



# Needs Assessment for the Town of Fenwick Island

April 18, 2016

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# Executive Summary

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As technology advances, GIS (Geographic Information Systems) is becoming increasingly more vital to all scales of government. However, there is a lack of development in GIS within local government for Sussex County Delaware, where the governments could benefit the most. Fenwick Island, one of the smaller municipalities on the Coast of Sussex County, is a prime example of a town that could benefit. Due to its size, the town faces the challenge of a small budget, but also is confronted with the risk of flooding due to its proximity to the ocean and overall elevation. At this time, any GIS work is fulfilled through contracting which can be expensive for a larger project. This lack of GIS could be preventing Fenwick Island from using spatial products for effective decision-making and from using spatial products as evidence for grants.

To address the lack of GIS and the potential to improve, a project was proposed to outline their current town operations, town needs and objectives and assess the benefits and consequences that are expected with the resolution to these problems. It would also determine multiple alternatives to resolve this situation as well as offer differently priced solutions and enhancements. This proposal would lead to a GIS Needs Assessment being conducted for the Town of Fenwick Island. This assessment will be provided to the town as a free resource to help the Town Council and Town Officials understand their current GIS situation and how it needs to be improve to successfully integrate GIS into their current structure. Upon approval, the project timeline was constructed and that can be viewed in the appendix. This timeline demonstrated not only the methodology of which the needs assessment will be based on, but ensured that the assessment would be completed before the deadline.

The start of the project was spent diagnosing what GIS functions were currently being utilized for the town and how much GIS data Fenwick Island currently possessed. From there, it was determined what town officials would be able to work more effectively with GIS and what specific layers were necessary. New data was also created based on the town's interests and what would be most beneficial to create a foundation for GIS. These files were then stored in a geodatabase in a meaningful manner to ensure they would be ready to use when the town was.

This report will also recognize who in the Town of Fenwick Island will utilize GIS. While the town as a whole can benefit from integrating GIS, it is not necessary for every employee to access GIS and use it. Not only would it be expensive to train the staff, but it would also increase the likelihood of data become corrupt or being inaccurate.

One of the key stages was the creation of the budget. This would be one of the main factors that decided whether GIS would be integrated. To help ensure that the best GIS method was

recommended, numerous alternatives were investigated as well as more cost-effective options. This investigation ultimately lead to a final recommendation that was not only budget-friendly, but would ensure a long-lasting system for Fenwick Island to utilize and enhance.

This report will specify implementation challenges that need to be avoided or resolved to ensure the success of GIS in Fenwick Island. It also investigates the potential for enhancements through grants and other innovated methods for town employees to use GIS. This assessment will be presented to the Fenwick Town Council on April 22<sup>nd</sup> to determine whether or not they will advance with the recommended integration. Their response and reaction will be recorded in the final section before the appendix.

# Project Introduction

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## Essential Personnel

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Proposal Area:	Fenwick Island, Delaware
Executive Sponsor:	Dr. Michael Scott, Salisbury University
Project Sponsor:	Merritt Burke IV, Town Manager of Fenwick Island
Project Manager:	Kathryn Maglio

## Background

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Fenwick Island was incorporated in 1953 in Sussex County, Delaware. With a population a little less than 400 residents, the town has an area of half a mile. The town has twelve streets with beach access, creating a haven for tourists. Fenwick Island is visited by 150,000 tourists annually. Due to its location between Ocean City, Maryland and Rehoboth Beach, Dewey Beach, Fenwick Island and Bethany Beach have been called “the quiet resorts” bringing a million-dollar revenue to Fenwick. Most of this revenue is poured back into the town to improve the aesthetics and host events to draw in more visitors through the Bethany-Fenwick Chamber of Commerce.

## Business Needs

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At the time of the report, there was no GIS integrated into Fenwick Island. During the creation of this project, it was discovered that the Town of Fenwick Island relied on contracting GIS projects to have spatial products created. Not only can this be expensive but, it does not allow Fenwick Island to have any control of their own spatial data. There is also the concern of sea-level rise. Despite being a key tourist location due to its proximity to the water, the town falls below three meters above sea level with the exception of the dunes. This is a cause of concern for many town officials and residents. GIS would allow Fenwick Island to address this rising dilemma and create spatial data for new town threats, such as the newly developed pine beetle infection.

With the ability to create this data and utilize it to solve local problems, the town can serve its citizens and tourists more efficiently and allow this data to be more public accessible. As shown in the proposal, there is the concern of Fenwick Island being too small of a town to justify the integration and cost of GIS. However, there are towns similar to Fenwick along the East Coast who have already applied GIS to their communities effectively. Below is a table that shows similar beach areas that have created spatial products that are similar to the ones that Fenwick Island would benefit from:

Town Location	Use of GIS
Nags Head, North Carolina	Public maps to show piers and beach access for visitors.
Portsmouth, New Hampshire	Public maps showing different hourly parking locations and bike racks for visitors and residents.
Bluffton, South Carolina	Online GIS portal to numerous maps including road maintenance and voting precincts.
Darien, Connecticut	Online GIS portal with multiple layers, including hurricane inundation and wetlands.
St. Augustine, Florida	Public maps showing bike locations and archeological sites.
Charlestown, Rhode Island	Online GIS portal with multiple layers including heritage sites and boat launch sites.

## Business Objectives

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1. More efficient decision making with spatial evidence
2. Ability to have in-house GIS and not have to pay higher fees for contracting GIS work
3. Data integration with Delaware Department of Planning and Fenwick Island through data sharing
4. Data integration with Sussex County and Fenwick Island through data sharing
5. Independence with spatial data and ability to control and create own spatial products
6. Public has access to improved and more recent spatial products.

## Project Approach

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There are several ways to integrate GIS into a local government. The government could choose to go with ESRI products (most common choice) or with opensource. The cost of hardware and essential personnel can vary as well based on if the town already has efficient hardware available for GIS and depending on whether the staff needs to be trained or if a new employee needs to be hired for the GIS duties. This report will explore the cost for all variables in order to assess the best solution for the town to better assist the town official in their decision of whether to implement GIS in Fenwick Island.

The final product will vary based on the decisions made by the town officials and on the recommendation included in this report. The structure of the GIS system will be the same, however. The following steps will help create the system:

1. An observation of the current use of GIS in the town will be conducted.
2. Each department has an individualized assessment to see how meaningful GIS would be for them.
3. All data will be accounted for and digitalized and stabilized for later use. Any relevant data needed for the town will be created as well if time allots for it.
4. Data from Sussex County of Mapping and Addressing and Delaware Department of Planning will be obtained to store with Fenwick's current data.
5. A database will be created to organize the data in a meaningful way.
6. An investigation into the total costs of the alternatives to implement GIS will be conducted to ensure the best method of implementation is suggested to the town.

This project will begin at the end of January 2016 and will conclude in May 2016. This needs assessment will be presented to the Town Council where a decision will be reached on whether Fenwick Island will choose to implement GIS into the town.

## Project Goals

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1. Assess total use of GIS within the Town of Fenwick Island and how it can be built upon.
2. Devise multiple approaches to implementing GIS for the town.
3. Create a recommendation tailored to the town's GIS needs and considers alternative solutions.
4. Suggest a system based on the current system that is easy to learn and use or that is easy to adapt current employees to.
5. Increase quality of geographic products created by the town and create easier access for the public to these products.
6. Implement a system that can last long term and improve the quality of data stored on the town.

## Consistency with Fenwick Island's Mission Statement

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The Town of Fenwick Island does not have a mission statement for the entire town, however, both the police department and the beach patrol have their own. The statements are focused towards serving both citizens and those who visit and pledge to maintain security and peace for both the beach and the town as a whole. This mission statement could be better enforced with spatial evidence, if GIS were to be implemented. The potential spatial products could also assist with gaining grants for the town.

Fenwick Island is also committed increasing and strengthening the commercial businesses within the town limits. By implementing GIS, they would be able to conduct an analysis on the current businesses and investigate what benefits would be suitable to encourage businesses to expand and invite other businesses to Fenwick Island.

# Methodology

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To conduct a needs assessment correctly for Fenwick Island, a top-down assessment method was applied. In a top-down assessment, the focus of the report starts with looking at the organization as a whole and then investigating it in smaller segments, starting at the top of the structural hierarchy and descending downward from there to the smaller departments and committees. This allows for a detailed understanding of the structure and operations of each component to Fenwick Island. This investigation will indicate whether or not GIS implementation would be beneficial to Fenwick Island and if applicable, what the most successful path of implementation of GIS would be.

## Investigate Current GIS Knowledge

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The first step towards performing a needs assessment is to investigate the knowledge of GIS that Fenwick Island employees already possess. This pertains primarily to Town Manager, Building Official, Police Department, Public Works, and the Town Clerk. This information will indicate how intensive of a training plan would be needed if multiple town employees were to need to access GIS or if other alternatives would be needed to distribute the spatial products to the employees when needed.

## Analyze City Structure and Current GIS Operations

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Multiple meetings were scheduled with the Town Manager in order to better understand the city structure, the main responsibilities of the town officials, and the town's relationship with the county and state governments. The Fenwick Island website also details the duties of each section. The town officials that will be detailed are the Town Manager, Building Official, Police Department, Public Works, and the Town Clerk.

## Analyze User Data Needs

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After compiling a better understanding of how the town is structured and the regular operations, the potential spatial data needs for the town official in question can be concluded. Due to Fenwick's smaller size, there are only a few potential users for this system. Multiple meetings with the Town Manager were utilized to identify the data needs of the individual town officials. By understanding which of the official's responsibilities correlate with spatial data, the different data access needs of each official can be recorded.

## Survey City's Hardware and Software Capabilities

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In order to properly suggest a GIS solution for Fenwick Island, an understanding of where Fenwick Island stands with its current hardware and software capabilities is needed. This section is satisfied by conducting multiple meetings with the Town Manager and by investigating who assists Fenwick Island with their technical support. It will also look at the possibilities of using specific terminals for the town's GIS functions. By identifying these terminals, it can be decided who the primary users will be.

## Conduct Analysis of Sussex County GIS data and Sharing Capabilities

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After several attempts to contact Sussex County Department of Mapping and Addressing, contact was made. The online website was utilized to identify the total amount of spatial data available and the method of transferring data to other state and county departments. A meeting with the Town Manager of Fenwick Island helped provide insight on the relationship between Sussex County Department Mapping and Addressing and Fenwick Island. This will demonstrate how readily the two will be able to communicate and share spatial data.

## Conduct Analysis of Delaware Department of Planning GIS data and Sharing Capabilities

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Once again, a meeting with the Town Manager was utilized to understand the relationship between the Town of Fenwick Island and the Delaware Department of planning. The Delaware Department of Planning creates various spatial products for the state and offers a variety of spatial data on their FirstMap website that is publically available to download.

## Determine Data Requirements

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This phase of the methodology will focus solely on the spatial data currently available for the Town of Fenwick Island. This includes the data that will be created in this study and data already stored with Sussex County Department of Mapping and Addressing and Delaware's FirstMap. A master list will be included that details the individual layers and their attributes as well as what department would best benefit from that layer. By outlining this, it will be easier to determine what departments will need a direct user. This will also inform Fenwick Island of their current data inventory and where they would need to develop if they were to implement GIS.

## Determine Data Storage and Access Methods

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The amount of GIS users will determine the amount storage needed and whether or not a server product will need to be implemented. Based on the results, a model will be created to show how the database will be interacted with by the recommended number of users and how the individual data will be stored.

## Document System Requirements and Costs

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Based on what is determined in the sections previous about data needs storage and user access, the hardware and software needs will adjust as needed. This will detail the most effective software for Fenwick Island's needs and the funds needed to equip this software. The cost of training and the cost of hiring a qualified professional will be included as well.

## Analyze Alternative GIS Solutions

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To ensure the best solution is chosen for Fenwick Island, alternatives need to be explored. The alternatives that will be investigated consist of hardware, software and personnel alternatives as well as the cost and benefits of each one. They will be shown alongside the other paths to assist with choosing the best method for Fenwick Island. They will further be explored and it will be determined whether or not they will be considered for the final recommendation in the alternative solutions section.

## Determine Implementation Challenges

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Due to the scope of implementing GIS into a local government, it is to be expected that challenges will be encountered. The variables that could face obstacles include, but are not limited to: finances, potential users, data access and availability and the lack of experience with GIS within the town. In order to prepare, this section in the Findings will contain the most potential challenges and provide suitable solutions to overcome them.

## Review Solutions with City Personnel

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Once a GIS recommendation is created for Fenwick Island, it will be presented to the Town Council and any town residents attending the meeting. This will include a demonstration of a public accessible example of GIS for Fenwick Island and the most optimal route to achieving their GIS needs.

# Findings

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## Survey Current GIS Knowledge

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Upon reaching out to Mr. Burke for Fenwick's consent for the needs assessment, a meeting was set up to analyze the current GIS knowledge Fenwick Island employees possess. This would provide a baseline for the needs assessment. The Town Manager disclosed that he had GIS experience in the past and was fairly familiar with its capabilities and its jargon. However, he has not used GIS software recently. Unfortunately, the rest of town officials are not as familiar with GIS. There is not current use of GIS by the town except for static maps and data being contracted out. At this current time, there is no IT professional on staff. IT problems are sourced out to Solutions Plus.

## City Challenges

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As a smaller city, the Town of Fenwick Island faces many challenges. By identifying these obstacles, a resolution with GIS can be formulated. One of the main challenges the city faces is its size. The city has around 370 year-round residents and thirteen fulltime staff member. That being stated, the challenges begin with being able to obtain funding for the town. Funding is necessary for good benefits and to be competitive to retain good staff. One of the keys to funding is by having a good tax property base. It is also possible by using GIS evidence to obtain grants for the town.

Another challenge would be combating beach nourishment. As a town with twelve beach access streets, the beach is the main tourist attraction. This can be difficult because beach nourishment is an expensive process, but is necessary to maintain Fenwick Island's revenue. As mentioned above, the use of GIS evidence would benefit the town with obtaining grants. This would give Fenwick Island an advantage over the other beach towns competing for funding in this aspect. GIS evidence would also partially resolve the challenge of sea level rise. This rise would threaten the amount of beach available and the integrity of Fenwick's parcels and properties. The evidence would allow Fenwick Island to gain more resources to combat this.

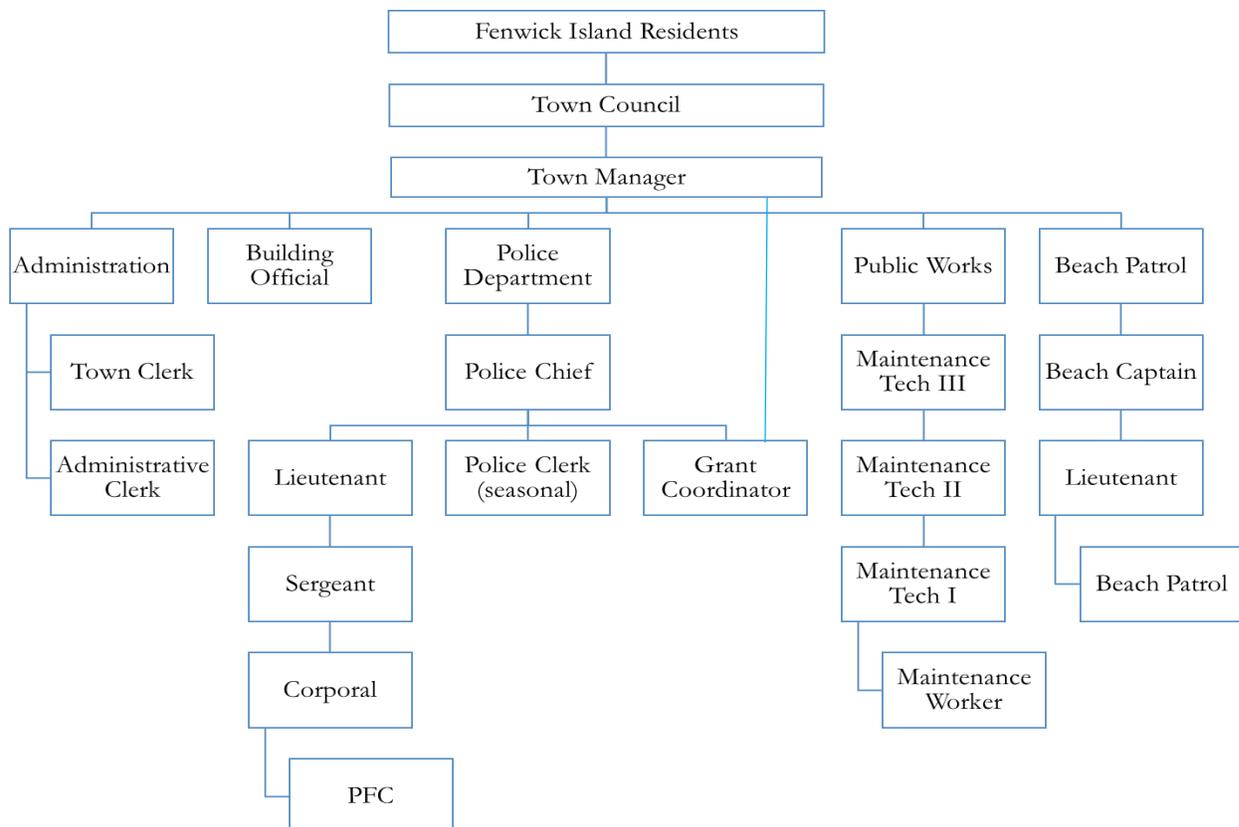
A major challenge that has Fenwick Island's attention at this moment is economic development. Businesses are needed to ensure the town is thriving and help draw tourists in. GIS would allow the town to analyze what businesses are leasing and where vacant properties are so they could focus their attention on fortifying those businesses and inviting new businesses to develop.

# City Structure

This section will use the updated town structure diagram below to identify the major town officials that would potentially access GIS if it was implemented. As stated previously, there are only 13 fulltime staff members in the town and there are part-time and seasonal workers for when it is the peak season (usually Memorial Day through Labor Day). It was also discovered that when positions are vacant (such as grant coordinator), the Town Manager takes over the functions till the position is filled.

There will also be an examination of the town’s relationship with the county and the state planning department to determine the sharing capability of data. This will demonstrate the ability for the state and county to communicate with Fenwick and Fenwick’s ability to obtain updated data from those facilities. As mentioned previously in the Methodology section, this analysis will be a top-down assessment. Because of this choice, I will begin analyzing the individual components mentioned on the structure figure below based on their current responsibilities and where GIS can be implemented to make their work results more efficient. Due to the lack of GIS in the current system, the datasets listed will need to be obtained before implementation.

2016 Town of Fenwick Island Hierarchy



## **Town Manager:**

### ***Responsibilities:***

As Town Manager, Burke has to act as a liaison for the Town Council, the town residents and the town employees. After speaking with him multiple times, it became apparent that he has more responsibilities than the ones listed on the Town Manager website page. Some of these additional duties are acting as the human resources department (i.e. hiring seasonal help), sitting on the town committees, assuming the responsibilities of the grant coordinator, and helping coordinate the town finances. The assigned Town Manager duties are included in the table below. The table will demonstrate what GIS data could be utilized for these tasks if GIS was implemented.

<b>Responsibilities</b>	<b>Relevant GIS Data</b>
Grant Coordinator	*Any GIS datasets that are relevant to the grant the town is applying for
Implement Town Council actions	N/A
Oversees Employees	N/A
Makes recommendations to the Council	N/A
Makes budget recommendations to the Council	N/A
Human Resources	N/A
Town Finances	N/A

### ***Conclusion for GIS abilities:***

Based on the amount of time the Town Manager's current responsibilities, it is determined that despite having the most experience in GIS, it would be better to not assign any GIS tasks to the Town Manager. While the grant coordinator duties are relevant to GIS, it would be better to have a different GIS user create spatial evidence for the grant instead of tasking Burke with it. His other tasks do not directly benefit from GIS so it is determined that he will not have GIS responsibilities.

## **Building Official:**

### ***Responsibilities:***

The Building Official for Fenwick Island is Patricia Shuchman. The main responsibilities of this position is issuing realtor, contractor and merchant licenses, issuing building and sign permits and being the Town Community Rating System (CRS)/Floodplain coordinator. These

responsibilities can be seen on the Fenwick Island’s website. The relevant GIS data layers are listed below with the corresponding functions.

Responsibilities	Relevant GIS Data
Issues realtor, contractor and merchant licenses	*Parcels *Town Boundary
Issues building and sign permits	*Parcels *Town Boundary
Town Community Rating System (CRS)/Floodplain Coordinator	*Parcels *Flood zones

***Conclusion for GIS abilities:***

Based on the Building Official’s primary duties, it would be beneficial for Shuchman to have access to multiple GIS files. That being stated, it is noteworthy to mention that none of the town employees have GIS experience or training besides the Town Manager. Because of this learning curve, it needs to be noted when forming a recommendation for the town. While the Building Official would benefit from using these layers, there would be a fairly high financial cost to train the employees on how to navigate the software.

**Town Clerk:**

***Responsibilities:***

The Town Clerk has the most varying responsibilities after the Town Manager. The main functions for the Town Clerk are: maintaining and archiving Town Council documents, official proceedings, ordinances, resolutions and official records, maintaining Town Council meeting and election materials, providing notary public services, recording official documents, maintaining property and gross rental tax records, and maintaining the town website<sup>1</sup>.

Responsibilities	Relevant GIS Data
Maintaining and archiving Town Council documents, official proceedings, etc.	N/A
Maintaining Town Council meeting and election materials	N/A
Providing notary public services	N/A
Recording official documents	N/A

<sup>1</sup> The Town Clerk responsibilities can be found on the website in this order. The direct link is listed in the works cited.

Maintaining property and gross rental tax records	*Parcels
Maintaining the town website	N/A

***Conclusion for GIS abilities:***

The Town Clerk is similar to the Town Manager in that most of their duties do not have relevant GIS data that would increase the efficiency of their tasks. While parcels would assist the Town Clerk with maintaining property and gross rental tax records, it would not be cost effective to train the Town Clerk on how to view this dataset in GIS. It would be more beneficial to set up a system where another town employee would navigate this dataset for the Town Clerk.

**Public Works:**

***Responsibilities:***

As seen in the city structure diagram, the Public Works department is comprised of four employees. The main tasks assigned to the Public Works department are oversee the construction and maintain the town’s infrastructure, property maintenance and sanitation, landscape maintenance, street maintenance, bulk trash collection, storm water infrastructure inventory<sup>2</sup>. The relevant datasets to this department and its tasks are listed below.

Responsibilities	Relevant GIS Data
Oversee the construction and maintain the town’s infrastructure	*Fenwick Island Roads *Sewer datasets *Water datasets *Electrical datasets
Property maintenance and sanitation	N/A
Landscape maintenance	N/A
Street maintenance	N/A
Bulk trash collection	N/A
Storm water infrastructure inventory	*URS master drainage dataset

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<sup>2</sup> The Public Works department’s responsibilities can be found on the website in this order. The direct link is listed in the works cited.

***Conclusion for GIS abilities:***

Due to the nature of the responsibilities listed above, it would be beneficial for the Public Works department to have access to the GIS datasets. However, as stated previously, because the town does not have GIS currently implemented and the employees have no experience with GIS software, this could only be done if there was an investment in employee training.

**Police Department:**

***Responsibilities:***

The police department consists of a Police Chief, a lieutenant, three corporals, and a sergeant. A Police Clerk is hired seasonally as well. The main responsibility of the police department is to enforce the laws and ordinances, serving the citizens of the town, and maintain the peace. The police department also acts through several programs to benefit citizens. One program is House Watch where the police will periodically supervise residential properties whose owners are out of town. House Watch is closely related to the Commercial Emergency Preparedness program which allows businesses to register their locations to be intermittently checked up on when the business is vacant.

Responsibilities	Relevant GIS Data
Enforce laws and ordinances	N/A – however, the location of incidents can be used to create a crime dataset
House Watch	*Parcels *Town Boundary
Commercial Emergency Preparedness	*Parcels *Town Boundary

***Conclusion for GIS abilities:***

While there is a demand for GIS to be used in tandem with the regular responsibilities of the police department, it would not be efficient to expect the police department staff to directly access GIS. As stated previously, it would be costly to train an existing staff member in GIS. It would be more beneficial to have the police department to focus on their pre-existing responsibilities.

## Sussex County Department of Mapping and Addressing

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The Sussex County Department of Mapping and Addressing and Fenwick Island do not have frequent communication at this time. However, if GIS were to be implemented into Fenwick Island’s system, this relationship should be enhanced. Upon speaking with Town Manager Burke, it

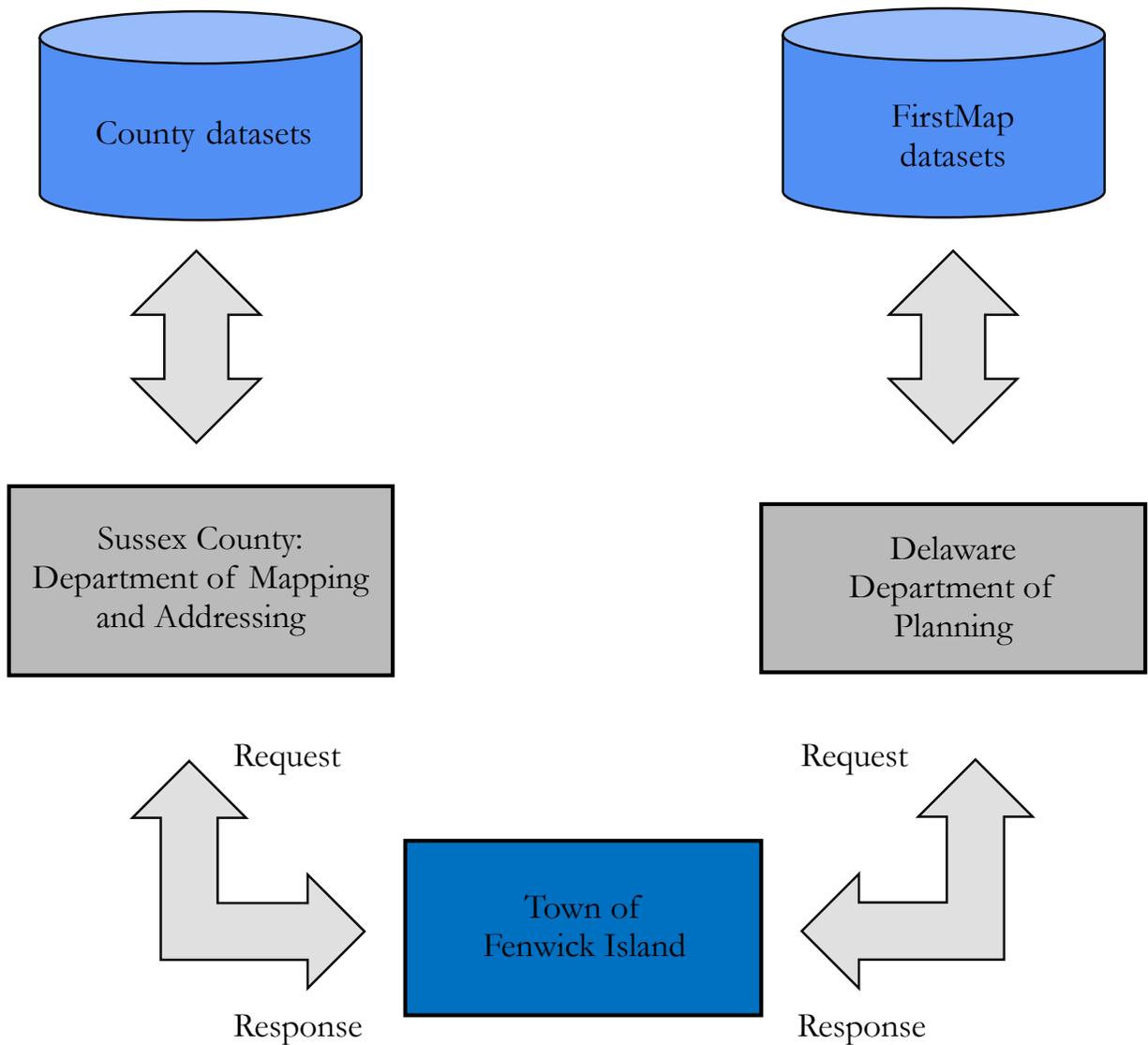
was disclosed that while they do not commonly interact with the Mapping and Addressing department, if GIS were implemented, there would be no concern about the data sharing capabilities between these two entities.

In order to request the data for Fenwick Island, it was necessary to contact the department directly. This form of data request and what layers were requested can be seen in the appendix. While speaking with the employee on the phone, it was acknowledged that the data can be easily shared and that a schedule could be developed for the town to be issued spatial data according to when it is updated by the county. A table is listed below that details the data currently possessed by the county that would be valuable to the Town of Fenwick Island.

Relevant GIS Datasets	Sharing Capability
Parcels	Yes
County Boundaries	Yes
Public Schools	Yes
Libraries	Yes
Streams	Yes
Major Rivers	Yes
Lakes, Ponds, Bays	Yes
Flood Zones	Yes
Publically Protected Land	Yes
Communities	Yes

All of the data needed for Fenwick Island to implement GIS successfully is available to the town. The layers are transferred through email and is in a shapefile format. As mentioned above, there will need to be a schedule set up if town were to receive the files as they were updated. This schedule would save the town time by not constantly needing to check on the update status of certain files and it would allow Fenwick to work with continuously accurate data.

Below is a figure that would best describe the potential relationship between the Sussex County Mapping and Addressing department. While this transaction does not currently exist for GIS data, it is believed that this would be the model if the Town of Fenwick Island were to integrate GIS.



## Delaware Department of Planning and FirstMap

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Similarly to the relationship with the Sussex County Department of Mapping and Addressing, the Delaware Department of Planning and Fenwick Island have an inconsistent, but positive relationship. If Fenwick Island were to integrate GIS to their current structure, communication would be increased and their relationship strengthened. The following table lists the relevant GIS data that would be obtained from the Department of Planning if GIS were accepted into the town structure.

Relevant GIS Datasets	Sharing Capability
Election District Boundaries	Yes
Contours – Sussex County	Yes
Delaware Ecological Network	Yes
Soils Sussex County	Yes
Watersheds 0216	Yes
DE Wetlands – Tidal Wetlands 2007	Yes
Impervious Surface Sussex East 2012	Yes
2012 Landuse, Landcover	Yes
Census Block Groups 2012	Yes
Census Housing Units	Yes
Census Tracts	Yes
Centerlines	Yes
Evacuation Routes	Yes

To transfer data, the Department of Planning uses the FirstMap application to allow users to choose from different genres of data and then open the files in ArcMap Online to interact with. The files listed in FirstMap are available to download through the application and there is no restraint on the quantity downloaded. However, if Fenwick Island were to implement GIS, it would not be efficient to manually download the updated datasets as they are published on FirstMap. As with the Sussex County Department of Mapping and Addressing, a schedule can be created to have the newly updated datasets transferred to Fenwick Island.

The figure above that was used to describe the relationship between Sussex County Mapping and Addressing and Fenwick Island also demonstrates the potential GIS relationship between Fenwick Island and the Department of Planning as well. As stated previously, while there is no current transfer of GIS data, this implementation would allow for that development.

# GIS Applications

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Before a recommendation can be made on how to implement GIS into Fenwick’s current system, a master list of all the spatial data relevant to Fenwick Island must be composed. However, due to the multiple statements of having the town officials request the data or products from someone instead of obtaining the data themselves, there will be no analysis of the GIS privileges for individual employees. This GIS design will be focused on a sole user fulfilling the requests of their supervisors and peers.

## GIS Data Requirements

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The analysis of the GIS needs of the individual officials in the previous section was necessary to identify the datasets needed for the town geodatabase. Based on the findings in the city structure, it has been acknowledged that the Town Clerk and the Town Manager will not utilize GIS directly. Because of this, the datasets necessary to the other officials and the datasets cited previously as being relevant to Fenwick Island from the state and the county will be compiled in an organized list. The spatial files that have already been created for the town during this assessment will be featured as well.

These files will be organized in the following directory to demonstrate the amount of data needed, where they are sourced from, how often the layers need to be updated and how high of a priority it would be to obtain these files. There are also individual data groups that the data is sorted into: imagery, administrative, town-created data, hydrology, environmental, utilities/infrastructure, and police/emergency management. The priority is determined by how relevant the file is to Fenwick Island’s main GIS needs or by how readily easily it is to create or obtain that file. There are files listed that are not created yet, these files are denoted with an asterisk so Fenwick Island is able to recognize these with ease.

Directory of Desired GIS Data for Fenwick Island			
Dataset	Source	Data Updating	Priority to Obtain
<b><u>Imagery</u></b>			
True Color Orthophotography	ESRGC	Updated with ESRGC imagery	Medium
DEM – 10 meter	USGS	Maintained by USGS	High
<b><u>Administrative</u></b>			

State Boundaries	DE FirstMap	Maintained by state	Low
County Boundaries	DE FirstMap	Maintained by state	Low
City Boundary	DE FirstMap	Maintained by state	High
Census Tracts	DE FirstMap	Maintained by state	Medium
Census Block Groups 2012	DE FirstMap	Maintained by state	Medium
Census Housing Units	DE FirstMap	Maintained by state	Medium
Parcels	DE FirstMap	Maintained by state	High
Election District Boundaries	DE FirstMap	Maintained by state	Low
Schools	Sussex County	Maintained by county	Medium
Libraries	Sussex County	Maintained by county	Low
Communities	Sussex County	Maintained by county	Low
Fenwick Island Parks	Fenwick Island Needs Assessment	Update as needed	Medium
Town Municipalities	Fenwick Island Needs Assessment	Update as needed	Low
<u>Town-Created Data</u>			
Smoking Receptacle	Fenwick Island Needs Assessment	Update as needed	Medium
Beach Access Streets	Fenwick Island Needs Assessment	Update as needed	High
Parking Locations	Fenwick Island Needs Assessment	Update as needed	High
Bike Racks	Fenwick Island Needs Assessment	Update as needed	Low
<u>Hydrology</u>			
Watersheds 0216	DE FirstMap	Maintained by state	Medium
Streams	Sussex County	Maintained by county	Low
Major Rivers	Sussex County	Maintained by county	Medium
Lakes, Ponds, Bays	Sussex County	Maintained by county	Medium
Flood Zones	Sussex County	Maintained by county	High
<u>Environmental</u>			
Pine Beetle Tree Locations	Fenwick Island Needs Assessment	Update seasonally	Medium

Impervious Surface Sussex East 2012	DE FirstMap	Maintained by state	Low
DE Wetlands – Tidal Wetlands 2007	DE FirstMap	Maintained by state	High
2012 Landuse, Landcover	DE FirstMap	Maintained by state	High
Contours – Sussex County	DE FirstMap	Maintained by state	Low
Delaware Ecological Network	DE FirstMap	Maintained by state	High
Soils Sussex County	DE FirstMap	Maintained by state	Medium
Publically Protected Land	Sussex County	Maintained by county	High
<u>Utilities/Infrastructure</u>			
Master Drainage Dataset	URS	Update as needed	High
Fenwick Roads	Fenwick Island Needs Assessment	Update as needed	High
Centerlines	DE FirstMap	Maintained by state	Medium
<u>Police/Emergency Management</u>			
Evacuation Routes	DE FirstMap	Maintained by state	High
FIPD Life Guard sheds	Fenwick Island Needs Assessment	Update as needed	Low
Life Guard Stands	Fenwick Island Needs Assessment	Update as needed	Medium
*Incident Locations	Fenwick Island – If GIS is implemented	Update daily	High
*Crimes	Fenwick Island – If GIS is implemented	Update daily	High

The imagery is one of the first data groups and will contain the digital elevation model (DEM) and the orthophotography. These two files are maintained by other departments or organizations, therefore, Fenwick Island only needs to receive the new imagery as it becomes available. The town-created dataset would be maintained and updated as needed. This dataset will grow as the town continues to develop its own spatial data.

The administrative dataset is one of the largest and is comprised mostly of files that are maintained by the state and by the county. These files should be easy to access due to the relationship between Fenwick Island and these entities. As stated previously, a schedule can be created to receive the new layers as they are updated. It might be considered as the town develops its GIS that Fenwick Island takes over the maintenance of its own parcels instead of waiting for the county. This would most likely not occur until two years after the town implements GIS to give the town time to develop their own original data, such as building foot prints, sidewalks, etc.

The environmental dataset is mostly updated by the state and county. The only file listed in this group that would be maintained by Fenwick Island is the Pine Beetle Infection locations. This file was created based on GPS data and was created March 2016. The town would want to update this data seasonally and would consider having it expanded to contain the owner's information for the trees that are on residential properties. This data group could also contain storm information and any other relevant data Fenwick Island creates in the future.

The utilities/infrastructure dataset is one of the least developed sets. There is the master drainage dataset that was created by URS on a contracting job and this will need to be utilized for Fenwick. The electric dataset is currently with Delmarva Power and that would need to be obtained if GIS is implemented. The water should also be obtained from Artesian Water. The infrastructure could be expanded as well by including sidewalks, fire hydrants, manholes and other datasets. This data group would require the most attention from Fenwick Island for maintenance, however, it would only need to be updated when changes are made to the individual systems.

The police/emergency management data group is a dataset that would need to be improved upon if GIS is implemented. Two of the five proposed data files are not created and would require the GIS user to go through a large number of police records to develop the files. However, these created layers would be one of the most beneficial to the safety of the town and should be considered a high priority. These layers would also need the most maintenance with daily updates, though, this would save the GIS user time on updating individual files instead of bulk data entry and would allow the town to have the most current records for crimes and incidents.

## Data Storage and Access Methods

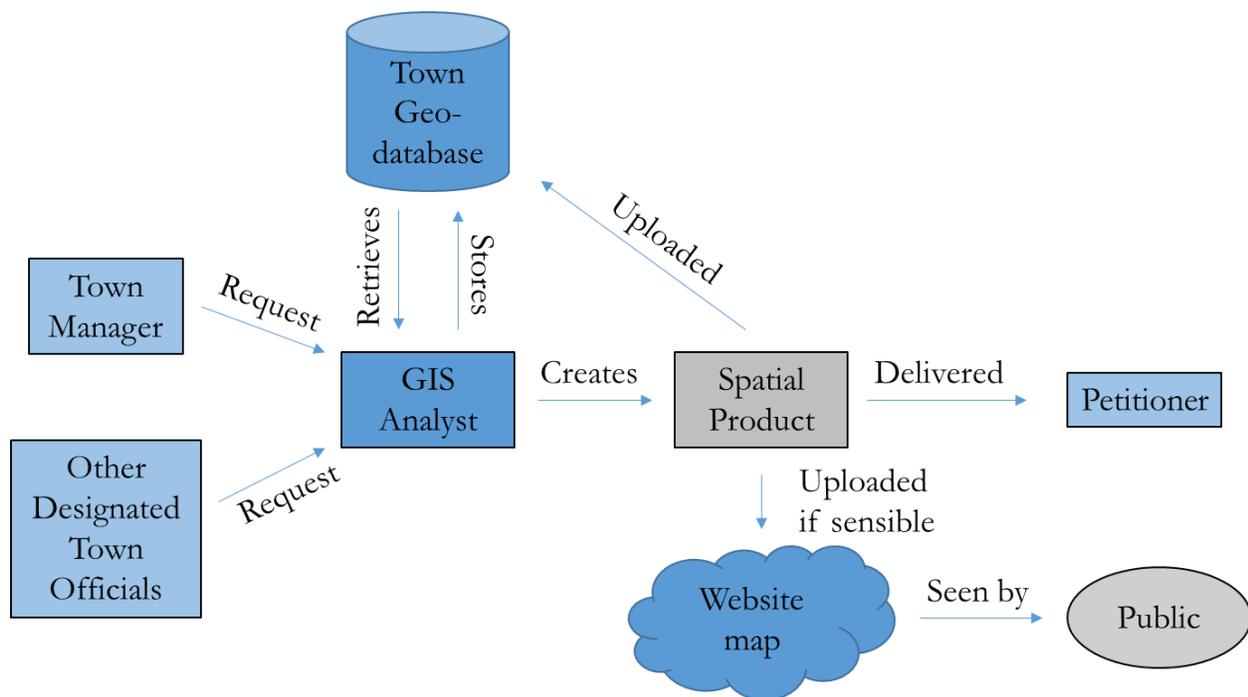
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The Town of Fenwick Island currently has a computer network where town documents and materials are stored. This would be the location of the geodatabase so that the database will be secure and there would be no concern of data loss. If the database is stored on an external hard drive or to a single computer, there is a higher risk of losing data or of the data becoming corrupt.

This would also be beneficial in the case of the GIS user’s computer being replaced – they do not need to transfer over the data, only the software.

For the GIS user, it has been made apparent that Fenwick Island would not benefit from having multiple users. To have multiple users for a GIS software, Fenwick would either need to have everyone share one computer for GIS or have a floating license – both options are disadvantageous due to the high cost of the floating license and the conflict of using the computer at the same time. There is also the high cost of training multiple employees to use GIS. Due to these restrictions, it is suggested to only have one GIS user. The approved town officials (Town Manager, Police Chief, Building Official, and Maintenance Tech III) would be able to submit a form requesting a spatial product and the GIS user would then fulfill the request. An example of what this form could look like is featured in the appendix.

Diagram for GIS interaction and creation:



The above model demonstrates how the Town Manager and other town officials would receive requested spatial products and how that spatial product would be stored and if applicable, how it would be made available to the public. The GIS analyst would process requests as they are turned in and would notify the petitioner of the expected completion date for the product. The Town of Fenwick Island’s online map would be determined based on the software chosen by the town. The different software options will be detailed in the section, however, a map should be utilized by the town, regardless of their software decision.

# System Requirements and Costs

This section will look at the varying costs for the different variables that are needed to implement GIS into Fenwick. Each variable will have several alternative choices that will help achieve implementation and their benefits and negatives will be included as well. There is a section further in this report that will detail how the more complex alternatives could be implemented and whether or not they will be featured in the recommendation for the town.

## Software Alternatives

For GIS software, there is a standard in government and then there are two alternatives. The standard for government offices and most GIS users is ESRI's ArcGIS. This is the software that most GIS users are familiar with and this is the software that would allow for the easiest sharing capability with the state and the county. It is also advantageous in having geodatabase storage. The file geodatabases allow for up to a terabyte of data storage and allow the user to create domains, topography rules and relationships between different files to make the data "smart". An example of this would be having a topography rule of not allowing a building footprint to intersect a parcel line. This intelligence allows for more efficient GIS products and ensures a limited amount of errors. The other advantage of ESRI are the included maintenance and updates, online mapping account and technical support.

The disadvantage of supporting ArcGIS is the higher cost compared to similar GIS software. This software would cost 1,500\$ for the first year and 500\$ for every year after for Fenwick Island through the GSA license. The other drawback of selecting ESRI would be the need to train or hire someone to understand how to utilize the geodatabases and store data in them in a meaningful way. This could be expensive due to this skillset being coveted.

The alternatives include Manifold 8.00 Professional + Geocoding and QGIS Version 2.8. Their drawbacks and advantages are listed in the table below as well as their price. However, they will be detailed in their own section under Alternative Solutions further on in the assessment.

Software Alternatives				
	Pros	Cons	What it includes	Total Cost
<b>ArcGIS Basic 10.3</b>	Most commonly used in government organizations, vast amount of	Higher cost than other alternatives, has an annual cost, requires	It includes updates for the software, 1 ArcGIS online account,	1,500\$ for the first year and then recurring 500\$ annual cost.

	training available, geodatabase storage, most commonly known GIS software	knowledge of databases to best utilize the geodatabases.	maintenance and 1 authorized technical support caller	
<b>Manifold 8.00 Professional + Geocoding</b>	More affordable option from a GIS company, easy to use for those trained in SQL	Not as well-known as ArcGIS and no geodatabase storage.	It includes Internet Map server and two standard tech support incidents by email.	325\$
<b>QGIS Version 2.8</b>	Free alternative, has similar functionality to Manifold through PostgreSQL, and can be updated without a fee.	Hard to train for, commercial support given through contracting, very little training available, and no geodatabase storage.	Only includes the software.	0\$

## Hardware Alternatives

When meeting with Town Manager Burke, it was disclosed that Fenwick Island possessed a laptop that could be set aside for GIS. Normally laptops are not optimal for the use of GIS due to the lack of storage and the generally slower CPUs. Below is a table that highlights the specifications of the laptop in question.

Fenwick's Laptop Specifications	
CPU:	Intel® Core™ i3-3120
CPU Speed:	2.50 GHz
Video Card:	Intel® HD graphics 4000
Video RAM:	1.6 GB
RAM:	4 GB
OS:	Windows Professional 7 service pack 1
Monitor Maximum Resolution:	1366 x 768
Free Space:	220.7 GB

Despite being a laptop, the hardware passes the requirements to run ESRI’s ArcGIS, Manifold and QGIS. However, GIS would have to be the only function the laptop is used for to have efficient processing. Because of its specifications, it could be chosen for the hardware in the needs assessment, though it would be highly recommended to explore purchasing new hardware after a few years when Fenwick Island will convert from collecting data to running geoprocesses, which takes up more RAM and storage.

The following table demonstrates the cost of alternative hardware in the event of the laptop not being sufficient or additional grant funding that allows the purchase of additional hardware. The options listed are linked in the works cited in the appendix, however, the price is subject to change. The chosen alternatives have at least an Intel i-5 or Intel i-7 processor and both possess a CPU speed over 3.00 GHz. Additionally, the RAM is 8.0 GB and both options are desktops to provide more hard drive storage.

Hardware Alternatives	
Laptop (already obtained by Fenwick)	0\$
ASUS M32CD-B07 Desktop & 27" IPS LED Monitor Package	719.98\$
Asus - Desktop - Intel Core i7 - 8GB Memory - 1TB+8GB Hybrid Hard Drive – Gray & Asus - 24" Widescreen Flat-Panel LED-LCD HD Monitor - Black	1,162.98\$

The decision for the hardware ultimately will depend on the total cost of the hardware and how much Fenwick Island is willing to invest in up front. As mentioned previously, the laptop will be able to support the three software alternatives, however, it will only last for several years before Fenwick Island will grow out of it. The other options are more long-term and will be able to support Fenwick Island’s GIS functions for multiple years. The final recommendation will be made in the Recommended Action section.

## Staffing Alternatives

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The final aspect to consider when implementing GIS into Fenwick Island’s current structure is who will actually use it. It has already been stated that this system will utilize one user based on the current demands of the town and their current staff. The alternatives for staffing include a student worker, part-time GIS analyst and training an existing staff member. The table below features the cost, advantages and disadvantages of each alternative.

Staffing Alternatives			
	Pros	Cons	Total Cost
<b>Student Worker</b>	Able to hire student worker at a reduced rate, more exposure to new technology, gain help with other tasks in town hall.	Would have to change student workers almost every term, would need to spend additional time training/supervising, could experience poor work	3,960\$ - Student wages + 10% overhead + 5,000\$ - Max ESRGC cost: 9,356\$
<b>Part-time GIS Analyst</b>	Would have a consistent and pre-trained GIS employee, would only need to train about inner town workings, does not need as much supervision as other two alternatives	Higher cost for salary compared to student worker, could have quality check problems, and would need assistance screening applicants.	20\$ an hour * 30 hours a week * 50 work weeks: 30,000\$
<b>Train Existing Staff Member</b>	Would only have to pay for training and additional bonus for skills, no need to hire anyone new, would already have knowledge of inner workings of the town.	Most employees have basic computer skills without a geography background, employees may not be interested in learning GIS, could have quality problems.	Training costs depend on the software that is chosen. Pay should be increased to at least 50,000\$ annually, depends on current employee's salary.

The best choice for Fenwick Island would be to hire a part-time GIS analyst. This would be a GIS professional already trained to use the software chosen by the town and would not require near as much supervision as the other two options. The main difficulty would be the financial burden of hiring a GIS analyst (though it is slightly reduced by having the position as part-time). There is also the difficulty of knowing whether or not the GIS analyst is creating accurate spatial products if they are the only ones with the ability to use the software. The final disadvantage is how to hire the best candidate. This drawback could be satisfied, however, by asking the county's mapping and addressing office for assistance in the hiring process.

The other two alternatives listed in the table will be further investigated in the Alternative Solutions section next. While the two options seem preferable because of their ease of integrating into the system and the financial benefit of a student worker instead of a part-time GIS professional, it should be noted that they have their downfalls and that will be outlined in the following section.

# Alternative Solutions

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This section will further detail what entails when implementing the following alternative solutions. As stated previously, though these options can be financially lucrative, Fenwick Island would only receive what it pays for. The advantages and disadvantages of each alternative will be detailed as well as what would need to be accomplished to integrate that option into Fenwick Island's GIS implementation. Following this section will be the final recommendation for the town on how to successfully integrate GIS if it is approved.

## Open-Source GIS (QGIS)

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As technology continues to develop, the use of open source software is becoming increasingly more popular. Open source software is typically defined as a software that costs little or nothing and allows for the user to further build upon the program. QGIS has no cost and is available as long as the hardware has internet connection to download the software and updates. Once installed, the user is able to be using GIS functions such as, editing, viewing and analysis tools.

The advantages to this software are limited solely to the price tag. This software has limited training materials available for users to learn the software. The training manual provided on the software's website is listed in the works cited of the appendix. This training manual contains very little screenshots and is shown on a Mac Platform which could be confusing due to Fenwick Island using Windows as an operating system. Because of the limited amount of GIS users who are experienced in QGIS, this would make it exceedingly difficult to find a GIS professional and even more so to try and train an existing town staff member.

QGIS software also fails to have the same geodatabase storage as ESRI. ESRI has a monopoly on this type of storage and can make it difficult for other software to compete. If QGIS is used, the software will consume more storage space than the geodatabase would. A shapefile (the typical file type for GIS) is comprised of seven components. When in a geodatabase, this shapefile is converted to a feature class and is compressed. If left as a shapefile, more space is consumed and if any of the seven components are lost, the shapefile becomes corrupt and unusable. There is also the disadvantage of not being able to create domains, relationships and topography rules to improve the data's intelligence. This would lower the efficiency of the GIS processes and could lead to errors in the data that would have been noticed if topography rules were in place.

Another disadvantage to recognize is the lack of technical support. Because QGIS is an opensource software, there is no formal customer service branch. On the website, it is mentioned

that for users who would like to use QGIS for their commercial needs can contract a company for tech support, however, this would not be preferable because the costs are not cited and could be fairly steep from a contracting company.

## Manifold

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While Manifold is more expensive than QGIS, it is only a sliver of the price tag of ESRI's ArcGIS. Like QGIS, Manifold offers the same GIS functions that ESRI does, however, Manifold tends to utilize SQL more often than ArcGIS. This can be seen as an advantage because most GIS professionals are familiar with SQL and can allow for more database designing as well with SQL.

Another advantage of Manifold Professional is that it includes internet mapping and two tech support incidents by email. This is beneficial when compared to QGIS that only includes the software and would need outsourcing for technical support. It is also considered a benefit when compared to ESRI that would cost 500\$ annually to include the internet mapping and tech support. However, ESRI's tech support includes unlimited calls during office hours and would include updates – something that is not specified for Manifold.

A disadvantage to consider is the lack of geodatabases. As mentioned previously, geodatabases are exclusive to ESRI and Manifold would not be able to utilize them. This would once again lead to the lack of “smart” data by inputting topography rules, relationship and domains and would consume more storage on the network than a geodatabase would.

An additional drawback would be training. While it would be somewhat difficult to find a GIS professional with sufficient experience with Manifold – it would not be impossible. If the town were to train an existing staff member, the learning curve for Manifold would be steep compared to ESRI. This software is based on SQL and without a computer science or GIS background, the interface and geoprocesses are more difficult to navigate. A training guide can be seen in the works cited component of the appendix. There are additional training materials available online through GIS users (i.e. YouTube).

## Staff Member Training

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The benefit of training a current town employee would be their knowledge of the inner workings of the town. They would be aware of where the town would like to go and how the town communicates with other branches of the county and state government. There is also the benefit of not needing to hire any new employees – the staff member needing GIS training would only need a

bonus for learning GIS. This limits the cost of paying a new salary and including benefits for the new employee.

This, however, is not the solution to Fenwick's implementation. Training an employee would not be sufficient because they would lack the geography background and almost all of the town employees have basic computer training. The Town Manager, who has GIS experience in the past, is not an option for the GIS user due to the lack of time available. Because of this lack of geography and computer science knowledge, the GIS products and processes may not be accurate and there would most likely be a need for more technical support.

The drawbacks stated are staggering because if the data product is inaccurate or if the GIS user has too much difficulty adapting to the software, Fenwick Island would have to choose between getting another GIS user or eliminating GIS all together. Both options would cause Fenwick Island to invest a significant amount of funding into a failed project.

## Student Internship Program

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While the concept of having a student worker creating GIS products can be daunting, it would be one of the more cost-effective and optimal options for the staffing alternatives. By hiring a student worker, not only would the town save on salary, the student has more exposure to the software. Students of Salisbury University's GIS track are knowledgeable in alternative software, new techniques being used in the field and are able to work at the competitive rate of 12\$/hour. Another benefit of the student worker would be having them assist with other tasks around town hall, such as answering phones and assisting with preparation for town events and meetings.

The main drawback of a student worker would be the term length. The student worker would be employed with the town for the summer (11 weeks), working 30 hours a week and after that the term would end. The town has the option to hire the student again the next summer, but this staffing alternative is not as permanent as the part-time GIS analyst or the trained existing staff member.

Another drawback would be the potential need for more time spent supervising the student to ensure they are completing their tasks correctly and the risk for receiving poor-quality work at the end of the term. There is a resolution to this concern. The first resolution is that Dr. Scott would be able to recommend sufficient students, who are driven, in advanced GIS courses and are efficient to Fenwick Island for hiring. This would mean ESRGC contracts out the student to Fenwick Island – allowing Fenwick Island to no longer be responsible for the taxes on the student's pay and other

hiring hassles. An additional resolution included in the cost of the student already is the ESRGC maintaining the data and quality checking the student's work.

The ESRGC charges a rate of \$21.78/hour for maintaining and updating a town's data and for quality checking any work done by the student worker. The max amount of work that can be done by ESRGC is 5,000\$ or 229 hours. It would be safe to assume that Fenwick Island would not reach this max amount so it would be expected that the cost would be fairly less than the 5,000\$ limit. This work eliminates the concern for poor work (a concern for all of the staffing alternatives) and would justify the option of having a student worker. It is recommended that if the student worker is chosen, ESRGC should quality check their work and then maintain and update Fenwick Island's spatial data semi-annually, preferably once in April to prepare the data for the student and again in October to keep the data relevant.

## Recommended Action

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The conclusion of this needs assessment strongly suggests that Fenwick Island would benefit from the implementation of GIS. As stated previously throughout the report, there are numerous ways to implement the system. Due to these options, it is imperative that the correct method is applied to ensure a long lasting program that effectively integrates the system into the town and allows the town to take control of their spatial data and begin to apply it in a problem-solving manner. The following sections will provide recommendations on what alternatives previously suggested should be implemented and will include an outlook of Fenwick Island’s GIS goals.

## Recommended Software

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After comparing the potential software alternatives, the recommended software is ESRI’s ArcGIS. The software is the most used GIS software with both government offices and with GIS users. Because of this, it would be fairly easy to bring in a GIS user that is familiar with the software and there would be no concern of a learning period like with Manifold or QGIS. It would also allow for Fenwick Island to share data more easily with the Delaware Department of Planning and the Sussex County Department of Mapping and Addressing.

There is the added benefit of having the geodatabase storage. As stated previously, the geodatabase allows for up to a terabyte of storage and would allow for the storage to be used more effectively due to the feature classes. Storing the data as shapefiles would take up more space than having the data compressed to feature classes in the geodatabase. It would also allow for the data to be “smarter” by implementing topography rules, relationships and domains. There is still the concern of having the highest cost of the alternatives, but based on what it includes and the other stated advantages, the benefits outweigh the cost.

Recommended Software				
	Pros	Cons	What it includes	Total Cost
<b>ArcGIS Basic 10.3</b>	Most commonly used in government organizations, vast amount of training available, geodatabase storage, most commonly known GIS software	Higher cost than other alternatives, has an annual cost, requires knowledge of databases to best utilize the geodatabases.	It includes updates for the software, 1 ArcGIS online account, maintenance and 1 authorized technical support caller	1,500\$ for the first year and then recurring 500\$ annual cost.

## Recommended Hardware

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Despite the drawbacks of using the laptop already obtained by Fenwick Island, it is the recommended hardware for the starting phase of implementing GIS into Fenwick Island's structure. The laptop's specifications meet the recommended software's requirements and will be able to run ArcMap Basic 10.3. It is suggested that the laptop only be used for GIS because the software will require a large amount of hard drive storage and RAM.

It is suggested that the laptop be used for the first stage of implementing GIS, but it will be necessary for Fenwick Island to replace the laptop with a desktop. This replacement will most likely take place after three years of GIS being utilized in Fenwick. When it is replaced, it is highly suggested that Fenwick Island invests in a desktop with a CPU speed of at least 3.00 GHz and a 8.0 GB RAM. This will be critical for when Fenwick Island shifts from the data collection and creation phase of GIS to the actual analysis of the data captured.

Recommended Hardware	
Laptop (already obtained by Fenwick)	0\$

## Recommended User

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Based on the financial constraints of being a smaller town and the benefit of being assisted by ESRGC, the student worker is the best staffing alternative for Fenwick Island. This could change in the future, but at base stage of implementation, Fenwick Island would not only save on this variable, they would have the assistance of ESRGC maintaining the datasets and quality checking the student's work. Salisbury University also benefits by having the students gain more real world experience.

The best way to structure the student's work would be to have the student update maps for several selected datasets. These datasets should be selected based on priority and importance to the town, such as, utilities, commercial business locations, pine beetle infected trees, etc. In addition, the student will select a personal project they would like to focus on Fenwick. This project can be based on the student's interest or the student can ask for the town to assign another project. An example of this would be a student interested in creating a map looking at the depth of the water off the Coast of Fenwick Island to find the best surfing areas. This personal project will increase the amount of data available to Fenwick and would allow the student to add an independent study to their resume.

Recommended Staffing			
	Pros	Cons	Total Cost
<b>Student Worker</b>	Able to hire student worker at a reduced rate, more exposure to new technology, gain help with other tasks in town hall.	Would have to change student workers almost every term, would need to spend additional time training/supervising, could experience poor work	3,960\$ - Student wages + 10% overhead + 5,000\$ - Max ESRGC cost: 9,356\$

## Implementation Outlook

If Fenwick Island were to choose to implement GIS based on the recommendations stated above, the total cost can be seen in the table below with the first year and the next five years:

<b><i>Fenwick GIS Potential Cost</i></b>	<b>1<sup>st</sup> Year Costs</b>	<b>Yearly costs for five years</b>
<i>Software Costs:</i>	1,500\$	500\$
<i>Hardware Cost:</i>	0\$	0\$
<i>Staffing Cost:</i>	9,356\$	9,356\$
<i>Total Cost:</i>	10,856\$	9,856\$

As technology improves and more spatial data is developed, the GIS needs for Fenwick Island will not be static. The current need as specified above is to create a foundation of which Fenwick Island’s system can be built on. This includes creating new data, continuously maintaining the data already stored and creating spatial products to be shared with the public. However, in a few years, that need will be fulfilled and Fenwick will have new GIS needs. This outlook is designed to predict the future GIS needs of Fenwick and address how they can fulfill them. This forecast only extends to 15 years due to how quickly technology changes and because of the potential change in town interests.

### **Immediate Goal (First six months):**

The priority objective for Fenwick Island upon approving implementation would be the preparation and creation of four main data groups. In the data directory featured in the GIS Data Requirements section, several datasets are shown to be lacking data. The immediate goal would be to take these datasets (utilities/infrastructure and police/emergency management) and expand on their extent.

The utilities/infrastructure dataset can be improved by creating more features. The current dataset would only have the drainage dataset, roads and centerlines. This can be improved by creating building footprints off of county data or town maps (if they exist) or by using imagery. There is also the potential of creating a sidewalks feature class and a fire hydrant feature class. One of the more significant files to consider creating would be a point feature with the locations and elevations of the manholes in this town. However, due to the time it takes to accurately record a location with a GPS, it may be better to create this file in the off-season.

The next dataset to enhance would be the police/emergency management dataset. Currently it only contains the evacuation routes obtained from the state and the life guard stands and sheds locations that was created in this assessment. The priority would be creating the police crimes and incident layers to better understand where the different types of crimes are clustered. Another feature that would be a priority is the creation of a storm surge file. This file could be focused on showing the different levels of storm surge based on the individual categories of hurricanes. This would allow the town to better prepare for an emergency.

### **Short-term Goal (0.5 - 5 years):**

In the recommendations above, it is stated that for the time being, selecting the laptop and student worker alternatives will suffice. They are optimal because of their cost (or lack thereof for the laptop) and because they address the immediate GIS. The goal for the first five years is to create new data that is tailored to Fenwick Island, continuously maintain the data that is already stored for Fenwick Island and create spatial products to be shared with the public.

As stated previously, the student worker will use ESRI products to maintain the pre-determined datasets and then conduct a GIS analysis or data collection of their choice. This addition to Fenwick's GIS data will allow for a foundation to be built. Though, once the foundation is built, the need will be satisfied and Fenwick Island will have a new need: using the data created and gathered to conduct analyses.

### **Mid-term Goal (6-10 years):**

In order to run analyses on the data created and gathered by the student worker, there will be a need for a full-time GIS professional. It would be best to hire an analyst because they will have the data editing and collection training from previous technician experience, but also be prepared to develop models and conduct geoprocesses to supplement Fenwick Island's decision making.

A full-time GIS professional will cost around \$50,000 annually to employ not counting benefits. There is also the added cost of most likely having to purchase new hardware because the laptop will not have the capabilities to run the added GIS processes. The suggested solution to these

higher costs would be to hire a GIS analyst for both Fenwick Island and Bethany Beach. The reason Bethany Beach is suggested is due to the shared Chamber of Commerce between the two towns already. With this connection and the close proximity, Bethany Beach is the most likely cooperative for Fenwick Island to share a full-time analyst.

The main concern with sharing a GIS analyst would be one of the towns pushing their work ahead of the others. Bethany Beach would be the most likely culprit of this. To avoid this dilemma, it would be beneficial to have the GIS analyst respond directly to the Town Managers and not the individual departments and create a request system that requires a certain amount of time for each request to be processed and that requests are fulfilled based on the order they are received. By eliminating the potential for some projects being more urgent than others, it forces the projects to be submitted in time if the town managers would like the project completed.

### **Long-term Goal (11-15 years):**

The long-term goal for Fenwick's Island would be to expand upon the mid-term goal by encouraging the remainder of the Quiet Resorts (Rehoboth Beach and Dewey Beach) to join the GIS coalition created by Fenwick Island and Bethany Beach. By cooperating with the other Quiet Resorts, it would increase the amount of funding available to hire another GIS analyst. With two GIS analysts, there can be an increase in quality data and there can be more data available for coastal Sussex County.

Once again, a system to organize the spatial requests as they are delivered is needed to ensure the smaller towns are not at a disadvantage when competing with Rehoboth and Bethany for products. While before it was suggested that the Town Manager of the respective towns submit the request, however, with this amount of town officials utilizing the system, it may be worthwhile for each town to have a GIS liaison with the GIS analysts. The towns should consider having their respective liaison obtain a certain amount of training in GIS to submit a more qualitative request.

### **Concerns with Goals:**

One of the main concerns with the goals outlined above is how towns have been competing for resources, tourists, and other various resources. Due to this competition, it would be difficult to inspire cooperation between Fenwick Island and the other Quiet Resorts. However, if the Town Managers and Town Councils can be persuaded to see the benefit of integrating GIS into their structures and recognize how financially advantageous it would be to share GIS analysts.

There is also the concern of the larger towns (Bethany and Rehoboth) running over the smaller towns (Dewey and Fenwick). While structuring the request system to treat the needs of the towns fairly would be best, it is also idealistic to assume there would be no conflict. To avoid this,

The Quiet Resorts should investigate hiring three GIS analysts. Rehoboth and Bethany Beach could have their own analysts, while Dewey and Fenwick could share an analyst to avoid trampling. Because Fenwick and Dewey Beach are similar in size, there should be little to no conflict.

# Potential for Enhancements

While the previous section detailed the best method for implementing GIS into Fenwick Island’s current structure, there are potentials for improvements. One of the potential enhancements not detailed in the assessment yet would be to utilize a grant to finance the first year implementation of GIS. Grants are available for the improvement or advancement of GIS for local governments, the only complication would be finding the grants that are applicable to Fenwick Island and applying for them. FEMA has several grants that could be applicable to the implementation and the appendix contains the list of grant categories as well as the guidelines for what the awarded funds can be used for.

Another potential enhancement would be the investment in iPads and a GIS application to allow for Public Works employees be able to see the utilities around their GPS location. An application to investigate would be Utility Data Collection which is 94.99\$ per download. This application would allow shapefiles to be uploaded and would show these features over imagery based on where the user is located. Attributes can be seen within the app and would even allow the user to manipulate the data within the app. If this enhancement was chosen, the Public Works users would need to have training in the app. Below is the table demonstrating the cost for this enhancement, however, a different application can be selected to modify the cost:

<b>Enchantment with Utilities iPads</b>		
	<i>Two Users</i>	<i>Four Users</i>
<b>9.7 – inch iPad Pro Wi-Fi + Cellular 32GB – Space Grey with AppleCare+, cases** and tax</b>	1,955.34\$	3,910.68\$
<b>Utility Data Collection App</b>	189.98\$	379.96\$
<b>Total Cost:</b>	<b>2,145.32\$</b>	<b>4,290.64\$</b>

\*\*Otter box has released an estimated price of the cases being around 99\$ each for this model, but have not released the finished product yet.

# Implementation Challenges

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As with all major projects, there are potential challenges to be considered if it is approved. The first challenge would be the cost. As mentioned in the enhancements section, a grant could be obtained to help offset the cost. However, there is the concern of a grant not being attained. Fenwick Island will need to consider this when deciding on whether or not to implement. The recommended action is the most cost effective/efficient option available and it might have an even lower cost due to the unlikelihood of Fenwick Island hitting the maximum amount of hours ESRGC can work on the data.

Another significant concern with the implementation of GIS is Fenwick Island's commitment to the system. This is a major investment and it requires each designated town official to be integrated in the potentials the software offers to their individual tasks. There is a possibility with having a student worker only conducting work in the summer instead of having a year-round GIS analyst that Fenwick could fall victim to this.

A solution for this failure to commit could be creating a GIS committee for Fenwick Island staff members to attend to contribute different GIS projects proposals amongst each other. This could be difficult because Town Manager Burke is the only staff member who has GIS experience. Sending a designated town official to the Delmarva GIS conference to see what is changing in the field and how other towns are utilizing GIS on the Delmarva Peninsula. The cost to attend the conference is only around 70\$ for early registration.

# Conclusion

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After several months of studying and observing Fenwick Island, it is strongly recommended that Fenwick Island integrates GIS into their current structure. Due to their proximity to the ocean and the hazard potentials as well as the benefit of having spatial evidence for grants, Fenwick Island would be able to having better decision-making abilities and would be able to provide more spatial products for its citizens.

Though there are multiple alternatives shown for staffing, hardware and software, it is highly advised that Fenwick integrates the recommended action. This recommendation was chosen based on the financial burden it would present to Fenwick as well has how many benefits it yields. The choice of ESRI software would allow for smarter storage and for increased sharing capabilities with Sussex County Mapping and Addressing and Delaware Department of Planning. It would also allow for use of ArcGIS online which would give the public access to the spatial data Fenwick Island chooses to upload.

It is recommended that Fenwick Island utilizes a student worker for the first five years of implementation as well. Having a student worker would allow Fenwick Island cut costs of integration and would also allow for ESRGC to maintain and update their data without fear of quality. The student will also assist with tasks around town hall and will relieve stress on other town officials while learning how a local government functions.

The option to integrate GIS into the Town of Fenwick will be decided by the Town Council. It is strongly suggested that if the Town Council would like to have control of their spatial data, be able to competitively compete for resources, save on contracting costs, be one of the first Sussex County town to fully integrate GIS, and improve decision-making it in the town, that they should approve this proposal.

# Town Council's Response and Reaction

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This needs assessment was presented to the Town Council on April 22<sup>nd</sup>. Upon presentation, there were no questions and each council member and the Town Manager received a copy of the report. The decision will ultimately be left up to the Town Council on whether Fenwick Island should implement GIS. There will be a budget meeting later this month where the fate of the project can be further discussed.

They have the following resources if they choose to implement: Dr. Michael Scott's contact information, the email for ESRGC, the contact information for the ESRI sales representative who provided estimates, and a geodatabase with the data created during this assessment. The contact information will be below in the appendix. Additionally, they will have a CD from URS contracting that contains the master drainage system. If there is further assistance needed, they are also able to contact the project manager (Katy Maglio).

# Appendix

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This section contains the works cited and the supporting documents used to create this Needs Assessment. It also contains the citation for the report that was used as templates for this needs assessment in the Works Cited. This report was create on April 18<sup>th</sup>, 2016 with the hopes of structuring the potential GIS structure that could be implemented into Fenwick Island. The report was created for the completion of the Project Manager's (Katy Maglio) Masters of Science in GIS Management at Salisbury University. Please contact the project manager using the information below for any questions:

Katy Maglio  
Katy.Maglio@Yahoo.com

ESRI Contact:  
Donn Neufeld  
DNeufeld@ESRI.com

ESRGC  
ESRGC@Salisbury.edu

Dr. Michael Scott  
MSScott@Salisbury.edu

## Works Cited

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Hardware alternative links:

[ASUS M32CD-B07 Desktop & 27" IPS LED Monitor Package](#)

[Asus - Desktop - Intel Core i7 - 8GB Memory - 1TB+8GB Hybrid Hard Drive - Gray](#)

[Asus - 24" Widescreen Flat-Panel LED-LCD HD Monitor - Black](#)

Visakowitz, Leah K. "The City of Crisfield: GIS Needs Assessment." Thesis. Salisbury University, 2014. Print.

Fenwick Island, DE. Web. <<http://fenwickisland.delaware.gov/>>.

"Documentation for QGIS 2.2." QGIS. Web. 2016.

<<http://docs.qgis.org/2.2/en/docs/index.html>>.

Manifold® System Release 8 User Manual. Web. 2016.

<<http://www.georeference.org/doc/manifold.htm>>.

# Project Timeline and Objectives

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## Contact sponsor (Deadline: January 21st)

- Gain approval from Fenwick Island to use their town and information
- Ensure they understand that all information in the report is public information

## Plan the project (Deadline: February 8th)

- Observe the town to create a requirements analysis
- Identify key members to the process, the available data and categorize what departments and committees will utilize GIS
- Create a schedule of tasks needed to be complete with a deadline.
- Begin creating a risk management plan in the event that an obstacle occurs.

## Conduct project (April 11th)

- Begin repairing or creating spatial data
  - i. Repair current data
  - ii. Digitize paper records to preserve spatial data
  - iii. Gather additional data that would benefit the town
  - iv. If applicable, create new data based on the demands of the town or project
- Database creation
  - i. Begin creating the geodatabase to store all of the data
  - ii. Store specific datasets based on topic and department use
  - iii. Budget creation
  - iv. Create an excel table to show costs of ESRI software and potential extensions for ArcMap compared to the cost of open source software and comparable features.
  - v. Calculate total cost of hardware, data and personnel needed
  - vi. Construct a multi-year timeline of how to implement each option into the government with budget costs included.

## Review project (Deadline: April 28th)

- Any concerns with the project will be addressed and investigated.
- There will be additional testing to ensure that the project was conducted correctly and that the appropriate solutions are taken.

## Project report (Deadline: April 21st)

- The report will be drafted and finalized.

## Conclusion (Deadline: May 5th)

- The final report will be turned into the sponsor. At that time, they will be able to contact the project manager with any following questions.

## Interview with Mr. Frank McKenzie

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This interview was conducted at 11:30 am on March 28<sup>th</sup>, 2016 via phone. The purpose of this interview was to investigate the success Mr. McKenzie has had with a Salisbury University Intern Program for the last ten years. He is currently GIS for the Salisbury / Wicomico County Department of Planning, Zoning, and Community Development.

**1. How many student workers are employed at a given time and how many hours do they work a week? How long are the contracts? What is the average rate of pay?**

Two interns are employed at any given time. One is assigned to the planning office and the other is assigned to public works. They work for 20 hours a week and the contract is usually set for a semester. The contract can be recurring. The rate of pay is between 10\$-12\$ an hour based on the students experience. The student workers are paid through ESRGC, which saves the county time and money with setting up the contracts and taking care of the taxes. This service has a 10% overhead charge for the interns.

**2. What is the typical workload for a student worker? Does it differ depending on the efficiency of the student worker?**

The workload of the student is based on the student's ability and the amount of hours they are available a week. A few students need hand holding at the beginning. Their efficiency is tracked based on how well they image.

**3. Who does the student worker report to directly?**

The planning department intern reports to the director of planning and the public works intern reports directly to Dave Matters at public works.

**4. Are there alternate plans if the quality of the work is poor?**

The first objective is to try and catch the students' mistakes as they go along. They limit the student's exposure on the students who perform poorly. All interns work on copies, never actual main files. For the first time in the program's history, a student left a file without any information added to the features. To rectify this mistake, the next intern is cleaning up the mistakes.

**5. Has there been an instance where a student worker did not perform their tasks properly, and if so, what were the actions taken to rectify the situation?**

They have never had to dismiss a student before. They constantly audit the students work to avoid negative actions. Frank emphasized that when dealing with a student worker, it is important to keep in mind that they have never had a fulltime job.

**6. Why do you believe you have had a successful internship program with Salisbury University for the last ten years?**

Frank attributes the success of the program to ESGC. Dr. Scott screens students and suggests the best ones to Frank. The other attribute would be how the program offers experience to the student so it is an incentive to the student to do well.

# Example of a Student Contract and Terms of Agreement

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## “Appendix A”

### SCOPE OF WORK

#### Provision of Student Intern to [REDACTED] [REDACTED] Maryland

- A. Provide offsite support and guidance to one student intern, working in [REDACTED] Department of Public Works [REDACTED]
- B. The intern will be approved to work a maximum of:
  - Fall semester: 20 hours per week for 15 weeks (September 10, 2015 – Dec 16, 2015)
  - Winter semester: 29 hours per week for 3 weeks (Jan 4, 2016 – Jan 22, 2016)
  - Spring semester: 20 hours per week for 16 weeks (Jan 28, 2016 – May 18, 2016)
  - Summer semester: hours still available within the cost limit (May 19, 2015 – June 30, 2016)
- C. Track the student intern’s hours worked and submit timesheets for payment.

### TENATIVE PROJECT SCHEDULE

10SEPT2015	Project Begins; first day of student intern assignment
30JUN2016	Final day for student intern assignment

### COST

The cost of the project will be \$7,480 (\$6,800 direct costs + 10% SU Indirect Cost Recovery Fee). The ESRGC will invoice [REDACTED] at the end of each semester for hours worked by intern and/or deliverables are provided.

## **AGREEMENT TO PROVIDE SERVICES**

THIS AGREEMENT effective this 10th day of September 2015 by and between [REDACTED], Maryland (hereinafter referred to as "Sponsor"), and Salisbury University: Eastern Shore Regional GIS Cooperative, an agency of the State of Maryland (hereinafter referred to as "University").

### **WITNESSETH:**

WHEREAS, the services contemplated by this Agreement is of mutual interest and benefit to University and to Sponsor, will further the instructional and research objectives of University in a manner consistent with its status as a non-profit, tax-exempt, educational institution, and may derive benefits for both Sponsor and University through inventions, improvements, and/or discoveries;

NOW, THEREFORE, in consideration of the premises and mutual covenants herein contained, the parties hereto agree to the following:

#### **Article 1 - Definitions**

As used herein, the following terms shall have the following meanings:

1.1 "Project" shall mean the description of the project as described in Appendix A hereof, under the direction of Dr. Michael Scott as Principal Investigator.

1.2 "Period of Performance" is September 10, 2015 through June 30, 2016.

#### **Article 2 - Contracted Work**

2.1 University shall commence the performance of Project promptly after the effective date of this Agreement, and shall use reasonable efforts to perform such Project substantially in accordance with the terms and conditions of this Agreement. Anything in this Agreement to the contrary notwithstanding, Sponsor and University may at any time amend Project by mutual written agreement.

2.2 In the event that the Principal Investigator becomes unable or unwilling to continue Project, and mutually acceptable substitute is not available, University and/or Sponsor shall have the option to terminate said Project subject to the provisions of Article 6.3.

#### **Article 3 - Reports and Conferences**

3.1 Written program reports shall be provided by University to Sponsor: NA

3.2 During the term of this Agreement, representatives of University will meet with representatives of Sponsor at times and places mutually agreed upon to discuss the progress and results, as well as ongoing plans, or changes therein, of Project to be performed hereunder.

#### **Article 4 - Costs, Billings, and Other Support**

4.1 It is agreed to and understood by the parties hereto that, subject to Article 2, total costs to Sponsor hereunder shall not exceed the sum of Seven Thousand Four Hundred and Eighty dollars (\$7,480). Payment shall be made by Sponsor upon receipt and acceptance of an invoice from University, at the end of each semester (Fall, Winter, and Spring) for hours worked.

#### **Article 5 - Publicity**

5.1 Sponsor will not use the name of University, nor of any member of University's Project staff, in any publicity, advertising, or news release without the prior written approval of an authorized representative of University. University will not use the name of Sponsor, nor any employee of Sponsor, in any publicity without the prior written approval of Sponsor.

#### **Article 6 - Term and Termination**

6.1 This Agreement shall become effective upon the date first hereinabove written and shall continue in effect for the full duration of the Period of Award unless sooner terminated in accordance with the provisions of this Article. The parties hereto may, however, extend the term of this Agreement for additional periods as desired under mutually agreeable terms and conditions which the parties reduce to writing and sign. Either party may terminate this agreement upon thirty (30) days written notice to the other.

6.2 In the event that either party hereto shall commit any breach of or default in any of the terms or conditions of this Agreement, and also shall fail to remedy such default or breach within thirty (30) days after receipt of written notice thereof from the other party hereto, the party giving notice may, at its option and in addition to any other remedies which it may have at law or in equity, terminate this Agreement by sending notice of termination in writing to the other party to such effect, and such termination shall be effective as of the date of receipt of such notice.

6.3 Termination of this Agreement by either party for any reason shall not affect the rights and obligations of the parties accrued prior to the effective date of termination of this Agreement. No termination of this Agreement, however effectuated, shall affect the Sponsor's rights and duties under Article 7 hereof, or release the parties hereto from their rights and obligations under Articles 4, 5, and 7.

#### **Article 7 - Independent Contractor**

7.1 In the performance of all services hereunder:

7.1.1 University shall be deemed to be and shall be an independent contractor and, as such, University shall not be entitled to any benefits applicable to employees of Sponsor;

7.1.2 Neither party is authorized or empowered to act as agent for the other for any purpose and shall not on behalf of the other enter into any contract, warranty, or representation as to any matter. Neither shall be bound by the acts or conduct of the other.

7.2 Either the University or Sponsor may hire, retain or otherwise engage any independent third-party to perform services relating to or in connection with Project, and will promptly disclose this information to the remaining party to this Agreement.

## **Article 8 - Insurance**

8.1 The University and Sponsor jointly and separately represent that each is subject to the provisions of either the Maryland Tort Claims Act or the Local Government Tort Claims Act and each is covered by insurance.

8.2 (i) It is hereby stipulated and agreed between Sponsor and University that with respect to any claim or action arising out of any services performed under or pursuant to this Agreement, each entity shall only be liable for payment of that portion of any and all liability, costs, expenses, demands, settlements or judgements resulting from the negligence, actions or omissions of its own agents, officers and employees. It is expressly understood however that both the Sponsor and University's liability is limited to the extent of insurance coverage under Title 9 of the State Finance Procurement Article.

(ii) In any action or claim arising out of any services performed under or pursuant to this Agreement, the University shall assume the defense of itself, its own officers, agents or employees in accordance with the Maryland Tort Claims Act, Maryland Code Annotated, State Government Article, Section 12-104 et seq. in its own agreements with its own officers, agents or employees.

(iii) In any action or claim arising out of any services performed under or pursuant to this Agreement, Sponsor shall assume the defense of itself, its own officers, agents, or employees in its own agreements with its own officers, agents, or employees.

## **Article 9 - No Warranties**

9.1 The University makes no warranties, express or implied, as to any matter whatsoever, including, without limitation, the condition of the research or any invention(s) or product(s), whether tangible or intangible, conceived, discovered, or developed under this Agreement; or the ownership, merchantability, or fitness for a particular purpose of the research or any such invention or product. The University shall not be liable for any direct, consequential, or other damages suffered by any licensee or any others resulting from the use of the research or any such invention or product. The provisions of this clause shall survive termination of this Agreement.

## **Article 10 - Force Majeure**

10.1 The University shall not be liable for any failure to perform as required by this Agreement, to the extent such failure to perform is caused or due to circumstances reasonably beyond the University's control, such as labor disturbances or labor disputes of any kind, accidents, failure of any governmental approval required for full performance, civil disorders or commotions, acts of aggression, acts of God, explosions, failure of utilities, mechanical breakdowns, material shortages, disease, or other such occurrences.

## **Article 11 - Non-discrimination**

11.1 The parties agree that the University shall follow its normal employment policies, which prohibit discrimination against any employee or applicant for employment on the basis of race, color, creed, religion, national origin, sexual preference, marital status, ages, sex, or handicap (except where bona fide occupational qualification so requires), with respect to this Agreement; the parties further agree that qualified individuals will not be denied the opportunity to contribute to the work to be conducted at the University under this Agreement on those bases or on the basis of their citizenship.

## **Article 12 - Governing Law**

12.1 This Agreement shall be governed and construed in accordance with the laws of the State of Maryland.

## **Article 13 - Assignment**

13.1 This Agreement shall not be assigned by either party without the prior written consent of the parties hereto.

## **Article 14 - Agreement Modification**

14.1 This Agreement and its appendices constitute the entire Agreement. Any agreement to change the terms of this Agreement in any way shall be valid only if the change is made in writing and approved by mutual agreement of authorized representatives of the parties hereto.

## **Article 15 - Notices**

15.1 Notices, invoices, communications, and payments hereunder shall be deemed made if given by hand delivery, registered or certified envelope, postage prepaid, and addressed to the party to receive such notice, invoice, or communication at the address given below, or such other address as may hereafter be designated by notice in writing:

# Proposed Form for Spatial Data Request

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## Town of Fenwick Island

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### Request for Spatial Product:

#### Information about Request:

Applicant Name: \_\_\_\_\_ Date Needed: \_\_\_\_\_

Department: \_\_\_\_\_

Title of Requested Data: \_\_\_\_\_

Please check all that apply:

- |  |   |  |  |  |
|--|---|--|--|--|
| <input type="checkbox"/> Need to view data | <input type="checkbox"/> Data edits/additions | <input type="checkbox"/> Data development/creation | <input type="checkbox"/> Need an updated map | <input type="checkbox"/> New map created |
|--|---|--|--|--|

Specify more about the option you chose above:

What will the product be used for:

Additional Comments:

\_\_\_\_\_  
*Applicant Signature* *Date*

#### Acknowledgement:

Date Received: \_\_\_\_\_ Proposed Date of Completion: \_\_\_\_\_

\_\_\_\_\_  
*GIS Employee Signature* *Date*

## FEMA Grant Opportunities

AEL/SEL Number	Title	Description	FEMA Grant Programs
04AP-03-GISSD	Data, Geospatial	Data related to positions on the Earth's surface in the form of databases, maps, satellite and other remote sensing imagery. For use with Geospatial Information Systems (Item 04AP-04-GISS)	Emergency Management Performance Grants (EMPG), Homeland Security Grant Program (HSGP), Intercity Bus Security Grant Program (IBSGP), Operation Stonegarden (OPSG), Port Security Grant Program (PSGP), State Homeland Security Program (SHSP), Tribal Homeland Security Grant Program (THSGP), Urban Areas Security Initiative Program (UASI)
04AP-03-GISS	System, Geospatial Information, (GIS)	Geospatial/Geographical Information Systems (GIS), including application software as well as integrated hardware for implementation. GIS systems support the acquisition, integration and dissemination of geospatial data and imagery. GIS systems provide or support multiple CBRNE terrorism prevention and response functions, including (but not limited to):- Geospatial Analysis - allows for association of intelligence and location-based information to perform complex analysis and visualization- Decision Support - provides a mechanism to deliver actionable intelligence, supporting strategic and tactical operations- Situational Awareness - supports a common operational picture with near real-time intelligence fused with geospatial information fully describing the area of operations in a spatial context Navigation- Monitoring (tracking, weather, traffic, assets, environment, damage assessments, disease surveillance)- Modeling - combines complex spatial information and applies modeling tools to predict consequences of events in support of planning, mitigation, response and recovery- Mapping - presents fused information in a standard, distributable and easily recognizable format Reporting (activity, after-action, alert-warning, location, situation, coverage portrayal)	Emergency Management Performance Grants (EMPG), Homeland Security Grant Program (HSGP), Intercity Bus Security Grant Program (IBSGP), Operation Stonegarden (OPSG), Port Security Grant Program (PSGP), State Homeland Security Program (SHSP), Tribal Homeland Security Grant Program (THSGP), Urban Areas Security Initiative Program (UASI)

[http://www.fema.gov/media-library-data/1431097871686-c497a8daafedf24a5e83a1f070b616bb/DHS\\_AEL\\_0507\\_2015.pdf](http://www.fema.gov/media-library-data/1431097871686-c497a8daafedf24a5e83a1f070b616bb/DHS_AEL_0507_2015.pdf)