

# Impacts of Sea Level Rise in Norfolk, VA

## Introduction

Norfolk, Virginia is home to the largest naval base in the world. Norfolk's main industries are: 1) Military and Defense, 2) Maritime and Transportation, 3) Bioscience and Medical, and 4) Colleges and Universities. Activities in these industries drive the region's economy and more than \$1 billion in investment to the region's infrastructure is underway. Norfolk is also highly vulnerable to the effects of climate change. Due to its geographical location on the Atlantic Ocean, sea level rise will greatly impair the city's valuable resources. The business sector will experience major financial losses and many people could lose their jobs. In addition, Norfolk's transportation assets including its freight rail service, international seaports, airport and roads are susceptible to damaging from rising sea levels, which could have an impact on the international community who rely on its shipping networks.

This project examines the potential impact of sea level rise at 3 feet and 6 feet on the following variables:

**Travel Infrastructure** – total miles of road and railroads in areas vulnerable to sea level rise.

**City Facilities** – total number of city facilities including schools, libraries, public safety, community centers, as well as nursing homes and places of worship in the impact zones.

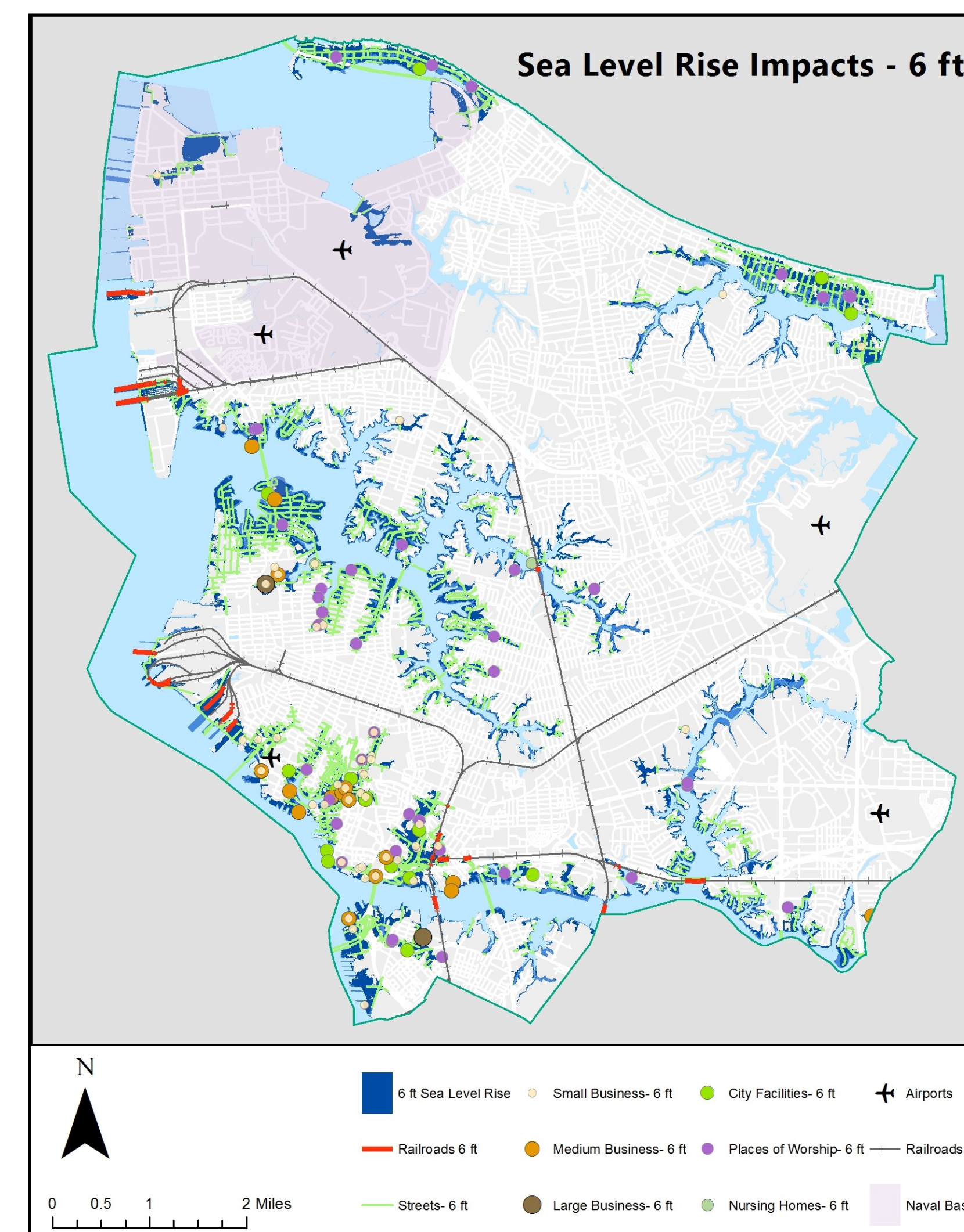
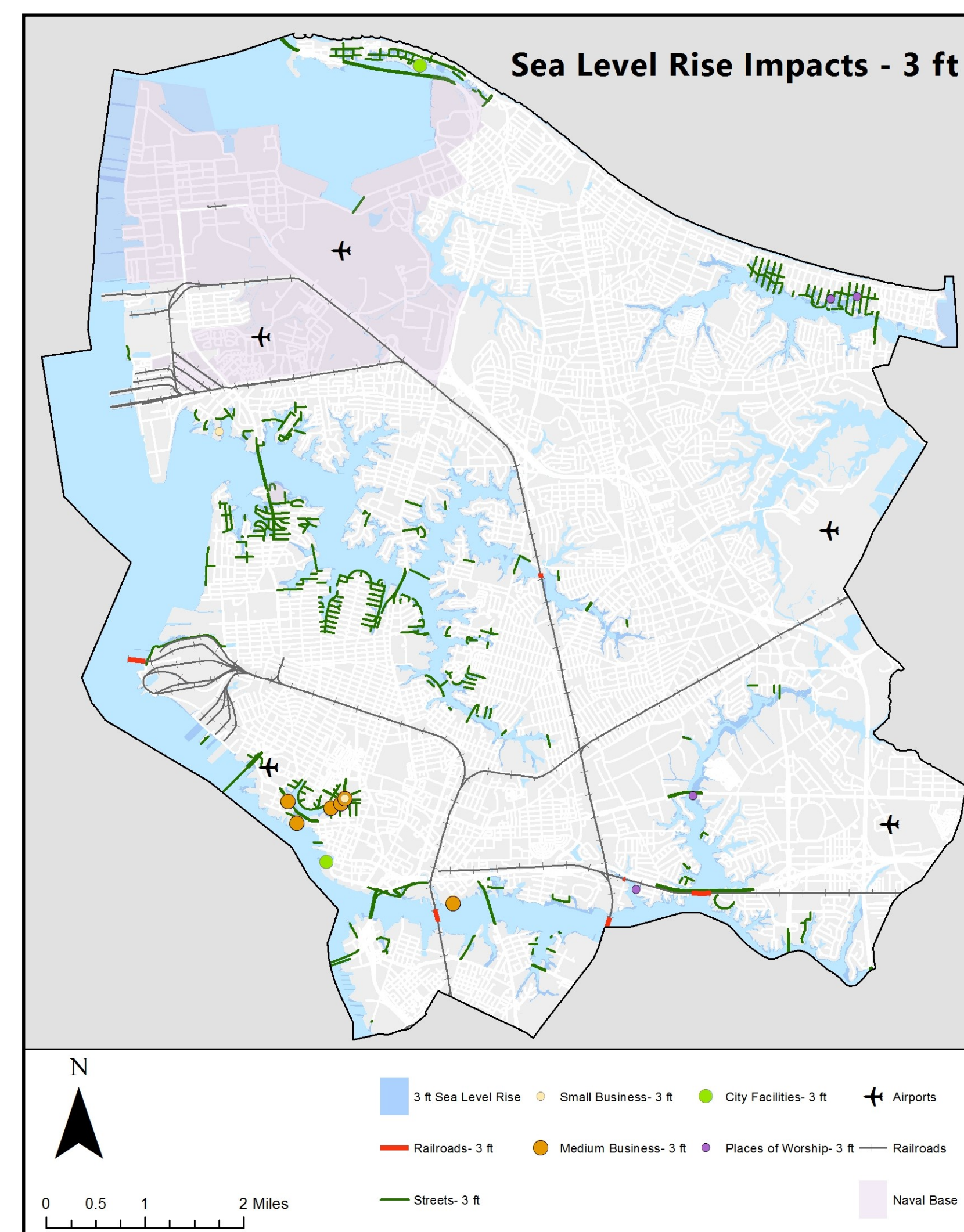
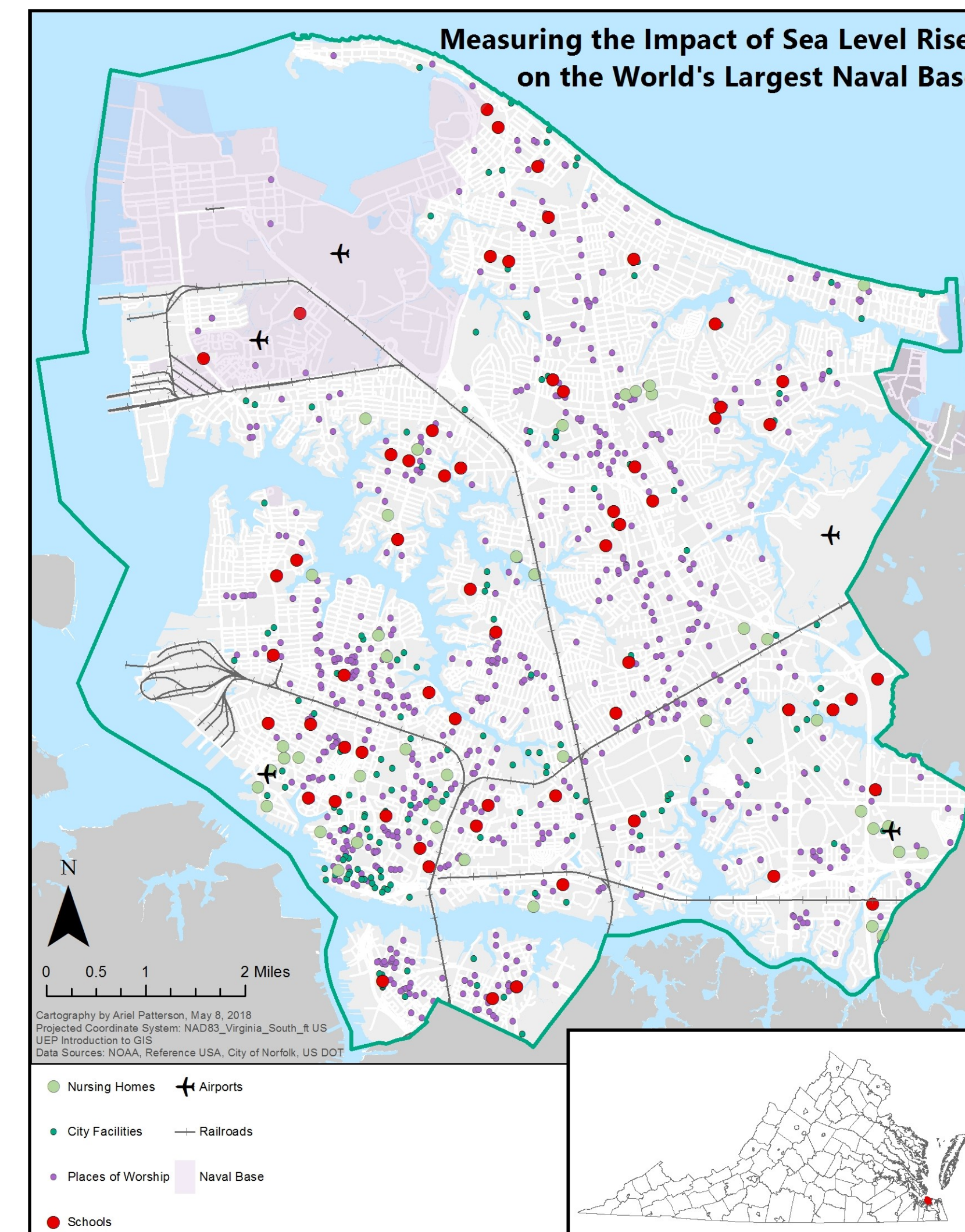
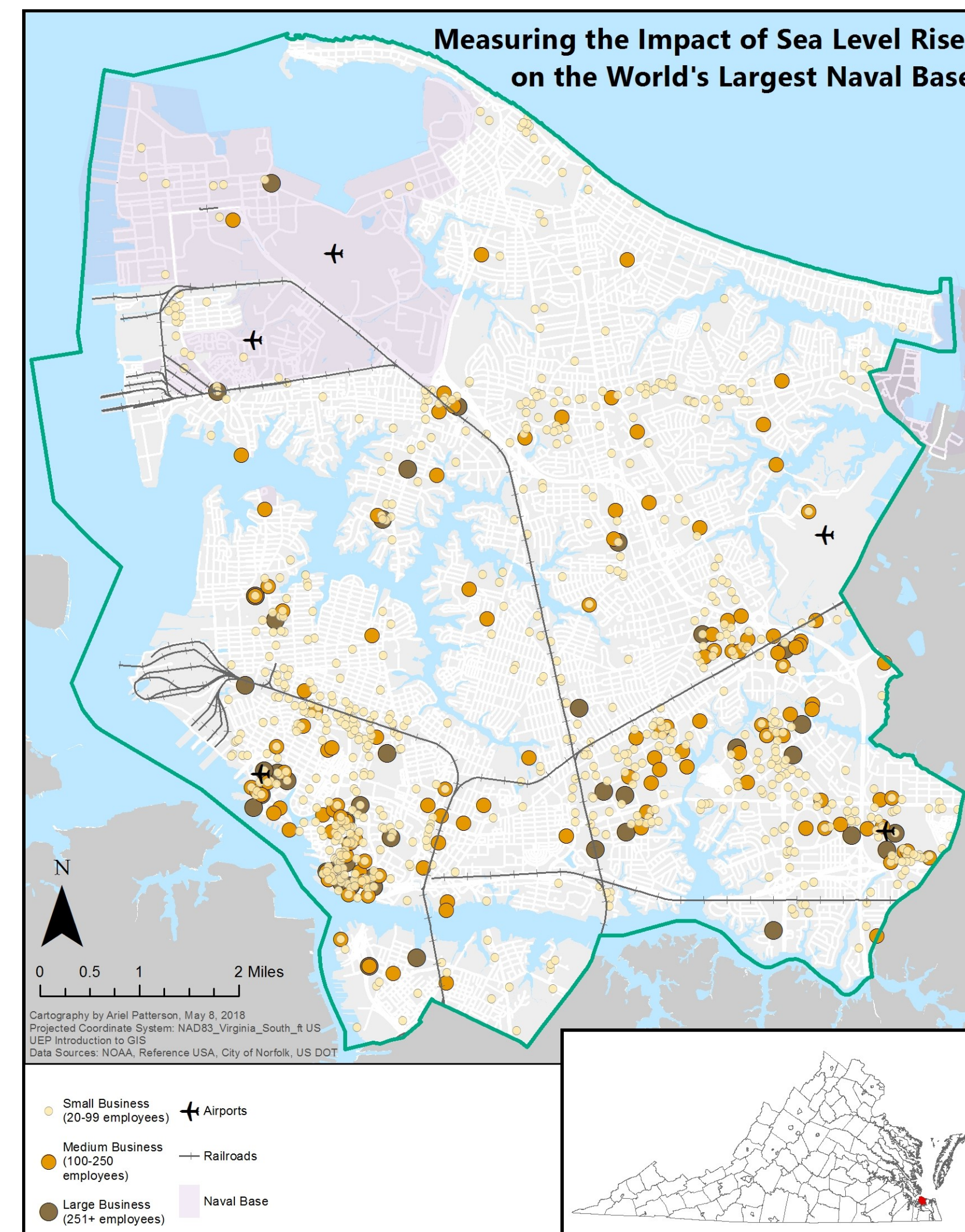
**Businesses** – total number and types of businesses impacted- small businesses (20-99), medium-sized businesses (100-250) and large businesses (251 or more); business sales lost; employees that will lose their jobs.

The goal is to observe the number and type of resources that will be impacted by sea level rise, and calculate the damages in terms of financial and human capital. The findings will provide evidence of the future impact of sea level rise on vulnerable areas containing valuable assets for City residents and the international community.

## Methodology

This project is supported with data from NOAA quantifies the areas affected by sea level rise at 3 feet and 6 feet as well as data from a multitude of other sources on businesses, infrastructure, and city facilities. Sea level rise will impact other variables but these categories will incur the largest financial and employment losses. This project was completed using GIS ArcMap.

To create maps and summary tables the following tools were employed to help answer the main research question: spatial joins, intersections, and clips. ArcGIS's calculation tools helped obtain answers for large data sets.

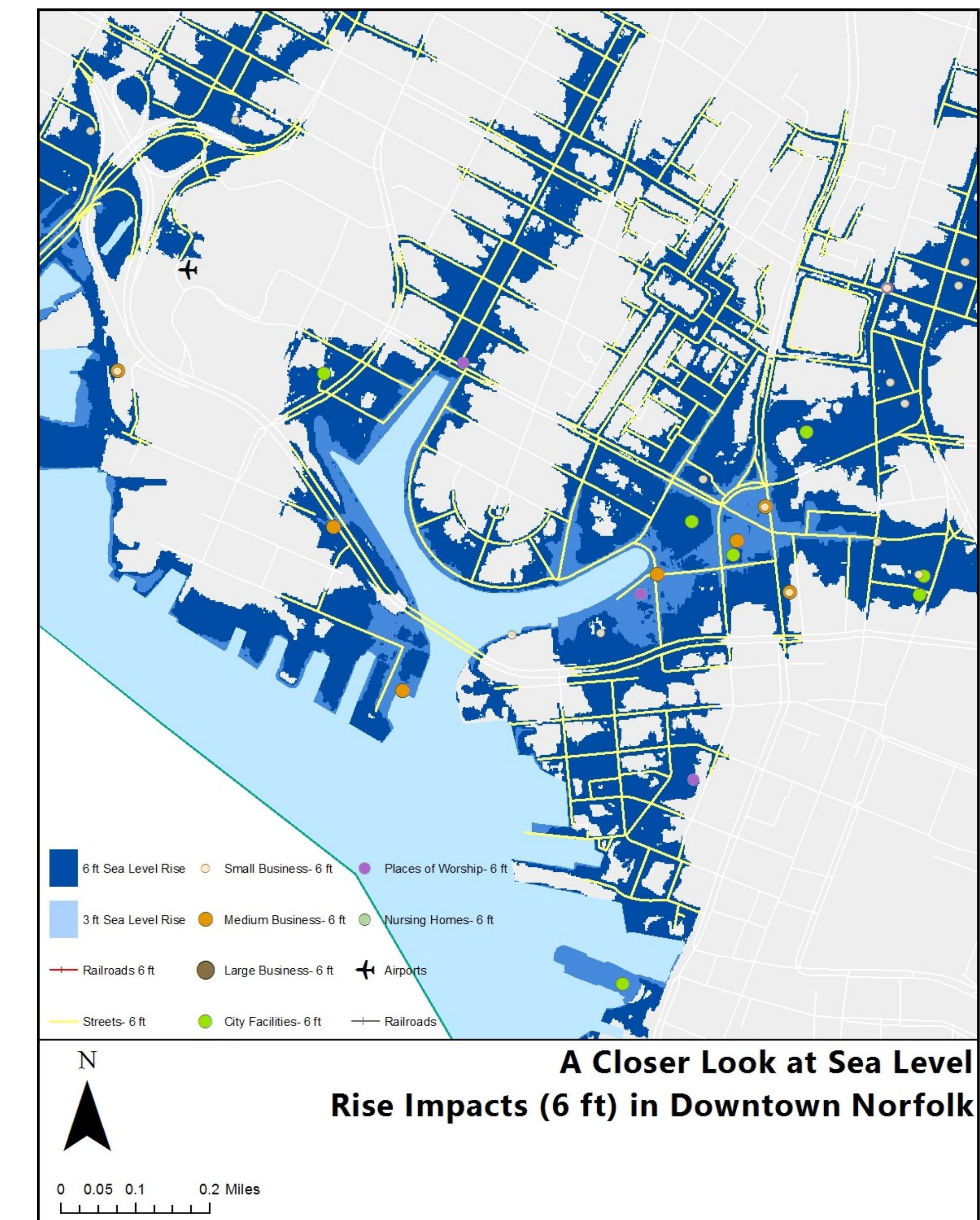


Variable	Impact
Number of Businesses Impacted	8
Number of People Who Will Lose Their Job	987
Approximate Sales Losses	\$59,314,000
Number of City Facilities Impacted	2
Number of Nursing Homes Impacted	0
Number of Places of Worship Impacted	6

Variable	Impact
Number of Businesses Impacted (20+ Employees)	100
Number of People Who Will Lose Their Job (At Companies with 20+ Employees)	9562
Approximate Sales Losses	\$688,906,000
Number of City Facilities Impacted	17
Number of Nursing Homes Impacted	7
Number of Places of Worship Impacted	50
Miles of Roads Impacted	149.59

## Results

The results of this project are best summarized in Tables 3 and 4. Scientists are unsure when water levels will rise 3 feet and 6 feet in Norfolk, VA. However, the NOAA Sea Level Rise Viewer tool predicts, under an intermediate high scenario, that sea levels will rise 3 feet by 2060 and 6 feet by 2100. Policymakers and engineers should take action now to plan for the upcoming effects of climate change. Further research should use GIS analysis to study variables like land use, environment and population in Norfolk, VA.



	3 ft	6 ft
Small Business (20-99 Employees)	\$0	\$344,255,000
Medium Business (100-250 Employees)	\$59,314,000	\$245,265,000
Large Business (251+ employees)	N/A	\$99,386,000
Total	\$59,314,000	\$688,906,000

	3 ft	6 ft
Small Business (20-99 Employees)	46	\$3,080
Medium Business (100-250 Employees)	941	\$2,481
Large Business (251+ employees)	N/A	\$4,001
Total	987	\$9,562

Cartographer: Ariel Patterson  
 Course: UEP 232 - Introduction to GIS  
 Date: May 8, 2018  
 Projected Coordinate System: NAD83\_Virginia\_South\_ftUS  
 Geographic Coordinate System: GCS\_North\_American\_1983  
 Sources: NOAA, Reference USA, City of Norfolk, Open GIS Data, U.S. DOT, Virginia GIS Clearinghouse, U.S. Small Business Administration

