

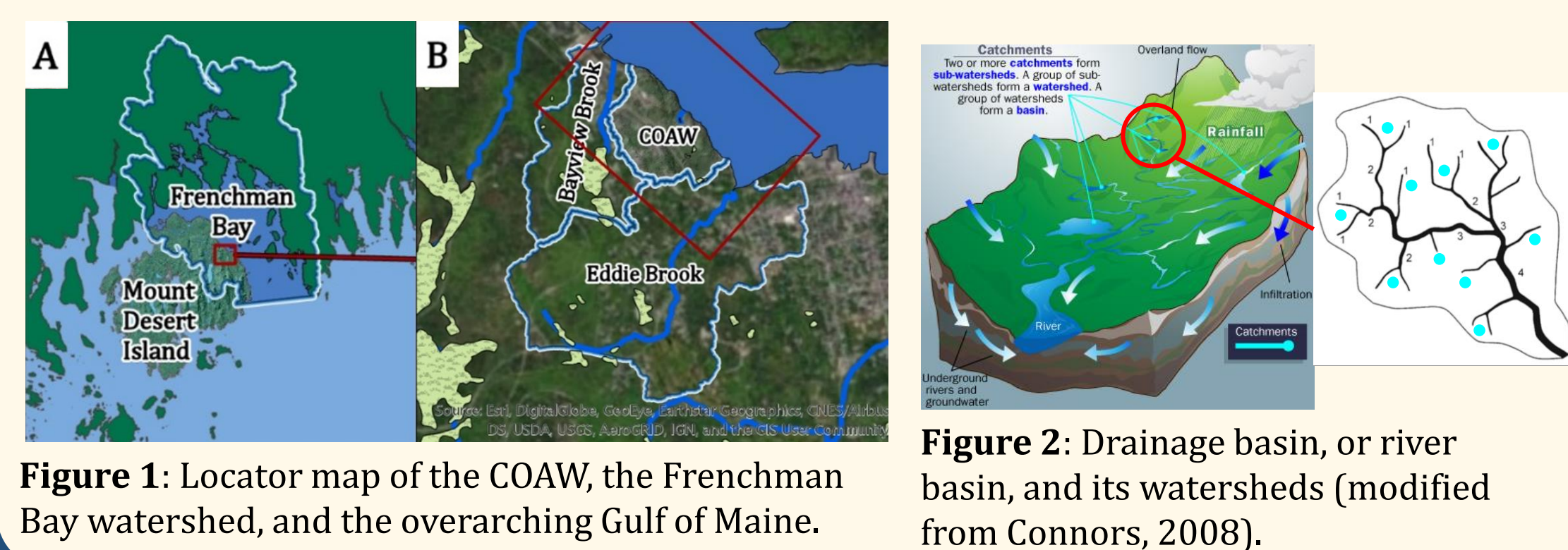
Past, Present, and Future: A COA Watershed Assessment

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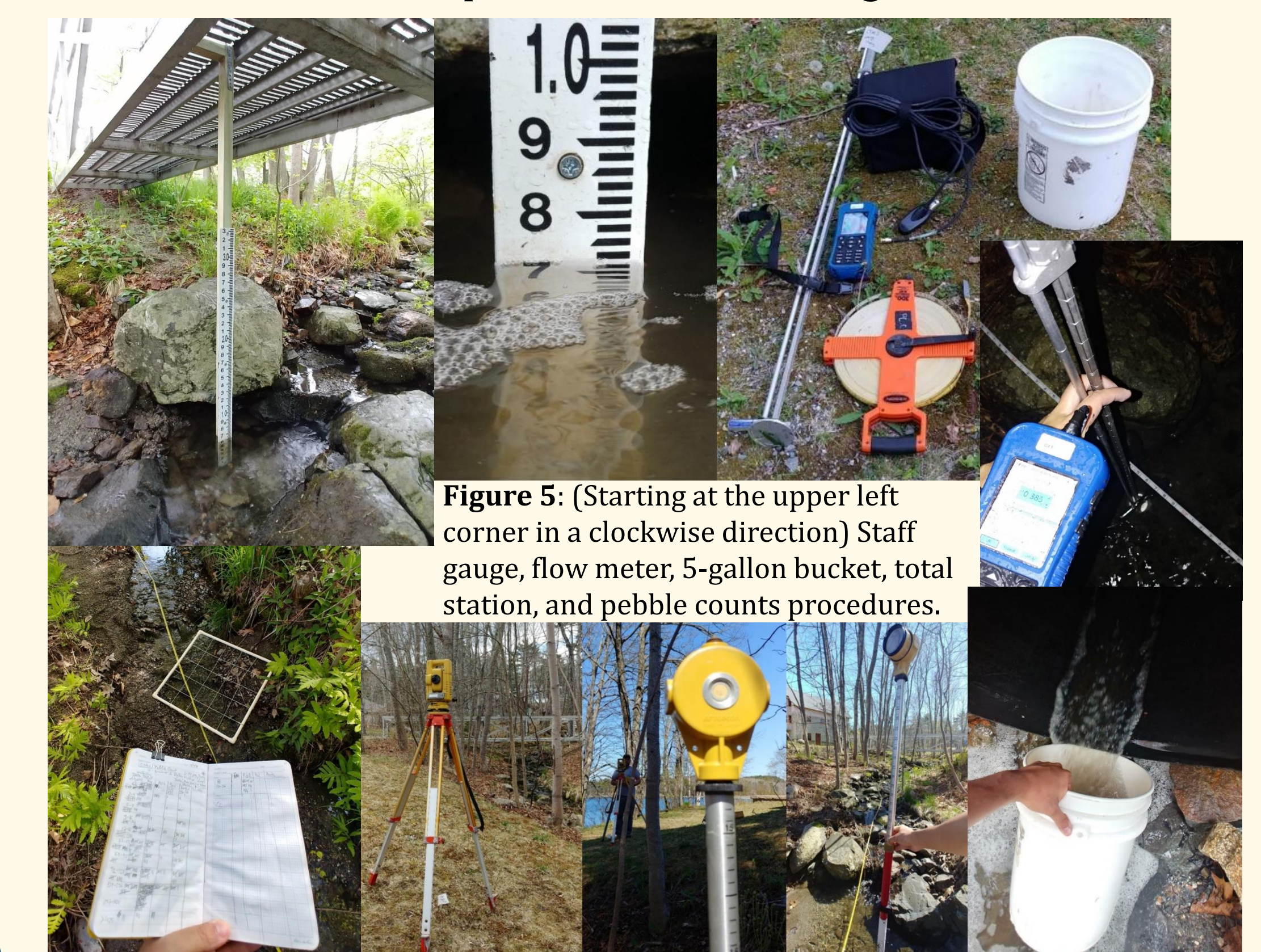
1. Introduction

- Senior Project: Environmental assessment of the COA Stream (COAS) and its respective COA Watershed (COAW)
- Develop a comprehensive database with the history, geology, soils, topography, hydrology, vegetation, land cover, and development of the COAW
- Context of rapid landscape changes due to the Route 3 Reconstruction Project, the new Center for Human Ecology, and COA's ambitious sustainability goals regarding climate change
- Watershed districts, USGS Hydrologic Units, and USDA Soil & Water Conservation Districts data limitations

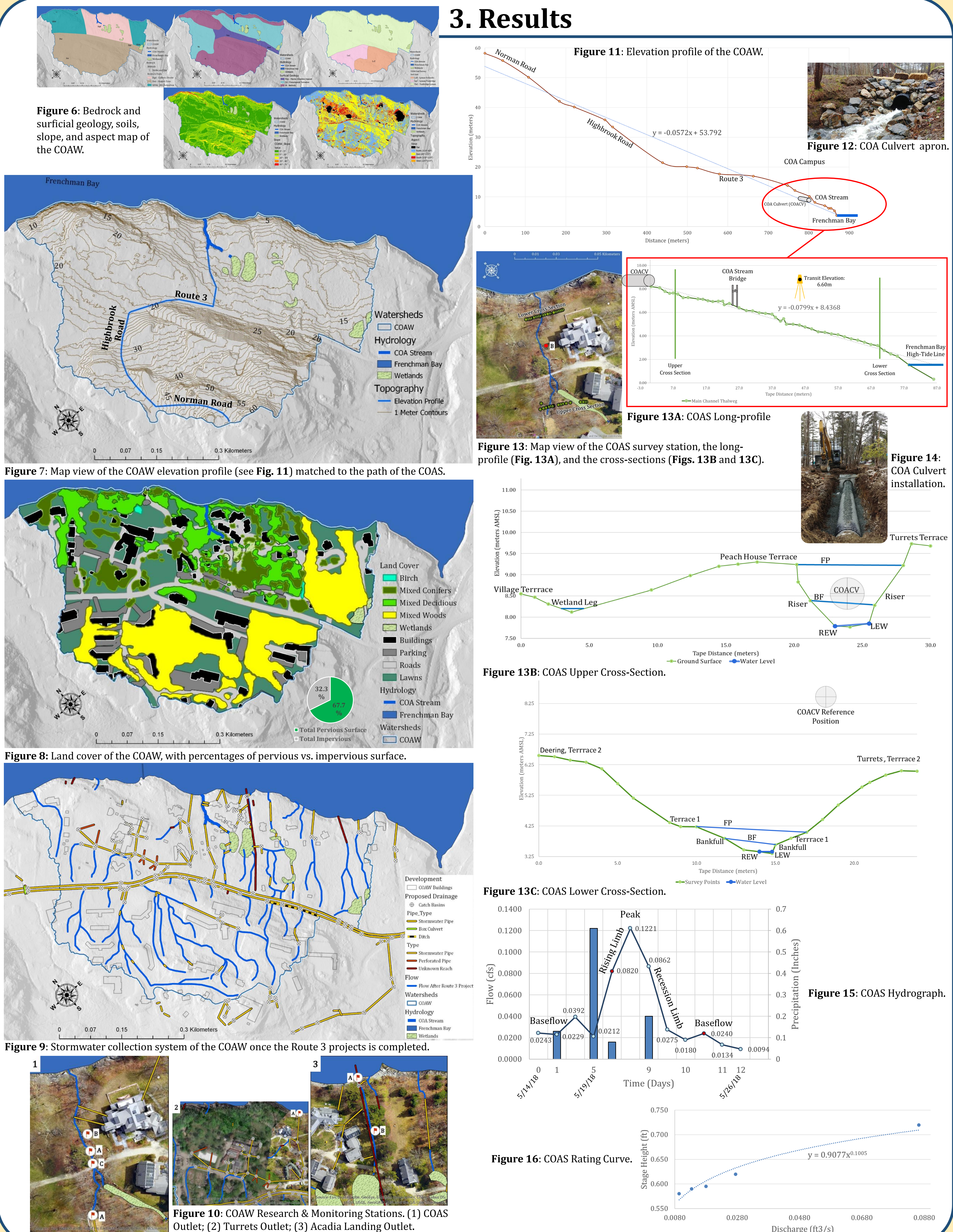


2. Methodology

- Social Sphere
 - Land use histories
 - Connection of the community to their local waterway
- Spatial Sphere
 - ArcGIS Pro Hydrology Tools
 - Spatial database of water infrastructure
- Ecological Sphere
 - Applied ecohydrology, with fields methods such as discharge, stage, surveying, and pebble counts
- Economic Sphere
 - Drinking water, sewage, and stormwater systems
 - Watershed sustainability in terms of water, waste (discarded resources, GHGs emissions), and energy usage (watershed microgrids)
 - Land & Sea connection at the intertidal zone, with direct impacts on coastal fishing communities



3. Results



- Manning Equation $V = \left(\frac{1}{n}\right) R^{2/3} S^{1/2}$
Where:
 R = hydraulic radius of channel (m)
 S = slope of the water surface (not channel bed)
 n = channel roughness (referred to as roughness coefficient)

Table 1: Derived Bankfull and Floodplain Discharge from COAS Cross Sections				
Cross Section	Lower		Upper	
Flow Conditions	Bankfull	Floodplain	Bankfull	Floodplain
Mean velocity (V) in m/s	0.16	0.35	0.27	0.47
Discharge (Q) in m ³ /s	0.096 (3.4 cfs)	2.00 (71 cfs)	0.69 (24 cfs)	5.11 (180 cfs)
Slope (S_e)	0.0799	0.0799	0.0799	0.0799
Roughness Coefficient (n)	0.61	0.61	0.61	0.61

- Shear stress $\tau_c = 0.045 (\rho_s - \rho_w) g D_{50}$
Where:

ρ_w = density of water (1,000 kg/m³)
 g = acceleration due to gravity (9.81 m/s²)
 R = hydraulic radius of channel (m)
 S = slope of channel bed (0.0799)

- Critical shear stress $\tau_0 = \rho_w g R S$
Where:

ρ_w = density of water (1,000 kg/m³)
 ρ_s = density of sediment (assume the sediment density of quartz, 2,650kg/m³)
 g = acceleration due to gravity = 9.81 m/s²
 D_{50} = median grain size in meters (40mm, or 0.04m)

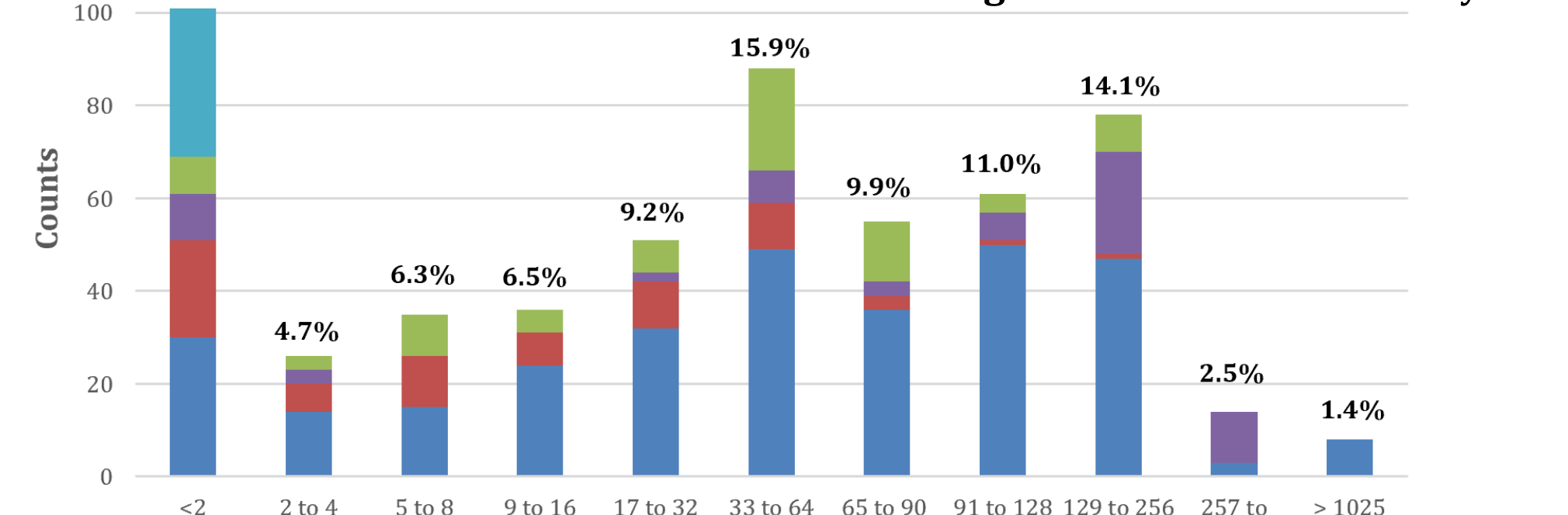
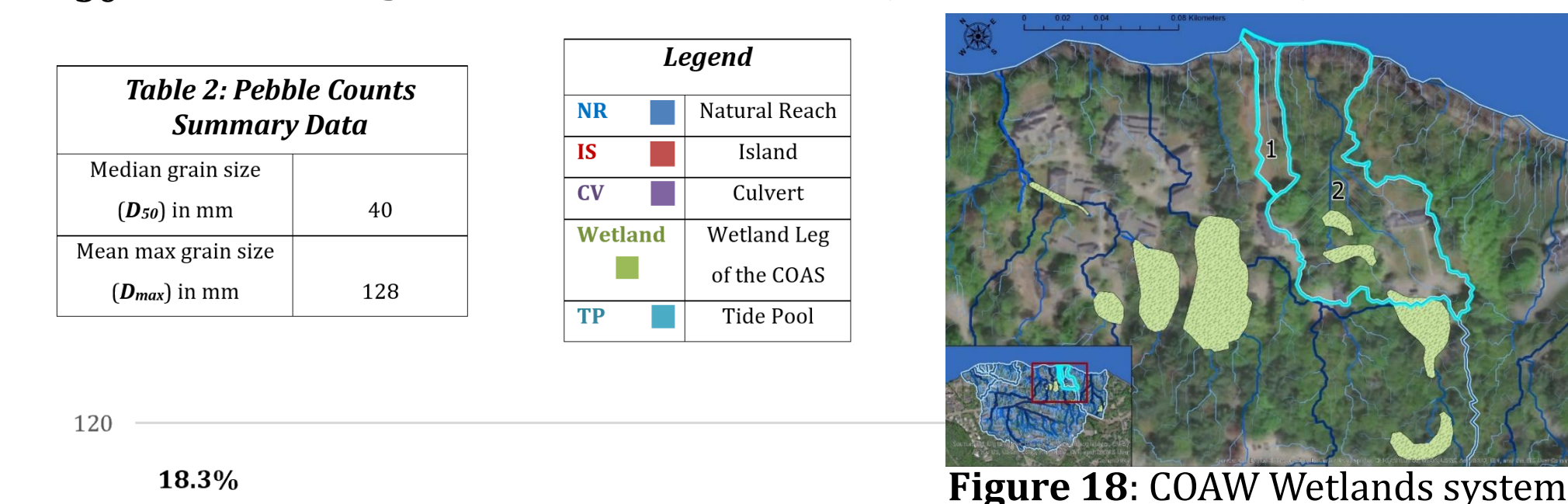


Table 3: Sediment Transport at the COAS					
Date	5/19/2018 (0.69in Rain)				
Context	Baseflow	Rising Limb	Peakflow	Lower Bankfull	Lower Floodplain
Shear Stress (τ_0) in pascals	16.66	30.72	40.12	152.25	512.25
Critical Shear Stress (τ_c) in pascals	29.14	29.14	29.14	29.14	29.14
Critical velocity (V_c) in (m/s)	1.91	1.91	1.91	1.91	1.91
Mean velocity (V) in m/s	0.036	0.054	0.064	0.16	0.35

4. Future Research

- Continue monitoring the COAW's outflows once Route 3 is finished, thus making the rating curve and hydrograph more accurate, while helping identify BMPs for decision makers
- Add YSI metrics (turbidity, conductivity, DO, TDS), nutrients, cations, and bacteria sampling to future monitoring efforts
- Adopt a watershed framework to study sustainability indicators related to water quality, nutrient cycling, discarded resources, energy usage, and greenhouse gas emissions

5. Acknowledgements

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