

CCF Salt Marsh Planning Areas

Chatham Conservation Foundation
Salt Marsh Task Force
Gerry Stahl, Chair
May 2020

GIS Map Assessment Analysis and Results
Completed by Bryan Horsley, APCC for CCF
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Introduction to preliminary overview of CCF salt marsh planning areas

The purpose of this project was for the Association to Preserve Cape Cod (APCC) to assist the Chatham Conservation Foundation (CCF) with development of a Geographic Information System (GIS) to identify existing salt marsh areas that overlap or are adjacent to properties that they manage through ownership or conservation restrictions. By identifying these salt marsh areas and overlaying with other data layers in the GIS (aerial imagery, salt marsh, sea level rise, cranberry bog, and restoration projects) we identified areas of future salt marsh migration potential, potential restoration project sites, and priority areas for conservation and facilitation of future marsh migration and restoration. Data layers included in the resulting GIS were provided to APCC from CCF and other sources including the Cape Cod Commission (CCC), Mass GIS, Mass DEP, and Mass DER. All data layers and the resulting ArcMap Document file were provided to CCF on a portable drive.

For each targeted salt marsh area listed below we have provided information in the following categories. The following descriptions of each category describe what data were used, where the data were acquired, and how they were interpreted by APCC.

Site Description: Describes the geography and extent of the targeted area. Completed by evaluating aerial imagery in ArcGIS Desktop and Google Maps and based on previous site visits.

Salt Marsh Area: Provides acreage of total salt marsh. Salt marsh areas were identified in ArcGIS Desktop from the *Salt Marsh* data layer. This layer was created by APCC by combining the salt marsh features from the *Wetlands* data layer downloaded from the Cape Cod Commissions Data Hub with salt marsh features collected in the field by APCC with a Trimble GeoXT handheld GPS unit within Frost Fish Creek. Areas were calculated in units of acres using the 1983 North American Datum (NAD). This same datum was used for all area calculations in this project.

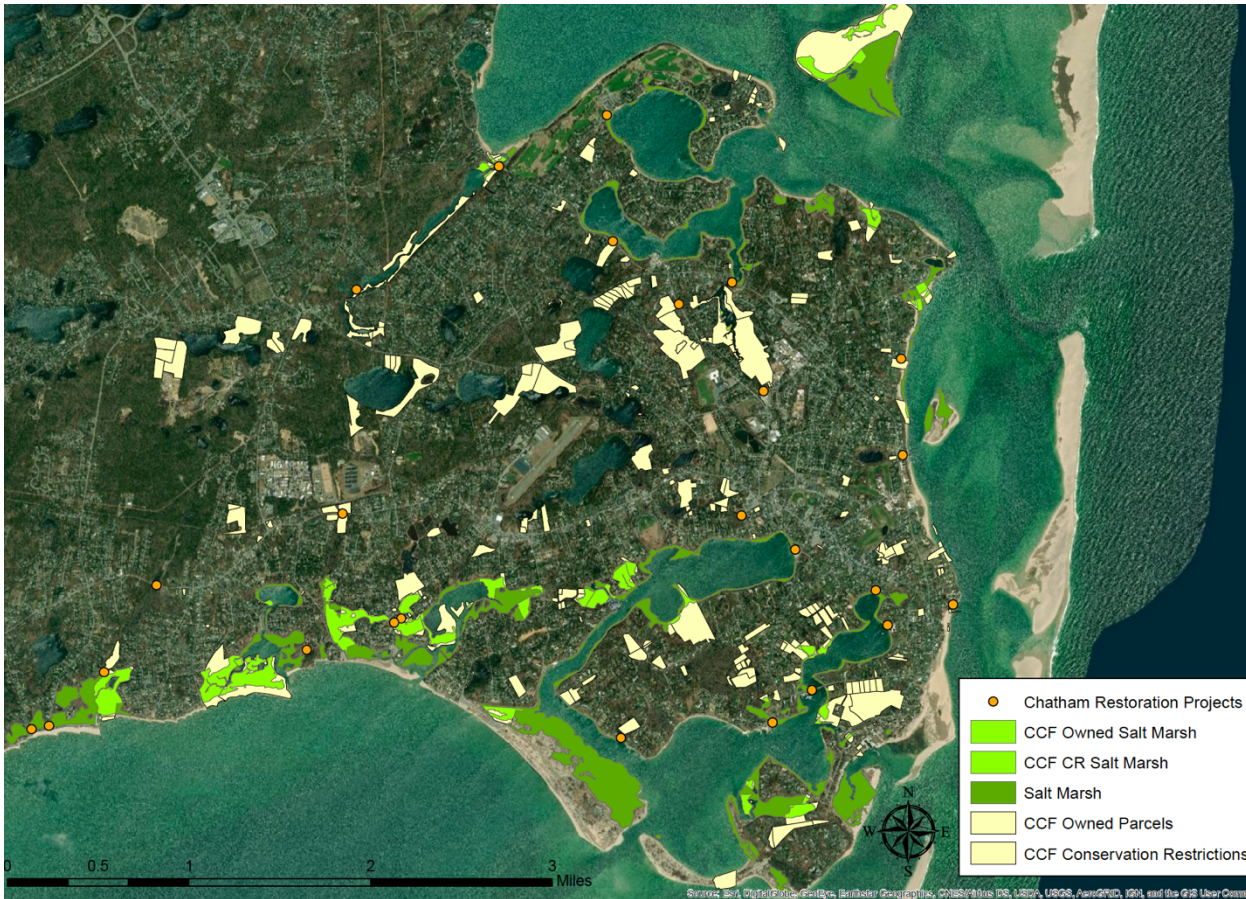
CCF Properties: Provides acreage of parcels owned by CCF, parcels with conservation restrictions (CRs) held by CCF, and the total area of salt marsh within each type of CCF property type within the targeted area. The CCF ownership and CR data layers were provided to APCC by CCF and area of overlap with salt marsh was attained by overlaying CCF property layers with the Salt Marsh layer and using the intersect tool in ArcGIS Desktop. Resulting layers included *CCF Owned Salt Marsh* and *CCF CR Salt Marsh*.

Restoration Sites: Provides an initial desktop assessment of possible ecological restoration needs and completed restoration work within the targeted area. Note that this is not a thorough assessment and further consideration of restoration opportunities, benefits, and feasibility issues should be assessed before taking any steps toward completing a restoration. The *Chatham Restoration Projects* data layer was used to identify previously documented sites. This layer was created by APCC by copying point features within the Town of Chatham from the *Cape Cod Restoration Projects* data layer as downloaded from the Cape Cod Commissions Data Hub. Note that many of the sites identified in this layer were originally compiled by APCC's Restoration Coordination Center.

Salt Marsh Migration Potential: Describes areas of possible salt marsh migration potential as a result of either active tidal restoration by opening or enlarging existing restrictions to tidal flow or passive sea level rise (SLR) or a combination of the two. Migration potential was assessed by viewing the *Sea Level Rise 4ft* data layer beneath the *Salt Marsh* data layer over

a satellite basemap and identifying the largest areas of flooding in inland directions that were not obstructed by development or infrastructure. The Cape Cod Commission's Sea Level Rise Viewer tool was used to check interpretations of ArcGIS Desktop map results. The *Sea Level Rise 4ft* data layer was downloaded from the Massachusetts Ocean Resource Information System (MORIS) online mapping tool.

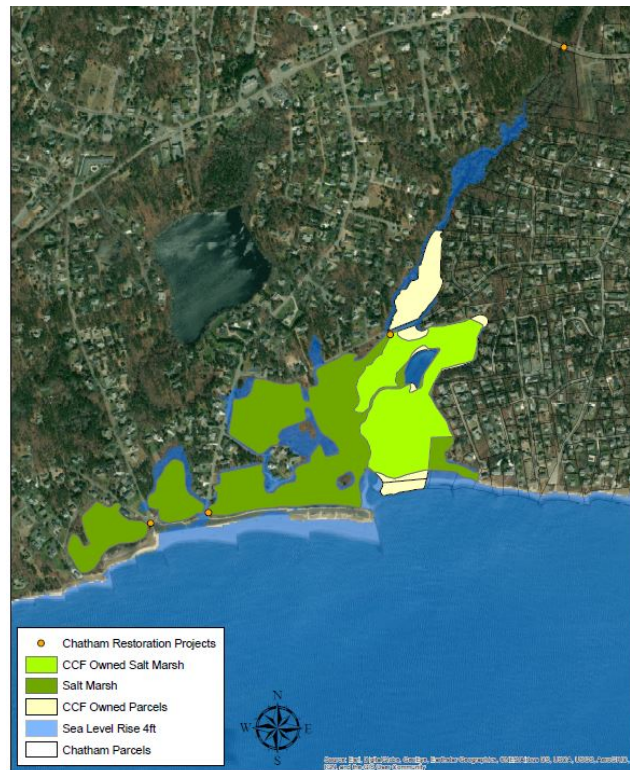
Cranberry Bogs: Describes location and extent of active and previous cranberry farming activities within the targeted area. Three data layers were used for this assessment due to lack of one comprehensive data layer, which included 1. *Cranberry Bog*, which was created by APCC by extracting the cranberry bog features from the *Wetlands* data layer downloaded from the Cape Cod Commission's Data Hub, 2. *SURFGEO24K_PG_POLY*, which was provided to APCC from CCF who downloaded it from MassGIS, and 3. *WMA_Cranberry_Bogs_SERO_Draft_Aug_2019*, which was provided to APCC from MassDER and was developed by MassDEP.



This map provides an overview of CCF owned parcels and CRs (in yellow), including those that are predominantly salt marsh (in light green).

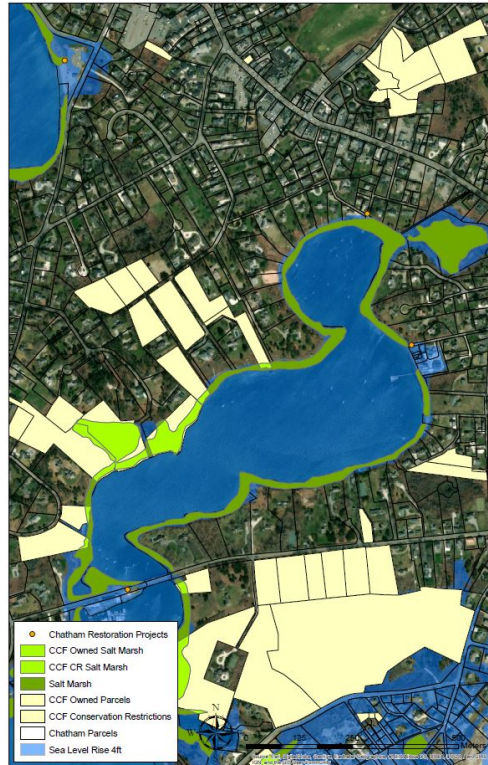
Following are initial assessment results by APCC for each of the targeted salt marsh areas:

1. Red River



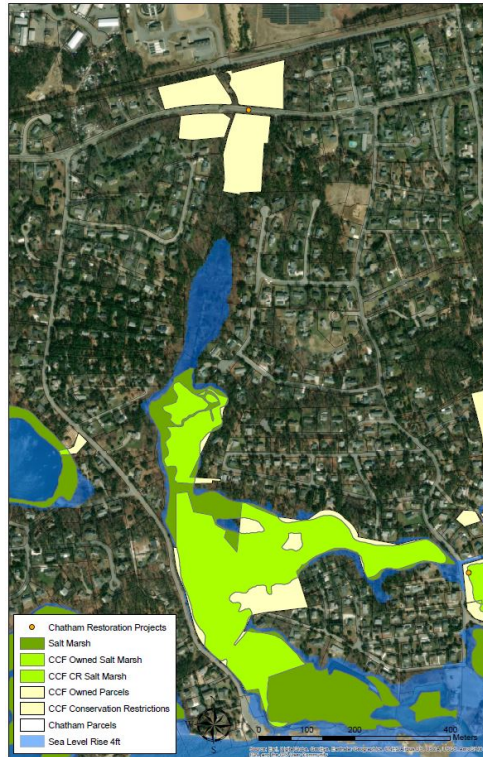
- a. Site Description: This creek and surrounding salt marsh area runs from route 28 southward to Nantucket Sound. The largest salt marsh areas exist just north of the Red River barrier beach. The system creates the border with the town of Harwich, thus intermunicipal cooperation would be important for any restoration efforts.
- b. Salt Marsh Area: Existing salt marsh area is 54.19 acres.
- c. CCF Properties: Within the targeted area CCF owns 24.57 acres of land to the east of Red River (the Chatham side) of which 17.92 acres is salt marsh.
- d. Restoration Sites: There are 4 restoration project sites indicated by the Chatham Restoration Projects data layer, two of which have likely already been completed. Status of the other two sites is unknown. Following up on prior tidal restoration work Mass DER, Cape Cod Conservation District and APCC are collaborating on post restoration monitoring and assessment in this area. Additional tidal restoration, stormwater management and vegetation management may be needed to achieve desired objectives.
- e. Salt Marsh Migration Potential: Based on assessment of sea level rise (SLR) layers over aerial imagery it appears that this marsh has good potential for some inland migration north of Deep Hole/South Chatham Road. A significant portion of this potential migration area falls on a CCF owned parcel, although additional marsh migration could occur further upstream toward Route 28 and within the town of Harwich.
- f. Cranberry Bogs: According to the Surficial Geography layer much of the wetlands comprising the upper reaches of Red River were previously cranberry bogs.

2. Mill Creek



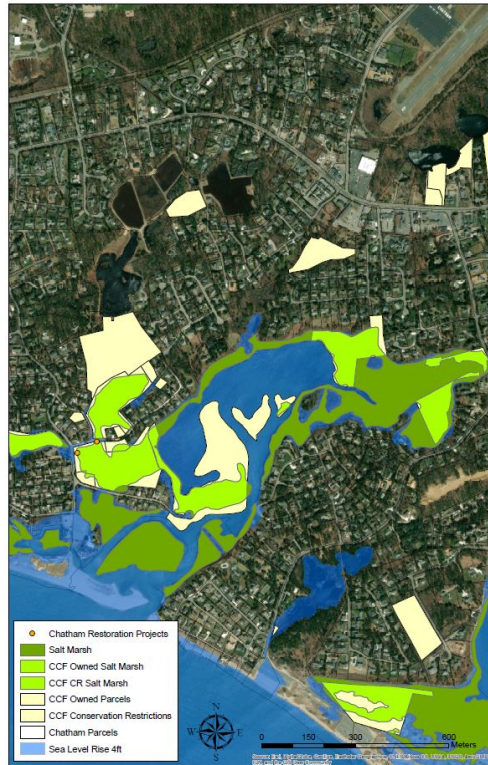
- Site Description:** Mill Creek is a tidal estuary, which extends northward from Nantucket Sound to Taylor's Pond. Forest Beach is a barrier beach that protects a large salt marsh area in the southern part of this system.
- Salt Marsh Area:** Total existing salt marsh area throughout this estuary totals 58.78 acres.
- CCF Properties:** CCF currently manages conservation restrictions and owned properties within and adjacent to this estuary totaling 61.71 acres of which 40.58 acres is salt marsh. Most CCF managed properties cover the salt marsh area just north of Forest Beach. CCF owns two smaller properties along the shore of Taylor's Pond.
- Restoration Sites:** There is 1 restoration project site identified by the Chatham Restoration Projects data layer, which is a tidal restriction at Chatharbor Lane between Mill Creek and a small salt marsh area to the east. CCF does not currently manage any properties within or adjacent to this potential restoration site although there may be parcels in this area desirable for future acquisition to facilitate the restoration.
- Salt Marsh Migration Potential:** Migration potential for marshes in this area appear limited due to elevation and development of surrounding land. The top priority for restoration to facilitate marsh migration is the Chatharbor Lane site on the eastern side. There also appears to be an area on the western side of this marsh near the intersection of Forest Beach Road and Bay View Road where some marsh expansion is possible. This area falls mostly within existing CCF conservation restricted property. Field assessment of this area to look for opportunities to facilitate salt marsh expansion is recommended.
- Cranberry Bogs:** There are no existing or previous cranberry bogs within or adjacent to this estuary according to any of the three cranberry bog layers included on our map.

3. Cockle Cove Creek



- a. Site Description: This creek flows southward from near the Chatham transfer station into a tidal marsh area adjacent to Ridgevale Beach. After flowing beneath the Ridgevale Beach footbridge it connects with Nantucket Sound at its intersection with Buck's Creek. Based on previous field visits to this site, I recall there being significant areas of invasive common reed (*Phragmites australis*) throughout the center of this salt marsh area, which may be a target for future management activities. Poor water quality due to unacceptable bacteria levels often results in public advisory notices to avoid contact with water in this area.
- b. Salt Marsh Area: Total existing salt marsh area in this estuary totals 34.57 acres.
- c. CCF Properties: CCF owns and manages 35.18 acres of land within this estuary of which 22.69 acres are salt marsh.
- d. Restoration Sites: There is 1 restoration project site identified by the Chatham Restoration Projects data layer, which includes a combined collapsed culvert beneath route 28 and potential stormwater management to improve stream flow and water quality. CCF owns properties adjacent to this potential restoration site (north and south of Route 28). CCF also manages conservation restrictions immediately adjacent to the west of this area, thus there is substantial opportunity for improved management of stormwater in this area to benefit water quality in this creek. There is also a potential tidal restoration project at the point where a side stream of Cockle Cove Creek connects with a side stream of Bucks Creek to the east near the intersection of Ridgevale Road and Cranberry Lane. Restoration at this site could help to control nearby *Phragmites* although requires further assessment for feasibility and benefits.
- e. Salt Marsh Migration Potential: Migration potential for salt marsh likely exists upstream to the north of existing salt marsh. Much of the potential salt marsh migration area is privately owned and may be of interest for CCF to acquire.
- f. Cranberry Bogs: The Surficial Geology layer indicates that much of the existing salt marshes in Cockle Cove Creek were cranberry bogs in the past. It would be interesting to look at some marsh peat samples to see if there are layers of sand indicative of cranberry farming. This assessment could also inform future restoration activities at former cranberry bogs that are planned for tidal restoration.

4. Bucks Creek



- a. Site Description: This creek is sourced in a complex of active cranberry bogs between Route 28 and Stephen Drive. From there it flows southward through wetlands, much of which are retired cranberry bogs and into salt marsh areas. Aerial imagery shows evidence of significant harmful cyanobacteria blooms just south of the active bogs, which is indicative of thermal stress and nutrient export associated with cranberry farming. Bucks Creek connects with Cockle Cove Creek just prior to connecting with Nantucket Sound.
- b. Salt Marsh Area: Total existing salt marsh in this system is 67.18 acres.
- c. CCF Properties: CCF manages 58.40 acres of land within and adjacent to this estuary of which 46.78 acres are salt marsh. CCF may be interested in acquiring additional properties to the north of existing properties along Bucks Creek and into areas of historic and current cranberry farming where restoration may be desirable.
- d. Restoration Opportunities: There are 2 restoration project sites identified by the Chatham Restoration Projects data layer, which are both tidal restoration projects. The first was mentioned above under Cockle Cove Creek, which would restore flow between Bucks and Cockle Cove Creeks and potentially have some positive benefit to control Phragmites. The second, which has already been addressed, helped to restore tidal flow beneath Cranberry Lane and upstream into a marsh area currently dominated by Phragmites. Just north of this area is where aerial maps appear to show cyanobacteria blooms in small ponded areas.
- e. Salt Marsh Migration Potential: The primary area of migration potential is upstream of the Cranberry Lane culvert nearly all of which CCF currently owns or holds a CR.
- f. Cranberry Bogs: Bucks Creek has substantial historic and current cranberry farming activity in areas extending from Ridgevale Road South, across aptly named Cranberry Lane and north to Route 28.

5. Oyster Pond



- a. Site Description: The Oyster Pond system extends from an open water salt pond at the northernmost point (Oyster Pond) southward through the Oyster River, which runs along the north side of Hardings Beach and eventually connects with Stage Harbor.
- b. Salt Marsh Area: The largest continuous area of salt marsh in this system is found along the inside of Hardings Beach (95.7 acres), another barrier beach, although there are multiple other smaller areas of salt marsh along the river and pond, namely two pockets of marsh on either side of Vineyard Ave. Total salt marsh in this system is 150.87 acres.
- c. CCF Properties: CCF owns 25.33 acres and manages CRs for 38.07 acres for a total of 63.40 acres of land managed within and adjacent to this system of which 25.76 acres are salt marsh.
- d. Restoration Opportunities: There are 3 restoration project sites identified by the Chatham Restoration Projects data layer, which are all stormwater remediation projects. At least one of the three projects has already been completed, although ongoing maintenance and monitoring of installed stormwater projects is essential to assure long term performance and pollution reduction. There are likely multiple other potential restoration projects in this system included a tidal restriction created by an earthen berm to the east of Vineyard Ave, Phragmites control, and additional stormwater project sites.
- e. Salt Marsh Migration Potential: Migration potential in this system appears minimal although the two marshes on either side of Vineyard Ave should be assessed in more detail as well as fringing shoreline around Oyster Pond. There is also a disconnected wetland area between Hardings Beach Road and Kemah Road that appears to be a good potential restoration and salt marsh migration site.
- f. Cranberry Bogs: The *Surfical Geography* layer indicates possible historic bogs in the wetland mentioned above along Hardings Beach Road as well as a couple small sites just north of Oyster Pond.

6. Morris and Stage Islands



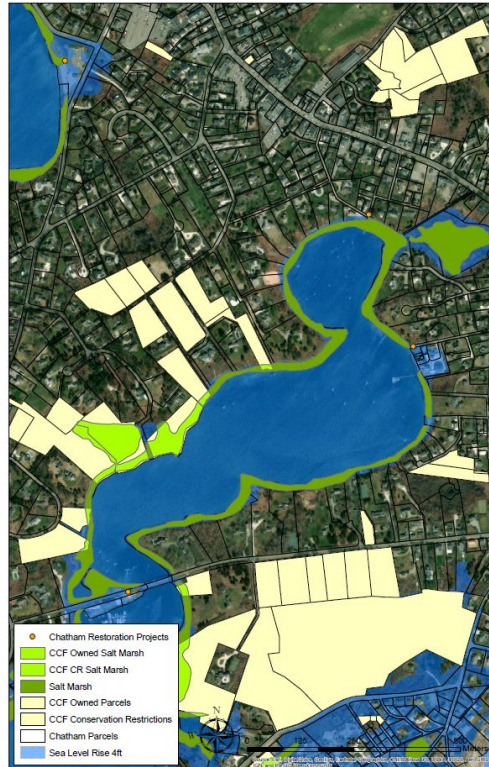
- a. Site Description: The Morris and State Islands system is connected to the mainland via a manmade causeway to the north. Surrounding water bodies include Stage Harbor to the west, Nantucket Sound to the south, and Chatham Harbor/Atlantic Ocean to the east. The sand bars to the east are in a constant state of flux due to currents and wave energy.
- b. Salt Marsh Area: Salt marsh areas fringe the protected Stage Harbor shoreline and a pocket behind a barrier sand spit to the east of the causeway along Chatham Harbor. Total salt marsh in this system is 75.78 acres.
- c. CCF Properties: CCF owns 30.00 acres and does not manage any CRs within and adjacent to this system of which 10.07 acres are salt marsh.
- d. Restoration Opportunities: There are no restoration project sites identified in this area.
- e. Salt Marsh Migration Potential: There are a couple significant areas for possible marsh migration including much of the southern end of Morris Island and a detached wetland (maybe currently a cedar swamp?) in the northern center of Morris Island. This latter area may require some assistance to facilitate tidal flow if deemed a desirable project. Note that the inland area does not show up on our GIS map but is clearly apparent with 4ft of SLR on the Cape Cod Commission's SLR Viewer tool.
- f. Cranberry Bogs: The three bog layers do not indicate any current or past cranberry farming activity on these islands.

7. Toms Neck



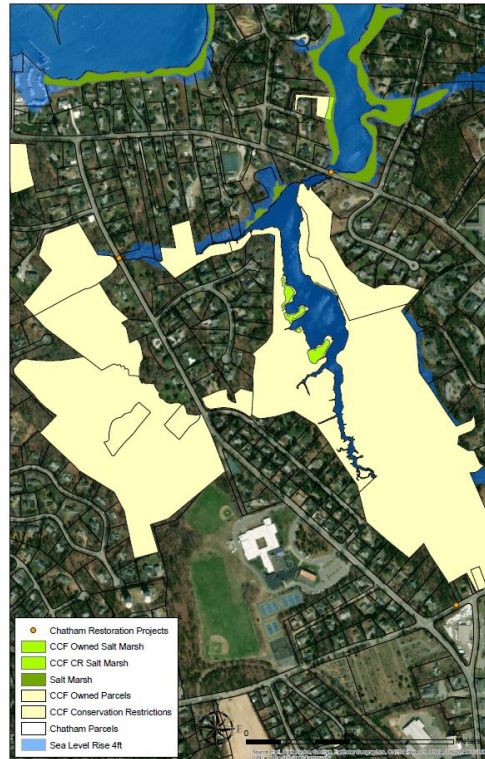
- Site Description:** Toms Neck is a land area north of the Morris Island causeway and south of the Chatham lighthouse. Surrounding water bodies include Mill Pond and Stage Harbor to the north and west and Chatham Harbor and the Atlantic Ocean to the east. Much of the center of this land area is dominated by a low-lying wetland area and flooding of residential properties and roads has been an increasing issue in recent years.
- Salt Marsh Area:** Salt marsh areas fringe the protected waters of Mill Pond and Stage Harbor shorelines and a couple small pockets on the southern end of the landmass. Total salt marsh in this system is 9.53 acres.
- CCF Properties:** CCF owns 54.50 acres and manages 0.69 acres of CRs within and adjacent to this system for a total of 55.19 acres of which 4.69 acres are salt marsh. Much of the low-lying interior land of Toms Neck is owned by CCF, which is also a large area of potential salt marsh migration. Restoration opportunities and additional property acquisitions should be explored in this area.
- Restoration Opportunities:** There are no restoration project sites identified in this area.
- Salt Marsh Migration Potential:** Due to low lying nature of much of this landmass, much of Toms Neck could allow for future marsh migration potential. Unfortunately, SLR will likely require many homes, cottages, and infrastructure to be removed from this area. But fortunately, this area may become a large salt marsh area in the future.
- Cranberry Bogs:** The three bog layers do not indicate any current or past cranberry farming activity in this area.

8. Mill Pond



- Site Description:** Mill Pond is a salt water body to the north of Toms Neck which is connected to Nantucket Sound through Stage Harbor to the south. Bridge Street crosses the channel between Mill Pond and Stage Harbor and allows boat passage beneath a newly rebuilt wooden draw bridge. While there may be a small restriction to tidal flow here it appears minimal at most.
- Salt Marsh Area:** Salt marsh areas fringe the protected waters of Mill Pond and there are a couple larger pockets of salt marsh, namely to the west adjacent to Elizabeth's Way and in the north near the intersection of Main Street and School Street. Total salt marsh in this system is 18.74 acres.
- CCF Properties:** CCF owns 34.9 acres and manages 2.23 acres of CRs within and adjacent to this system for a total of 37.13 acres of which 4.56 acres are salt marsh.
- Restoration Opportunities:** There are 3 restoration project sites identified in this area all of which are stormwater management projects. Current status of these projects is unknown.
- Salt Marsh Migration Potential:** Migration potential in this area appears to be limited due to elevation and surrounding development and infrastructure. There are a couple areas of possible migration on the south west of Mill Pond. The first is just north of Bridge Road on the west edge of the water and the second is just a bit further north on the same western shoreline. CCF owns much of the area for both opportunities and should consider managing them with SLR and marsh migration in mind. There also appears to be some potential for migration surrounding the pocket marsh area on the northern end of Mill Pond.
- Cranberry Bogs:** The three bog layers do not indicate any current or past cranberry farming activity in this area.

9. Frost Fish Creek



- a. Site Description: Frost Fish Creek is a complex tidal estuary that's hydraulically connected to Ryders Cove via a series of culverts beneath Route 28 and an earthen berm. The open water area branches to the west and narrows to a small stream beneath Crowell Road, and extends all the way to Lovers Lake. The main open water area continues southward where it narrows and ends at a concrete water control structure that blocks tidal influence from a large fresh bog area. APCC and CCF have worked together to assess this estuary as a possible site for tidal restoration to improve water quality and wildlife habitat. APCC conducted initial field work and wrote a restoration assessment report for CCF in early 2019.
- b. Salt Marsh Area: Salt marsh areas are patchy along the shorelines of the protected waters of Frost Fish Creek, although the restrictions to tidal flow have likely drastically reduced salt marsh area here compared with previous, unrestricted extent. Total salt marsh in this system, according to an initial field survey by APCC is 0.95 acres. APCC field survey also identified 2.30 acres of *Phragmites* within Frost Fish Creek and the upper bog area, some of which may also be classified as salt marsh.
- c. CCF Properties: CCF owns the majority of the land surrounding Frost Fish Creek for a total of 88.34 acres of which 0.67 acres are salt marsh. There are no CCF managed CRs within this area.
- d. Restoration Opportunities: There are 3 restoration project sites identified in this area all of which are tidal restoration projects. None of these projects have been addressed, although CCF and APCC have conducted an initial restoration assessment and are working with partners to further develop this project. In addition to tidal restoration work there are also a few sites where stormwater remediation would benefit water quality including along Crowell Road, Route 28 and Stony Hill Road. Low-lying residential properties are likely to create challenges for a full tidal restoration. To address this challenge, CCF may want to consider acquiring available properties within areas likely to be flooded by tidal restoration.
- e. Salt Marsh Migration Potential: There is substantial salt marsh migration potential within Frost Fish Creek, although completion of the proposed tidal restoration projects will be necessary to allow adequate tidal flow into the system to restore and expand salt marsh areas. Largest areas of marsh migration include the southern bog area and currently forested areas west of Crowell Road.
- f. Cranberry Bogs: Most of the land surrounding Frost Fish Creek was historically farmed for cranberries. This is the reason for installation of the many tidal restrictions and water control structures in this area.
- g. Restoration Priority: Frost Fish Creek is CCF's initial salt marsh restoration project. CCF contracted with APCC to conduct a preliminary study in 2018 for \$5,000. The study concluded that there were multiple tidal restrictions and

substantial salt marsh migration potential, warranting further investigation. CCF submitted a CPC proposal for \$75,000 to conduct two detailed studies (complete hydraulic and hydrologic modeling and complete water quality modeling, based on that), to be supervised by APCC. CCF is providing a \$5,000 match to this grant. The proposal was supported by the Pleasant Bay Association, APCC and the Town of Chatham; it was endorsed by CPC, the Chatham Board of Selectmen and the Chatham Finance Committee. It is expected to be approved at Town Meeting in September 2020.

10. North Chatham



- Site Description:** This site is comprised of a large lobe of land extending from Route 28 northward into Pleasant Bay. Lower Frost Fish Creek and Ryders Cove frame the western shorelines with Bassing Harbor to the north and Chatham Harbor to the east.
- Salt Marsh Area:** Salt marsh areas fringe much of the shorelines of this area with a few pockets of larger marsh areas throughout. Total salt marsh in this system is 32.59 acres.
- CCF Properties:** CCF owns 20.92 acres and manages 7.06 acres of CRs in this area for a total of 27.98 acres of which 9.05 acres are salt marsh.
- Restoration Opportunities:** There is 1 restoration project sites identified in this area which is a stormwater management project at Cow Yard Road. Current status of this project is unknown.
- Salt Marsh Migration Potential:** There appears to be some marsh migration potential in this area including an area extending from upper Frost Fish Creek to the east into North Chatham, fringing areas around many of the pocket marshes along the northern and eastern shorelines, and a significant area in the middle of the landmass, which appears to currently be a shallow wetland dominated by open water and algae growth. Note that SLR flooding of this area was observed using the Cape Cod Commission's SLR Viewer tool and does not show up with the *Sea Level Rise 4ft* layer included in our GIS. CCF manages land in many of these potential migration areas although none are managed in the area where Frost Fish Creek appears to have potential to extend eastward with SLR of 4ft. This may be a desirable area for future land acquisitions.
- Cranberry Bogs:** There are a few areas of historic cranberry farming activity in North Chatham. Most notable is the large wetland area in the center of the landmass that was described as a potential marsh migration area above.

11. Strong Island



- Site Description:** This site is comprised of an island within Pleasant Bay. The island exists to the north of North Chatham and is not connected to the mainland. The northern upland portions of the island have steep gradients and significant elevation above sea level. It's notable that this island is very much shaped like a shark tooth.
- Salt Marsh Area:** Roughly half of this island is comprised of salt marsh with the majority being on the southern end. Total salt marsh in this system is 75.52 acres.
- CCF Properties:** CCF owns the entirety of the upland portion of the island at a total of 79.39 of which 16.51 acres is salt marsh. The CCF may want to consider adding the southern salt marsh area as part of their acquisition.
- Restoration Opportunities:** There are no restoration project sites identified in this area and the island is mostly undeveloped, aside from a single home and outbuildings so restoration needs are likely minimal. The island should be surveyed for invasive vegetation.
- Salt Marsh Migration Potential:** There appears to be minimal opportunity for marsh migration on this island due to steep gradients and relatively high elevation of the northern upland landmass. This is one of the few marshes on Cape Cod that has not been extensively ditched and impacted by human activities and thus is of very high value to preserve and protect. Proposed dredging projects should be watched closely to assure deepening of adjacent boating channels won't increase undercutting and calving of salt marsh peat, which is mostly not protected by barrier beach or any significant natural structures.
- Cranberry Bogs:** There is no evidence of historic cranberry farming on this island.

12. Nickersons Neck



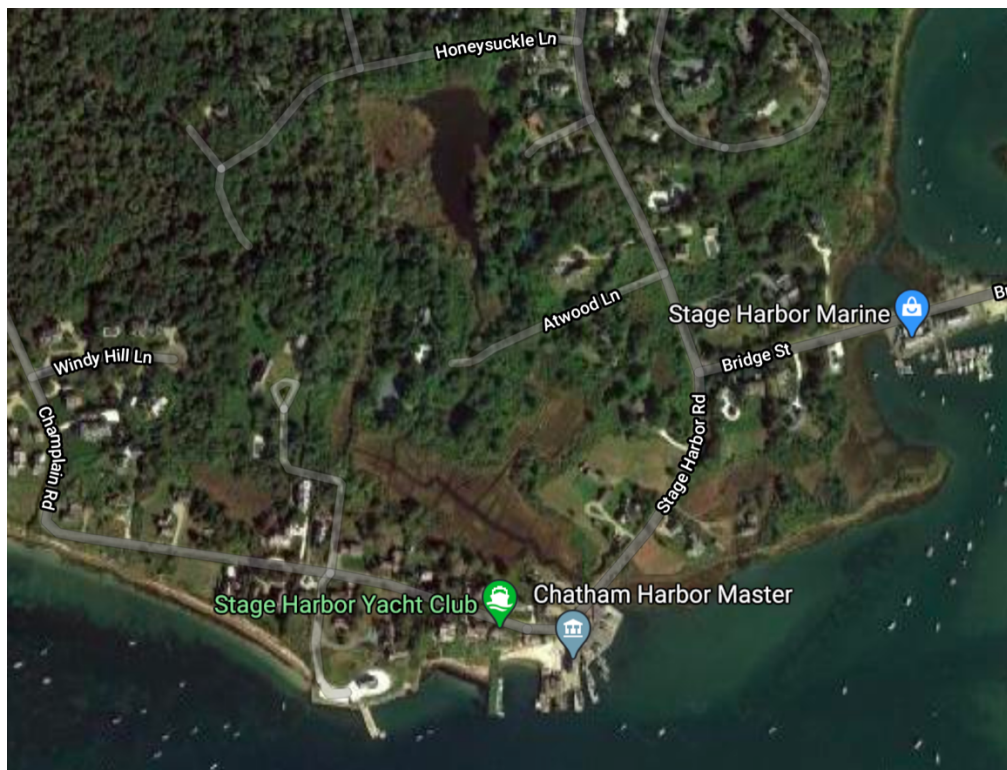
- a. Site Description: This site is comprised of a peninsula between Crows Pond and Pleasant Bay to the west of Strong Island. Much of the western portion of the land area is covered by the Easward Ho! Golf course and the eastern portion is residential. There's an open water wetland very close to the Pleasant Bay shoreline on the northern part of the neck.
- b. Salt Marsh Area: Salt marsh fringes much of the southern and eastern shorelines. Total salt marsh in this system is 8.29 acres.
- c. CCF Properties: CCF owned parcels cover a total area of 5.91 acres of which 0.10 acres is salt marsh. CCF does not manage any CRs in this area.
- d. Restoration Opportunities: There are no restoration project sites identified in this area.
- e. Salt Marsh Migration Potential: There appears to be some opportunity for marsh migration in this area. While the eastern end of the neck is low-lying and will flood with 4ft of SLR, there are roads and homes that will present challenges. Best migration areas include two wetland areas with the first between Strong Island Road and Eastward Road and the second north of Strong Island Road. CCF may want to consider additional property acquisitions in these areas of possible marsh migration.
- f. Cranberry Bogs: There is no evidence of historic cranberry farming on this peninsula.

13. Muddy Creek



- a. Site Description: Muddy Creek is a long and narrow tidal estuary that extends from the southwest corner of Big Pleasant Bay at Route 28 southwestward along the Chatham-Harwich border.
- b. Salt Marsh Area: According to our data layer, salt marsh is limited to a small area on the north end of this system. Total salt marsh indicated in this system is 2.20 acres. Current day salt marsh area is likely significantly larger than this due to a recent tidal restoration that has successfully increased tidal exchange, water quality, salinity and associated health and expansion of salt marsh areas south of Route 28.
- c. CCF Properties: CCF owned parcels cover a total area of 22.35 acres and manages CRs for 5.81 acres for a total of 28.16 acres of which 1.95 acres is salt marsh.
- d. Restoration Opportunities: There are 2 restoration project sites identified in this area. The first has been completed, as discussed above, to restore tidal flow beneath Route 28. The second entails a possible fish passage restoration at the southern end of the system to facilitate migratory fish passage to spawning grounds. Additional tidal restoration work may also be desirable in the future as there are few sites where earthen berms restrict flow through the system.
- e. Salt Marsh Migration Potential: There appears to be some opportunity for marsh migration in this area although it is limited due to elevation of surrounding land. Since the tidal restoration was completed salt marsh area is expanding and SLR will likely drive further expansion up the creek banks and into some low-lying areas in the southern reaches of the system.
- f. Cranberry Bogs: There are a few areas of likely historic cranberry farming in the southern end of Muddy Creek and the remaining earthen berms are evidence of this past activity.

14. Champlain Creek



Champlain Creek flows inland from Stage harbor at the mouth of Mill Pond.

Tidal flow to the 4.3 acre Champlain Creek Salt Marsh is severely restricted by an undersized and dilapidated 20 inch diameter metal culvert. Replacement of the undersized and failing culvert will re-introduce tidal hydrology to the site, restoring the former salt marsh.

Summary Data:

CCF Owned Parcels: 594.57 acres

CCF CR Parcels: 234.59 acres

CCF Owned Salt Marsh: 127.59 acres

CCF CR Salt Marsh: 50.05 acres

Chatham Salt Marsh: 13,017.32 acres

Chatham Restoration Sites: 25 sites

No.	Area	CCF properties	CCF CR parcels	owned or managed acres	CCF salt marsh acres	area salt marsh acres	cranberry acres	restoration priority	Notes
1	Red River	10, 146		25	18	54	most of area previously cranberry bogs	some work underway; good migration potential	Along Harwich border
2	Mill Creek	23, 211	193	62	41	59	0	needs field work to identify needs	Taylor's Pond to Forest Beach
3	Cockle Cove Creek	134, 135, 147, 166, 184, 192, 199, 206, 227	192, 206	35	22	35	most of area previously cranberry bogs	excellent migration potential; phragmites; culvert connecting Cockle Cove and Bucks Creek areas	Cranberry Lane features a 5-acre salt marsh that was once converted to cranberry production. The marsh quickly returned when farmed was ended, but an older culvert threatened the health of system, and Phragmites appeared at the edges. Restoration will be achieved by allowing unimpeded tidal flow to the marsh, which features a freshwater marsh and pond upstream. The site is owned by the Chatham Conservation Foundation. Completed in 2012.
4	Bucks Creek	11, 16, 28, 72, 75, 98, 130, 138, 141, 143, 186, 220, 223	186, 197	58	47	67	most of area previously cranberry bogs	excellent migration potential; phragmites; culvert connecting Cockle Cove and Bucks Creek areas	From 28 to Cockle Cove
5	Oyster Pond	81, 110, 125, 200, 202	180	63	26	151	small sites		Along Oyster River
6	Morris & Stage Islands	6, 111, 177, 185, 209, 214		30	10	76			Along creek into Morris Island
7	Tom's Neck	21, 22, 55, 65, 66, 85, 89, 100, 104, 157, 163, 216, 217, 218, 219		55	5	10		serious problem flooding or adjoining residential area	Near Morris Island causeway
8	Mill Pond	4, 95, 109, 114, 172		37	5	19			Atwood, Mill Pond
9	Frost Fish Creek	15, 27, 84, 101, 118, 121, 127, 137, 153, 154, 165,		88	3	3	most of area previously cranberry bogs	multiple tidal restrictions; phragmites; excellent migration potential with restoration; top priority area	From Ryder's Cove inlet, including across Crowell Rd

10	North Chatham	3, 59, 122, 128, 221, 222		28	9	33			Cotchpinicut & Minister's Point
11	Strong Island	69		79	16	75		invasives; possible fire danger	
12	Nickerson's Neck	1, 69, 77, 86, 88, 97, 131, 142, 145		6	0	8		potential of residential flooding	Between Crow's Pond and Strong Island
13	Muddy Creek	8, 9, 13, 24, 38, 45, 70, 152, 156, 161, 162		22	2	2	some evidence	site of major restoration effort	Muddy Creek is a 55-acre tidal wetland that borders Harwich and Chatham. The tidal wetland had long been disconnected from full tidal flow by two undersized, deteriorated culverts. DER, Harwich, Chatham, and other partners worked together to replace the culverts with a 94-foot bridge to improve both habitat and water quality in the system. The Muddy Creek Restoration Project was completed in 2016.
14	Champlain Creek	7, 17, 71, 99, 102, 148, 208, 213		16	2	4		site of current DER culvert replacement project	Tidal flow to the 4.3 acre Champlain Creek Salt Marsh is severely restricted by an undersized and dilapidated 20 inch diameter metal culvert. Replacement of the undersized and failing culvert will re-introduce tidal hydrology to the site, restoring the former salt marsh.
	subtotals	103	6	604	206	596			
	Total CCF acres	191	45	1183	214				