Salem State University
Marshlands Report

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Introduction

Our project's focus was on the marshlands located behind Atlantic Hall. The biggest issue we were looking to observe and capture were the mudflats found in the marsh, since they are one of the more important features located in this area. Due to the potential for sea level rise, damages could potentially occur in the marsh, central campus, and the surrounding buildings. Mudflats can serve as a barrier and are a good way to monitor sea level rise. These mudflats make up some of the larger parts of the marsh that we'll be looking at, so evaluating data on them could help us with seeing any potential signs of erosion, and gauge whether these mudflats were responding to changes in sea level and/or climate patterns.

Mudflats provide essential habitats for a variety of wildlife, and these areas are often rich in nutrients, and serve as breeding and feeding grounds for various wildlife. These areas can also help with reducing erosion. The marsh plays a crucial role in filtering pollutants and improving water quality, mudflats act as natural buffers during flooding events, which helps reduce the impacts of flooding on surrounding areas (like Salem State). These ecosystems also store carbon, which helps with climate mitigation. These marshlands also provide a site for recreational activities like bird watching and fishing, as well as educational opportunities to learn more about coastal ecosystems, so capturing data on their well being is an important aspect of this project.

We used data from September 5th, 2024 overlooking the marsh during high tide, as well as data from October 18th, 2024 during low tide that we used to capture what we were looking for (mudflats). The ideal seasons to capture the kind of data we wanted were in the winter (after storms), late summer, and early fall, when the sediment builds up. The data collected from September and October worked within that ideal range, capturing the mudflats at their highest. Looking at the patches of mud banks we might be able to determine our research questions. Our patches of data (mudbanks) don't move overnight but rather move over time from the incoming and outgoing tides.

Some research questions we considered:

- What are the sizes of the mud flats from September to October?
- Have the mud flats changed in size from September to October?

Flight information/justification

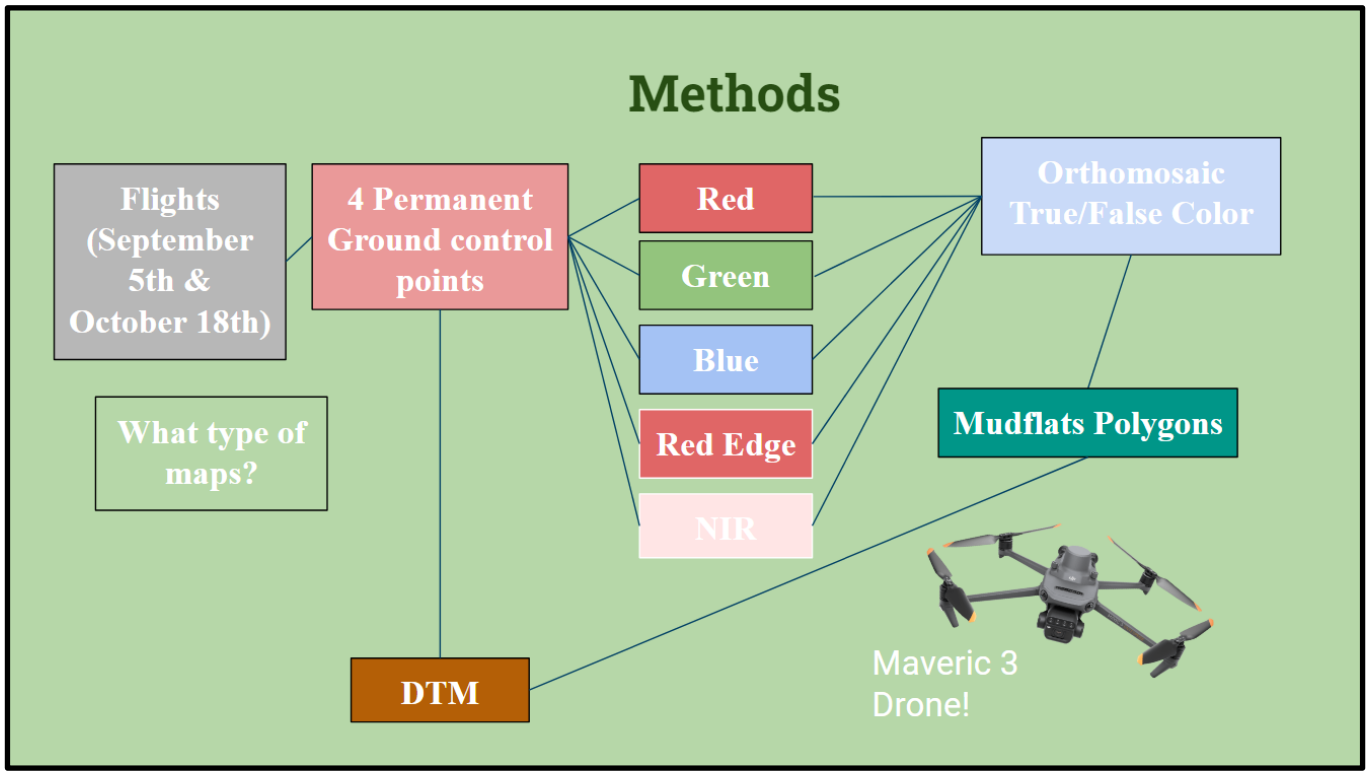
The biggest feature we observed during our flights were the mudflats in the marshlands behind Atlantic Hall. The flight we conducted on October 18th was a multispectral 3D flight over the study area. Potential factors that could have influenced our flight included changing tides, though we have data from both high and low tide. The percent overlap we used for our drone flight was 90/80. We flew at an altitude of 355 ft for both the September and October flights, and our minimum pixel size is 5cm. Our flight goal was to observe the marsh behind Atlantic Hall from an aerial 3D view. We made sure to be alert towards obstacles like building height, any pedestrians walking on the path near the takeoff/landing area, as well as wildlife. We also flew as close to low tide as possible to see the least water in our data.

Our October 18th Flight!

Scene Model	Drone	Scene/Feature	Good fit? (Yes/No)
Spatial Extent	Marsh, surrounding streets	Marsh, wetlands, soil,vegetation	Yes
Spatial Resolution (Individual)	Min. 5cm	Behind atlantic hall, west of bike path Large mudflats approx 30-60ft	Yes
Important Sensor Bands/Products	DSM, multispectral	DSM/Red	Yes
Temporal Resolution	10/18/24-Project 9/5/24- Class	Spring/Late Summer/Early fall, Low tide	Maybe
Necessary Accuracy	High absolute and High relative accuracy required	Absolute accuracy	Yes

Scene model

Methods diagram



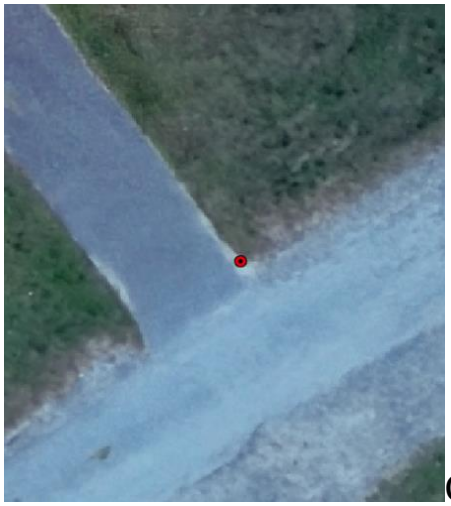
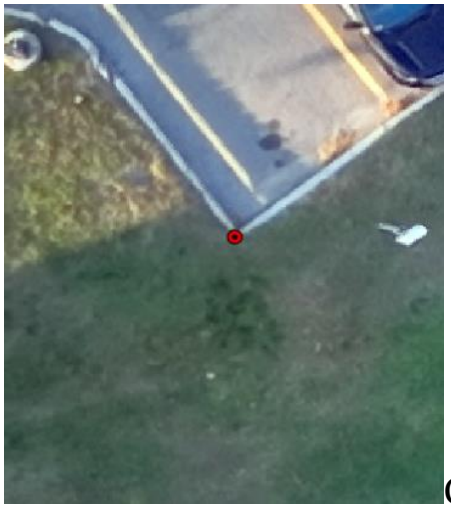
Methods description

We conducted two flights with the DTM and multispectral sensors equipped, one was in the late summer (September) near high tide while the other was mid fall (October), closer to low tide. Data collected from these flights were written onto a removable SD card within the drone. After data was collected during our flights, it was then processed. We identified 4 permanent ground control points within and around our main study area. These were things like clear corners in sidewalks, signs, or other landmarks that were not moveable or likely to be obscured. We set these ground control points into some of the images to ensure accuracy when processing the data into a full map. With the processed

drone imagery and multispectral band widths we were able to generate multiple styles of analysis maps. We drew polygons of mudflats during low tide.We can use the polygons so we can evaluate data like the min, max, average and elevation of these mudflats.

GCPs description/screenshots

Ground Control Points:	Location:
	**Sign bottom right corner, near the baseball field.**
	**Sign top right corner bike path.**

 GCP 3	**Right field corner, Atlantic Hall quad.**
 GCP 4	**Bottom left corner, Atlantic Hall parking lot.**

Our project features 4 Ground Control Points, used for processing individual images into a full orthomosaic. GCP 1 is located at the Southeast Corner of the baseball field sign. During processing, it was a little harder to tell exactly where the correct corner was for these GCPs because 3D objects can be visually skewed by viewing it from different angles. This same issue was experienced with GCP 2 is located on the Northeastern corner of the bike path sign. GCP 3 is located at this corner where walking paths meet behind Atlantic Hall, and was much easier to consistently mark than the previous two. GCP 4 was also much easier to mark, located at the most Southern corner of the Atlantic Hall parking lot.

Results (maps)

0 0.5 1 2 Miles

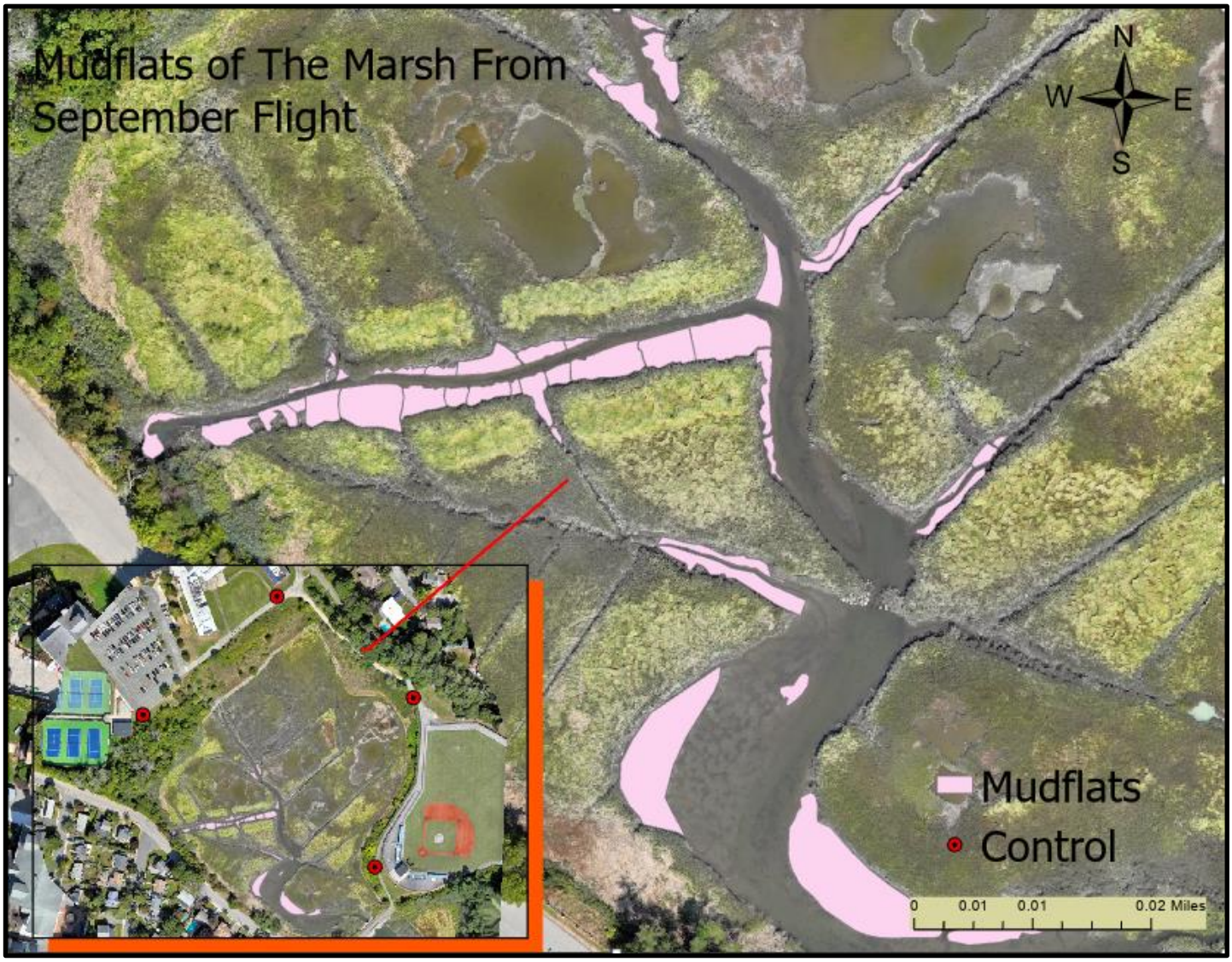
Study Area Boundary
Marshlands

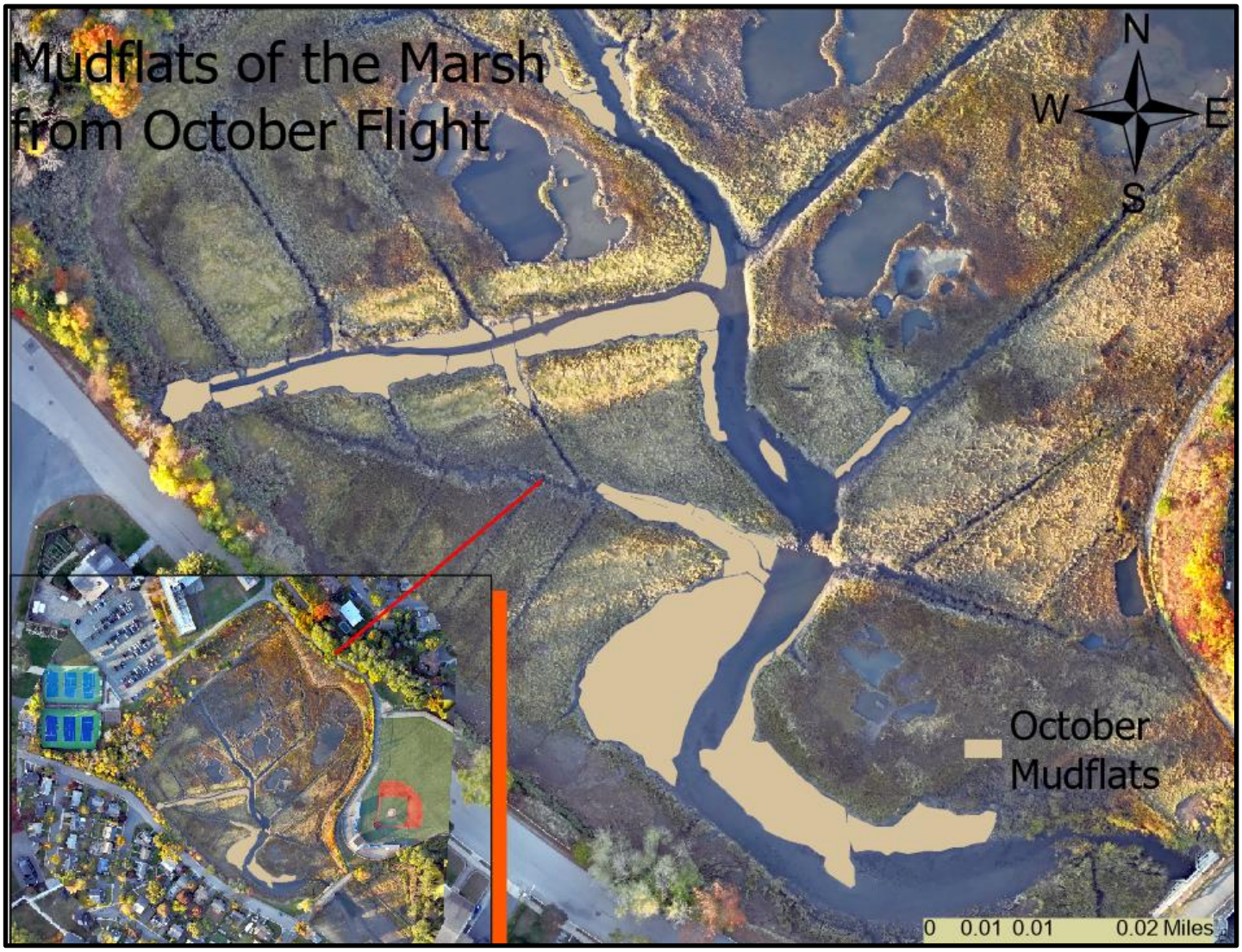
Marshlands

Baseball field

Study area boundary

N


Mudflats of The Marsh From September Flight
N
W
E
S
Mudflats
Control
0
0.01
0.01
0.02 Miles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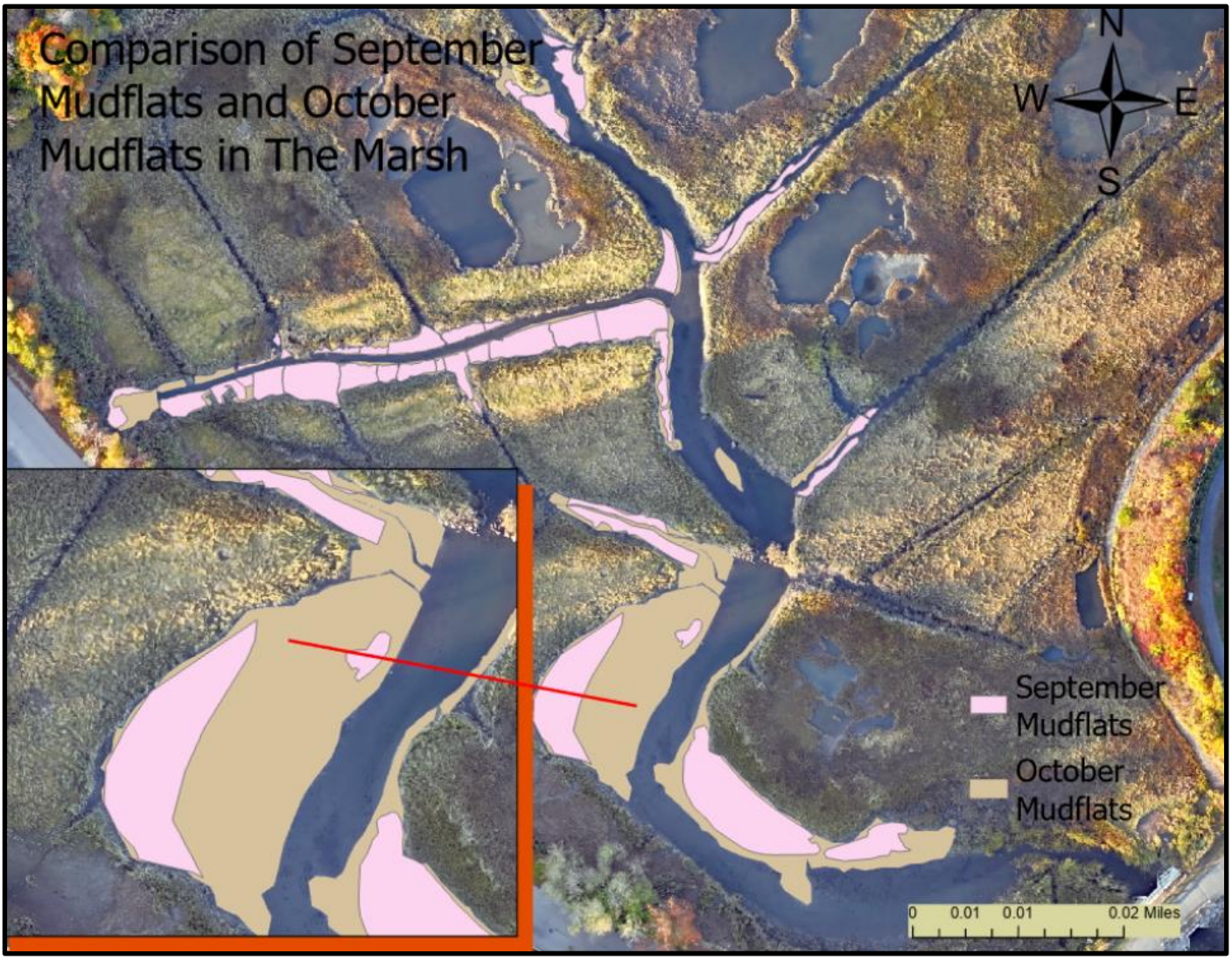
0 0.01 0.01 0.02 Miles

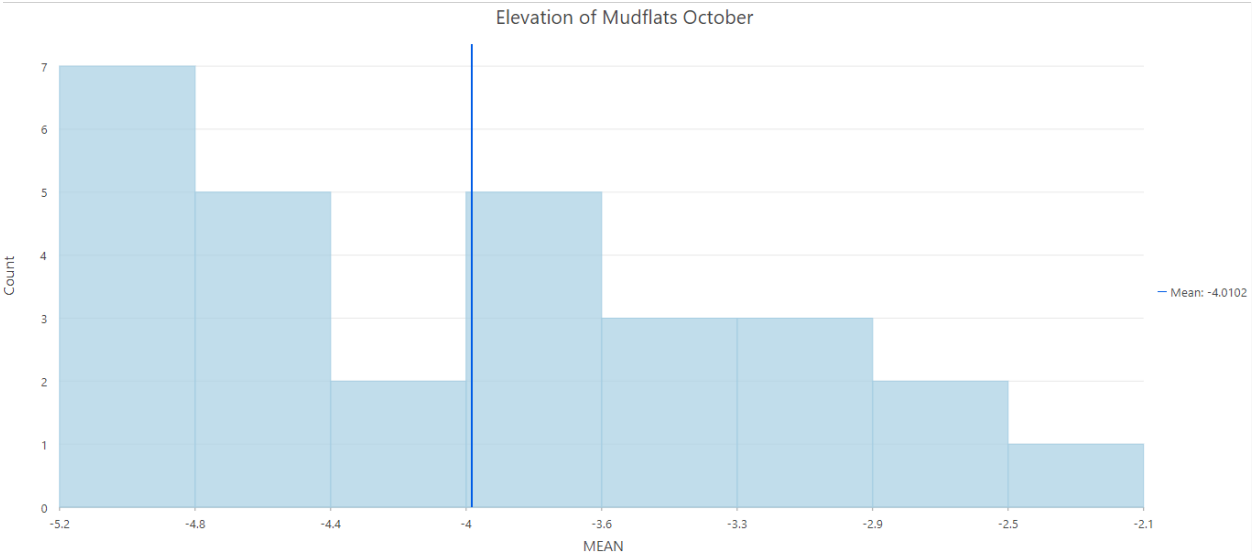


Discussion

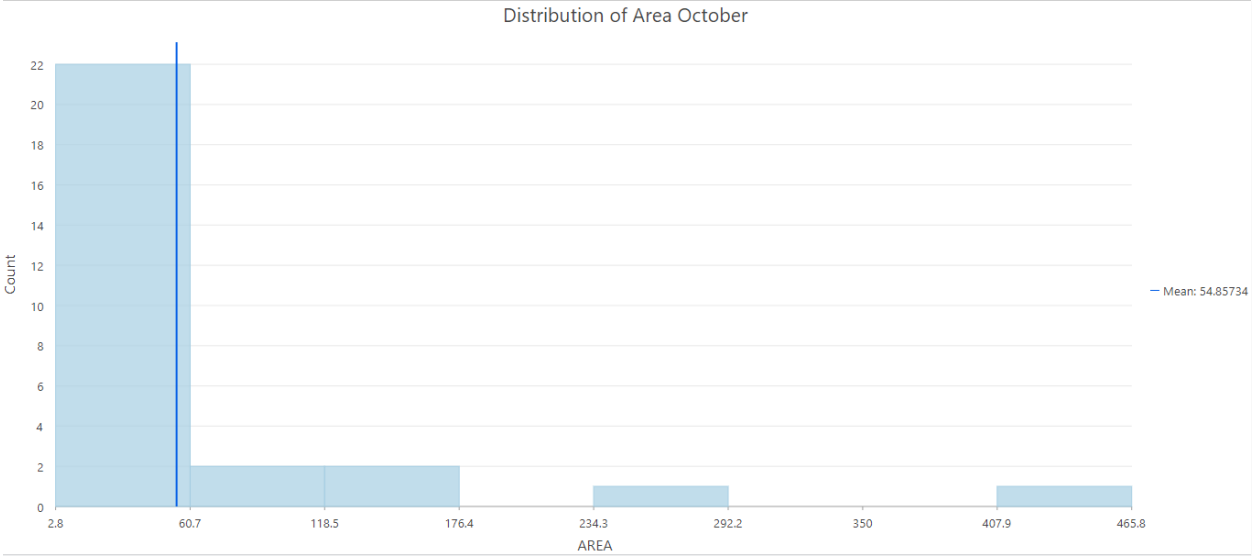
One of the biggest aspects of our project is the availability for future students to use our data from September and October, especially when focusing on specific mudflats to see/record any new changes over the seasons. Our own data showed that the mudflats in the marsh changed drastically from September to October. This change from September to October showed an increase in the size/area of the mudflats, most likely as a result of using the drone during both high and low tide.

It is important to note that the mudflats recorded during the September flight were easier to see and calculate compared to the October flight due to the vast difference in the

vegetation, the September imagery showing much greener grass than the October imagery. Highlighted in the above map includes the largest difference in the area of the mudflats we recorded, showing just how much they changed from September to October. Below are the elevations and distribution of the area of the mudflats from the month of October.



Mean of elevation is -4.0102 meters



Min is 2.8-60.7 sq meters

Max is 407.9-465.8 sq meters