Downtown Development District is home to an estimated 1,989 people, according to the 2010 Decennial Census. Of the 873 total households, 15.3% were vacant, and of the 739 total occupied units, 84.4% were renter-occupied (2010 Decennial Census, SF-1, total of all Census blocks in proposed Downtown Development District Application [City of Dover, 2014]).

The US Census Bureau cites the per capita income in the past 12 months in the city of Dover (in 2015 dollars, from 2011-2015) at $21,750, while the half-mile and one-mile radii were estimated at $20,104 and $22,343 (US Census Bureau American Community Survey, 2011 – 2015). The local economy includes accommodation and food service, retail, health care and social assistance, and manufacturing; as of 2012, 3,281 businesses were present in Dover (US Census Bureau American Community Survey, 2011 – 2015).

PREDICTED HEALTH IMPACTS

DOES THE BROWNFIELD REVITALIZATION PROJECT HAVE THE POTENTIAL TO INFLUENCE ECONOMICS IN THE COMMUNITY?

It is **plausible** that redeveloping this brownfield site, as part of a revitalization effort for the downtown area, can affect the economics in the community, if the site brings in jobs, businesses, and increased foot traffic to the area while reducing crime and blight. Further, the redeveloped site may increase the economic value of the area and increase interest in the area by real estate and business developers. With efforts to mitigate displacement, the overall impact would be **positive**, as these improved conditions would positively impact both household and community economics. By improving the economics in the area in ways that benefit community residents through expanded employment and local affordable services, the community could experience reduced food insecurity, job insecurity, and crime—all of which contribute to poor health.

The improved economics caused by the site would affect a **moderate number of people** as only so many people can get jobs from the food production site and revitalization of one brownfield site will not be able to completely shift the economic trend of the area. The economic impacts of redeveloping this site would begin with construction and continue as long as the site was being utilized and/or the positive economic trend continued in the area; thus, it is anticipated that the impacts could be **long-lasting**. The economic improvement caused by the site revitalization would help properties owners, residents and those employed in the area **who are most economically at risk**; however, the potential for future displacement should not be discounted. There is **sufficient** evidence that brownfield revitalization can positively impact health through improved economic conditions.

Table 11. Impact characterization and management strategies for Household and Community Economics

Criteria	Scale	Potential Impact Management Strategies
Likelihood	Plausible	To maximize the potential for this site to improve individual and community economics, the city should ensure an economically viable business is developed and an adept operator is selected for operation. The city should consider the community economics in developing this site by addressing access, equity, and stability.
Direction	Positive and Negative	The positive impacts can be heightened by encouraging engagement between the business and the community, in employment, and public facing programming training like educational tours and opportunities. Potential negative impacts such as displacement as a result of an increased cost of living by encouraging local hiring and supporting the development of other local businesses and considering anti-displacement measures.
Magnitude	Moderate	The magnitude of the economic impact may be increased by ensuring the success of this business and using its development as an opportunity to spur further development in the area, including in infrastructure, transportation, and other business development.
Permanence	Long lasting	The city should have a plan in place for selecting a business that has a high chance of long term success as well as a plan for if the first business fails, what the city will do to establish a second business in its place, or to take over the site or support a community led initiative.
Distribution	Most economically at risk	Currently unemployed or those living under the poverty line will benefit from the site development if they are hired and have access to the food produced there. They may also be most at risk for displacement if the neighborhood develops and raises the cost of living.
Strength of Evidence	Sufficient	None.

MONITORING AND EVALUATION

Monitoring and evaluation are the final steps in an HIA; they include an evaluation of the HIA process itself (i.e., process evaluation) and recommendations for how to evaluate the impact of the HIA on the project and its decision-making process (i.e., impact evaluation) and the impact of the project implementation on health (i.e., outcome evaluation).

PLAN FOR PROCESS EVALUATION

The HIA process was evaluated by the project team under the follow categories: goal achievement, successes, challenges, and lessons learned. Process evaluation asks if the HIA was carried out according to the plan of action and applicable standards (National Research Council, 2011). Minimum Elements and Practice Standards for Health Impact Assessment (Bhatia, 2011) provides a framework by which to evaluate an HIA, with standards set for each step of the HIA.

HIA GOALS ACHIEVED

After drafting the HIA report, the HIA Team members determined if the goals set out for this HIA were met. Table 11 lists the goals, with documentation supporting whether the goal was met.

SUCCESSES IDENTIFIED BY THE HIA LEADERSHIP TEAM

This rapid HIA was successful in several ways. One success identified was bringing together the city and other stakeholders to discuss brownfield revitalization in the context of improving health in the area. Dave Hugg, one of the leaders of the Dover HIA Team, explained that the city has been working on housing and crime issues, but that without adequate access to healthy foods, these households were still struggling; the rapid HIA provided a setting which made cross-disciplinary discussions possible. This HIA also identified site-specific recommendations for improved health, opportunities from linking program and policy goals (i.e. food innovation district supporting school food assistance), as well as recommendations for general urban revitalization. Furthermore, this project also expanded the effort to illustrate how health can be incorporated into future urban revitalization projects.

Table 12. Evaluation of HIA goal achievement

HIA Goal	Achieved?	Documentation
Develop a rapid HIA that promotes the consideration of health in the brownfield **revitalization** project **for Dover, Delaware**	Yes	The HIA assessed the potential direct and indirect health impacts of the proposal develop a food production facility on a remediated brownfield site in downtown Dover. Impacts on food access, employment, brownfield redevelopment, crime, and individual and community economics were assessed at the request of the City of Dover and their partners.
Bring evidence-based information to help inform the City of Dover's **decision to pursue a food production project,** such as an aquaponics facility, **on** a **remediated brownfield site.**	Yes	The recommendations included in the HIA are based on evidence found in scientific literature and other urban revitalization projects.
Raise awareness of HIA as a decision-support tool that considers direct and indirect consequences, both benefits and harms, before a **decision is made.**	Yes	Through the HIA Process, EPA raised awareness of HIA as a decision support tool with the city of Dover, the State of Delaware, EPA Region 3, the Office of Brownfields and Land Revitalization, and the public. Both potential positive and negative health impacts of the proposal were identified.
Demonstrate the use of HIA on a brownfield revitalization project.	Yes	This rapid HIA serves as a model for future application of HIA on brownfield revitalization projects.

CHALLENGES IDENTIFIEDAND LESSONS LEARNED BY THE HIA LEADERSHIP TEAM

One important challenge identified in this HIA was a lack of specificity in the project design and decision point. The City of Dover did not yet have a concrete project proposal for the HIA to evaluate; therefore, this assessment served to more broadly explore the health impacts associated with revitalization of a brownfield for food production.

The nature of a rapid HIA, with limited time and resources dedicated to this project was also a challenge. This effort would have benefitted from more research and community engagement to identify more specifically the health impacts and the priorities of the nearby community members, both of which would have improved the eventual recommendations. Data gaps and uncertainty in the literature could have been mitigated with more time, but they also represent opportunities for future considerations of health impacts in the development of the business plan.

The lessons learned in this rapid HIA include a greater understanding of the health impacts of brownfield revitalization and the potential for future application of HIA on these types of projects.

PLAN FOR IMPACT EVALUATION

Impact evaluation seeks to understand the impact of the HIA on the decision, the decision-making process, or other factors outside the specific decision being considered (National Research Council, 2011). The following questions could be used to determine whether the HIA influenced future brownfield revitalization decisions and decision-making processes in Dover:

- Did the City of Dover adopt and implement the recommendations of the HIA in the development of a business plan for the brownfield site? If not, was there rationale provided for why the recommendation(s) were not adopted?
- Does the City of Dover credit the HIA with informing their decision-making process (e.g., discussion of HIA findings in decision-making) or influencing the decision-making process regarding health considerations?

These questions could be answered with a short survey or interview of a City of Dover representative after the decision has been implemented. If the City does not create and execute a business plan for the site, then they should provide an explanation to the public explaining why this was the final decision and whether the HIA was useful in making this decision.

This HIA can identify potential indicators that may suggest a trend towards improved health in the neighboring community, but it is important to recognize that many factors influence individual and community health. Given that this is a rapid HIA and the project being evaluated has not yet been developed, the relationship between health outcomes in the community (i.e. adult and childhood obesity) and the proposed project is especially tenuous and difficult to measure.

PLAN FOR OUTCOME EVALUATION

Outcome evaluation focuses on the changes in health status or health indicators resulting from implementation of the proposal (National Research Council, 2011).

Below is a limited list of potential indicators, data sources, and partners that can be used to monitor the plan's impact on the health determinants identified in the HIA. These indicators are often proximate, as actual health outcomes from the decision may be difficult to monitor as changes in health related to a specific decision point or project. Also, both individual and population health are determined by a wide variety of factors, many of which are not related to the decision implementation.

Table 13. Proposed plan for monitoring health impacts post-decision

Health Determinant	Potential Indicators	Potential Data Sources	Potential Partners
Food Access	• Increased position in the Retail Food Environment Index • Food production at the site with distribution plan to local community	• Delaware Plan4Health • Site operators	• Kent County • Delaware Office of State Planning Coordination • Delaware Health and Social Services • Delaware State University • Delaware Department of Education • Delaware Department of Agriculture • U.S. Department of Agriculture
Employment	• Increased employment at the site, including employment from local zip codes	• Site operators • Job Corps	• Kent County • Downtown District Partnership • Site operators
Brownfield Redevelopment and Urban Revitalization	• Increased economic activity in the neighborhood as seen by an increase in the number of businesses or tax revenue • Future grants leveraged for further brownfield remediation and redevelopment • Increased public and private investment in the area.	• Downtown Dover Development Corporation • U.S, Environmental Protection Agency Office of Brownfields • U.S. Environmental Protection Agency Region 3	• Kent County • Downtown Dover Partnership • Delaware Office of State Planning Coordination • Delaware Department of Natural Resources and Environmental Control • U.S. Environmental Protection Agency Region 3
Crime	• Rates of violent and non-violent crime	• Dover Police Department records • Kent County Sheriff's Office • Local Hospitals	• Dover Police Department • Kent County Sheriff's Office • Delaware State University
Household and Community Economics	• Households living below federal poverty level • Annual household income • Monthly housing costs (renter and homeowner) • Number of cost –burdened households • Mean and median residential property values • Location affordability index	• U.S. Census Bureau/American Community Survey • HUD location affordability index (http://www.locationaffordability.info/lai.aspx) • Delaware State Housing Authority	• Dover Downtown Development • Delaware Office of State Planning Coordination • Delaware State Housing Authority

CONCLUSION

The goals of this rapid HIA were to explore the use of health impact assessment on a brownfield project to inform revitalization choices and to determine if the redevelopment of a brownfield property into a food production operation could have positive impacts on the health of the Dover community, through increased food access, employment, urban revitalization, and household and community economics. Furthermore, the HIA sought to compile information from a range of sources to provide evidence-based recommendations to decision-makers which can inform planning and maximize those positive health impacts and mitigate and/or avoid negative health impacts associated with implementation of the project. With limited details on the specific project or development proposals to provide operational details for impact assessment, some impact areas require further development. Additionally, integration of this project into other city, county, regional and state programs and innovative efforts focused on improving food access, strengthening local food production, and expanding job training and employment services will help maximize the potential health and economic benefits envisioned during this project.

Two tables below list site-specific recommendations and general urban revitalization recommendations developed with stakeholders as part of the HIA process; these recommendations are presented in no particular order (Table 14 and 15). Site specific recommendations inform the design of the site, including selection of the business operator, business plan design, and physical construction of the site. General revitalization recommendations inform the future planning of urban revitalization in the area that can magnify the impact of this site and promote future brownfield redevelopment and urban revitalization. In addition to the impacts discussed, there are two overarching themes included in the recommendations: 1) involving and keeping the community engaged in the planning, implementation, and monitoring of this brownfield revitalization project; and 2) working with and expanding support for community advocacy groups in addressing the community's needs and advancing equity in revitalization.

It can be noted that the scope of this rapid HIA was limited in its ability to capture all the potential health impacts that could result from the installation of a food production operation at the target site. However, this HIA is meant to serve as proof-of-concept to evaluate the health impacts of a brownfield revitalization project and a model for other rapid HIAs. Moving forward, intermediate and comprehensive HIAs can be utilized on this and other brownfield revitalization projects, which would incorporate more extensive stakeholder engagement efforts, additional data collection, market analyses and more quantitative and qualitative analyses of potential health impacts.

Although HIAs are often used to address a specific decision point, sometimes analyzing a series of alternatives, this HIA was more of an exploratory exercise in that there are many details about the potential project that were not finalized before the HIA began. For example, the operator of the site was not identified, though prospects range from a governmental organization, for-profit business, community organization, or a combination that links with nearby training and academic organizations. Additionally, the size and scope of the operation had not been fully characterized. Thus, the ability of the HIA to identify both short term and longer lasting impacts to community health is limited.

Although brief, the results of this assessment suggest that the revitalization project may be effective at meeting market needs and providing food to community members and more finely-honed proposals will assist in achieving those goals. Once the project is more fully formed, there are opportunities to further assess the potential impacts of the site and develop more detailed recommendations for how to maximize the positive health impacts and minimize any potential negative health impacts that result from this and future brownfield revitalization projects. Rapid HIAs may serve as an entry point to further HIA efforts, as might be the case in this project.

Table 14. Site-specific recommendations by health determinant

Health Determinant	Recommendation
1. Food Access	A. Establish a varied produce/fish selection for community nutritional needs and maintain interest of residents (and potentially local restaurants/schools).
1. Food Access	B. Conduct creative and aggressive outreach and advertising within the one-mile radius (and potentially beyond for local restaurants and schools).
1. Food Access	C. Conduct further research on the success of aquaponic operations.
1. Food Access	D. Decide on the business model for the site. For instance, will the project be a commercial, revenue-generating aquaponic or hydroponic facility, or for community use (non-profit or quasi)?
1. Food Access	E. Evaluate the feasibility of a "food hub" or similar system in Kent County to appropriately link small food producers to a larger market for the products to be grown.
1. Food Access	F. Refer to the Aquaponics Business Plan User Guide for operating strategies; additionally, consider human resource requirements, financial and non-financial resources, and adherence to recommended food safety practices to increase the sustainability of the project.
1. Food Access	G. Define the customer and type of distribution. Will the site be for residents only or will the site be for businesses?
1. Food Access	H. Document the impacts of reuse of the site for food production on local food access, attitude and behavior change and improved nutritional status.
1. Food Access	I. Collect baseline information on population food access, participation in nutrition assistance programs, consumption and dietary disease prevalence may need to be collected or existing information examined.

1. Food Access	J. Collaborate with Delaware State University on technical expertise pertaining to urban gardening, farming and aquaculture/aquaponics.
1. Food Access	K. Create a workgroup with local partners and faculty from Delaware State University to discuss and research how to introduce hydroponics/aquaponics to the local market.
2. Employment	A. Incorporate employment opportunities for residents during maintenance and construction.
2. Employment	B. Develop and incorporate urban farming and green infrastructure training for residents and community groups.
2. Employment	C. Include a processing component within a detailed business plan that would increase the number of jobs for the project.
2. Employment	D. Use green infrastructure to stimulate job creation through maintenance of the site's greenspace.
2. Employment	E. Consider creative ways to engage with Interfaith Mission, including volunteer opportunities in exchange for food or part-time work for those who may not be in a position to take on full time job.
2. Employment	F. Include Delaware State University faculty and staff in training opportunities on aquaponics and hydroponics.
2. Employment	G. Engage with local community members to determine culturally appropriate training and employment opportunities on topics such as language used in training and the hours the site is in operation, both in production and potentially open as a site for the purchase of produce.
2. Employment	H. Require the business operators to utilize the Aquaponics Business Plan, Aquaponic Business Plan Worksheet, and the Urban Farm Business Plan Handbook, as appropriate, in the development or demonstration of their business plan. In terms of employment, pay particular attention to their community engagement and hiring plan.
3. Brownfield and Downtown Revitalization	A. Focus future meetings on educating residents, workers and business owners on brownfields and revitalization opportunities. Solicit community, student or governmental interest and technical assistance in further site investigation to allay fears and respond to risk perceptions and planning for future brownfield revitalization efforts to support food innovation district diversity and expansion.
3. Brownfield and Downtown Revitalization	B. Consider outreach efforts, including a site tour and public meeting to review existing site documentation and results as part of a public meeting to facilitate future site and reuse planning.
3. Brownfield and Downtown Revitalization	C. Establish a community advisory council as a conduit for communication and longer-term engagement with community organizations and interested stakeholders seeking to revitalize brownfields and explore options for further food innovation district innovative efforts.
3. Brownfield and Downtown Revitalization	D. Examine the potential role of universities and institutions as large-scale purveyors and markets for food and as partners in changing community attitudes on food and increasing local food markets.
3. Brownfield and Downtown Revitalization	E. Conduct charrettes to explore the future redevelopment of this entire area to consider how a food production facility on this site might fit in with a larger revitalization plan. Visioning, design charrettes and creative

	engagement efforts can provide a forum for diverse involvement and community participation in revitalization planning and design.
3. Brownfield and Downtown Revitalization	F. Consider including the other four identified Brownfields in the area for an area-wide approach to revitalization. For example, the target site could be best used for food production, while other sites may be better located for distribution.
4. Crime	A. Increase street lighting along the proposed project site and install sufficient lighting on the site.
4. Crime	B. Utilize the CPTED (Crime Prevention through Environmental Design) elements in the Green Street Project design.
4. Crime	C. Create security measures in the buildings, including surveillance and fencing, to discourage vagrancy and illicit activities on the site.
5. Household and Community Economics	A. The City, in selecting the business to run the site, should require they utilize the Aquaponics Business Plan, Aquaponic Business Plan Worksheet, and the Urban Farm Business Plan Handbook, in the development or demonstration of their business plan.
5. Household and Community Economics	B. Follow the recommendations in the employment section that support local training and hiring programs for the nearby community, during construction, operation, and maintenance of the site and business.
5. Household and Community Economics	C. Evaluate which grants may support the development of a business at this site and support the business developer in their application process for the funding.
5. Household and Community Economics	D. Consider prioritizing local potential business owners in selecting the site operator.
5. Household and Community Economics	E. Advocate for the use of business revenue to support social services or activities at the site, including educational programming for children and the community on healthy eating and gardening. The city should consider matching funding for such activities.
5. Household and Community Economics	F. Consider alternative models of food distribution, such as a Community Shared Agriculture (CSA) program, which would reduce costs to residents and assist local farmers with production issues.
5. Household and Community Economics	G. Foster partnerships between this site and other nearby businesses and community organizations as this can promote the sustainability of the program and increase the leveraging of this site development into future economic development in the area.

Table 15. General urban revitalization recommendations by health determinant

Health Determinant	Recommendation
1. Food Access	A. Incorporate ease of access planning, such as green spaces, well-lit streets and sidewalks, ramps and wheelchair accessible areas for walkability and access to site.
1. Food Access	B. Include outreach efforts and partnerships with local organizations, food tourism and gardening networks with similar healthy food access goals, as well as plan for expansion with other nearby revitalizations projects.
1. Food Access	C. Work with Delaware State University to establish SNAP-Ed at the nearby schools, and institute outreach programs in the community through the university's Extension Program.
1. Food Access	D. Engage local students to assist in neighborhood research on the food environment and with outreach and information collection among peers and family members.
2. Employment	A. Provide funding opportunities for local entrepreneurs (e.g. small business grants, foundation matching, matching grants for job creation, etc.) aimed at creating jobs.
3. Brownfield and Downtown Revitalization	A. Work with DNREC to clarify the specific conditions of the site, use restrictions and review how the proposed food reuse and similar food production uses at a former brownfield will not pose a health risk to workers, residents and neighbors or consumers.
3. Brownfield and Downtown Revitalization	B. Inform residents about past hazards, ongoing land use controls and how proposed reuse does not pose risks. Future public meetings also can engage residents in identifying other potential brownfields as well as sites now serving or planned for gardens or food production.
3. Brownfield and Downtown Revitalization	C. Collect information baseline information on population food access, participation in nutrition assistance programs, consumption and dietary disease prevalence may need to be collected or existing information examined. Local students may be able to assist in neighborhood research on the food environment and assist with outreach and information collection among peers and family members.
4. Crime	A. Consider other community crime prevention measures such as community policing and community organization willingness to participate in crime prevention efforts.
4. Crime	B. Evaluate the success of juvenile justice programs how community projects, such as after school food/education programs, can address juvenile crime.
4. Crime	C. Partner with local law enforcement and community organizations interested in crime prevention to map and track revitalization impacts on crime.
4. Crime	D. Track crime and forge community partnerships with law enforcement to ensure crime does not extend to other areas that result in greater community impact (such as movement of criminal activity to parks or playgrounds).
5. Household and Community Economics	A. Monitor the increasing housing costs and cost of living in the region and research and develop strategies to mitigate displacement because of growing economic development in the region.

5. Household and Community Economics	B. Evaluate the active and public transportation access to the site and consider improving access by creating/rehabilitating sidewalks and bike paths and bus routes.

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