Four Corners Project: FY24 Summary Report

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Executive Summary

Project Overview

The Four Corners Project has three primary objectives:

- To build community understanding of the ecological, hydrological, and climate dynamics that influence Clarksburg and the Four Corners focus area.
- To prioritize solutions that
  - increase the resiliency of public and private infrastructure to flooding and storm damage;
  - expand all-persons access to parking lots, trails, evacuation routes, Town Field, and the Community Center; and
  - enhance public sites to support more recreation and community events.
- To complete preliminary concept designs for several locations throughout the Four Corners that integrate the community's priority solutions.

The work of FY24 has focused on the first two objectives. Between January - May 2024, our team conducted mapping and site analysis, completed six site visits, facilitated ten biweekly meetings with the project's core team, held two community workshops, and coordinated with consultants from Unpaved Trails for All, Flying Cloud Institute, and GZA.

Key Findings

Existing Conditions

The central tension of the Four Corners project is how to maintain resilient infrastructure in a floodplain that is by nature dynamic and ever-changing. The Four Corners area is largely located in a historic floodplain-wetland complex of poorly drained, hydric soils with very little elevation change in the low lying areas. These inherent topographic and soil characteristics, combined with historic and recent development patterns; variable infrastructure maintenance; and more precipitation all contribute to the increased flooding and stormwater problems Clarskburg is experiencing.

Land use patterns throughout the Four Corners influence stormwater and flooding dynamics. In the focus area, these patterns can be broadly categorized as Developed/Modified Uplands, Developed Floodplains, and Developed/Modified Wetlands. Generally speaking, development in the uplands diminishes capacity for slowing, infiltrating, and storing water and nutrients

higher in the landscape, while development or modification of floodplains and wetlands diminishes water storage capacity in the lower elevations.

Historic aerial photos from the 1940s and 1960 show that the floodplain/wetland complex at that time was primarily farmland, with minimal development in the uplands. Fields were drained by a network of 3,640 linear feet of agricultural ditches. By the 90s, fewer maintained ditches can be seen and today, there are an estimated 1,775 linear feet of ditches under variable maintenance regimes. In the 30+ years since those ditches were retired, wetlands have naturally reestablished, primarily on private property bordering the Town Field and Elementary School. In other areas of the Four Corners, former farmland has been converted to residential development.

An aerial photo from the 1960s shows the extent of agricultural fields and drainage ditches, and minimal residential development.

This aerial photo from 2012 shows significant changes in the landscape: some agricultural fields have reforested, some have been converted to residential development, and some are reverting to wetland.

Humans aren't the only modifiers of the landscape. Beavers also manipulate the land in the Four Corners to suit their unique needs and preferences. Historic aerials of former beaver dams, anecdotal reports from community members, and present-day active dams reveal the dynamic nature of beaver activity and, consequently, how water flows (or doesn't) through the focus area.

In the last 50+ years land use patterns in the Four Corners have changed slowly but significantly; however, precipitation has increased more dramatically. Rainfall in the last decade has averaged almost 5" more than in the previous 100 years. By 2050, precipitation is projected to increase by an additional 3+ inches[1]. Much of this additional precipitation is likely to occur in extreme weather events like Hurricane Irene and the rains of July 2023, resulting in increased flood hazard and related damages. (Anecdotal reports from some community members suggest that Hurricane Irene altered the confluence of the Tamarack and Hudson Brook, although this isn't apparent from aerial photos.)

Combined, all of these changes suggest that what may have worked in the past is not likely to work in the future. Successful solutions for the future of the Four Corners must respond to the

[1] LeNoir, J.M., Najibi, N., and Steinschneider, S., 2023, Predicted temperature and precipitation values derived from modeled localized weather regimes and climate change in the state of Massachusetts: U.S. Geological Survey data release, https://doi.org/10.5066/P9KTY3MS

realities of more frequent and intense flooding associated with rising precipitation and changes to landscape management.

Challenges + Community Priorities

Challenges that this project addresses fall within three main categories:

- Increased negative impacts of stormwater + flooding, especially in Town Field and residential parcels
- Inaccessible and/or unsafe trails, parking, pathways, and gathering spaces
- Limited active and passive recreational and gathering opportunities

In response to these challenges, community members that participated in Design Workshop #2 identified the following priorities:

- Manage Stormwater + Floodwater
  - Culvert Repair/Improvement
  - Ponds that hold floodwaters
  - Stream Channel Modification
- Improve Accessibility + Safety
  - Accessible Trails
  - Wetland Boardwalks
  - Safe Pedestrian Access between the School and Community Center
- Improve + Expand Recreational Opportunities
  - Better recreation fields and courts
  - Community Garden/Edible Landscaping
  - Playgrounds

Regulatory Landscape

A preliminary regulatory assessment and site walk was conducted with the assistance of a Senior Wetland Scientist from GZA. Several regulated wetland resources are in the project area, including *Bordering Vegetated Wetlands, Land Under Water Bodies and Waterways, and Bank and Riverfront Areas.* These resources require that special permitting be undertaken for any projects that alter their size and function. Several projects prioritized by the community will likely have minor to significant permitting requirements.

A majority of the Town Field is mapped within the 100-year Flood Zone. Because this area is a priority site for a number of improvements and/or alterations, it will be essential to confirm the accuracy of the base flood elevation referenced in the 1982 Flood Insurance Rate Map (FIRMette). Any changes to the elevation of the field within the flood zone would require a Notice of Intent, and possibly compensatory storage at the same elevation where fill is proposed. The Town can request a review/appeal of the base flood elevation by submitting a Letter of Determination Review (LODR) to FEMA.

Recommendations + Next Steps

- Modeling - Commission a flood plain study to determine the effects of future precipitation changes and solutions proposed by the Clarksburg community including dredging, pond creation, rechannelization, culvert replacement, and ditching of adjacent lands. The study area should include the portions of the Hudson Brook and its tributaries from its origin near the Vermont border to Hudson Brook Lane in Clarksburg. To be most useful to the ongoing work of this project in FY25, the study should be completed by an experienced and credentialed watershed modeler before October of 2024. The study shall use a two-dimensional HEC-RAS or its equivalent, as recommended by the selected contractor.
- Floodplain Determination - Work with BRCP, The Department of Conservation and Recreation (DCR) Flood Hazard Management Program (FHMP), and other agencies to determine the regulatory status and extents of the floodplain in and around the Town Field. RDG will seek to obtain a definitive determination as soon as possible.
- Wait to move forward on concurrent projects related to accessibility and circulation (Safe Streets and route to Pavilion) until Phase 3 is complete.

Mapping + Analysis

Background Information and Desktop Assessment (Sub-task 3.1)

Summary of Findings

Ecological Context

The majority of the area of interest identified for this project includes both private and public parcels, and is contained within a one-square mile sub-basin of the Hudson Brook. A large floodplain/wetland complex characterized by poorly drained, permanently or seasonally saturated (hydric) soils, and high ground water spans both sides of the Hudson Brook, stretching north to a forested wetland along Gravel Bank Road and east to Tamarack Swamp.

The Clarksburg Elementary School and Clarksburg Community Center, although at roughly the same elevation, differ in that the school sits atop excessively drained soils, while the Community Center, which sits at the edge of a forested wetland, is characterized by poor to moderately drained soils. Both sites drain toward the central floodplain/wetland complex where the Town Field and residential parcels are located.

These inherent qualities—combined with changes in land management, increased impervious land cover in the uplands, variable maintenance of culverts, shifting beaver activity, and increased frequency and intensity of precipitation—mean that there is no single or easy solution to the challenges being experienced. Rather, several interventions at differing scales and intensities will be needed. While it is possible to lessen localized risks through NbS and engineered interventions, successful long term solutions need to be understood and implemented at the watershed scale. That means taking actions that slow, spread, and sink stormwater rather than concentrating it into channels or ditches. Healthy forests and wetlands are two land covers that do this very well. More developed or modified areas often need a hand to achieve similar performance.

Watershed Scale Actions

Green Infrastructure**:** Rain gardens, bioswales, rain barrels and cisterns, and permeable paving are simple, effective solutions that increase the stormwater performance around the buildings, roads, and other structures that people depend on. Incentivize property owners to install features to infiltrate water around paved and impervious surfaces.

Forests: Because much of Clarksburg is already forested, protecting and enhancing the stormwater functions of the existing forest is essential to maintain and improve future performance. Actions that protect and improve stormwater function include allowing older and maturing trees to grow large, leaving downed wood and slash in the forest, proactive planting of climate adapted tree species, especially after large disturbances like microbursts and disease events, and managing against catastrophic fires. The Northern Institute of Applied Climate Science offers several decision making tools and guides to assist public and private landowners to protect their forest sponges.

In-stream flow: Replacing failing, clogged, and undersized culverts to meet or exceed Massachusetts' Stream Crossing Standards can improve flood resistance and resilience by alleviating upstream ponding that can lead to catastrophic failures. The Department of Environmental Restoration's Culvert Replacement Municipal Assistance Grant Program is one way to offset the costs of replacement and reconstruction.

Riparian Buffers: Reforestation of riparian areas not only improves in-stream water quality, but reforested banks can help protect adjacent and downstream lands from flood damage associated with debris and sediment. Where infrastructure and human life is not imperiled, encouraging and allowing streams to flood by reconnecting streams to their floodplains can relieve flood pressure downstream.

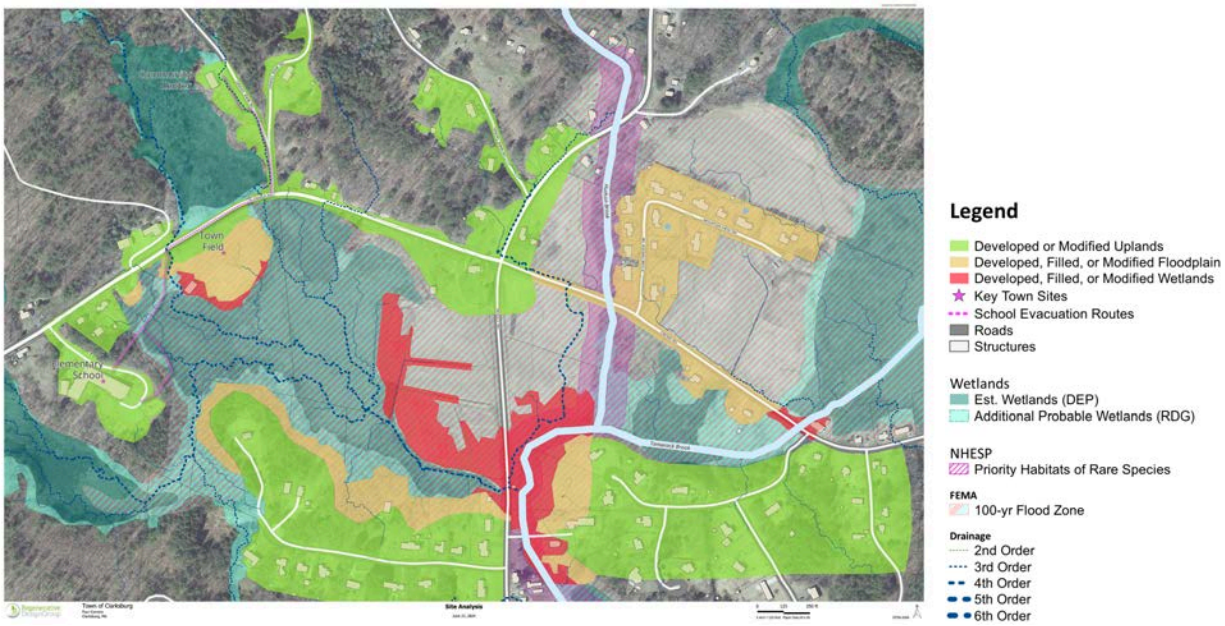
Wetland Protection + Restoration: Wetlands, including beaver impoundments[2] are well documented to improve watershed scale flood resistance benefits. While these features make it

[2] Hatch, Christine E., Beavers offer lessons about managing water in a changing climate, whether the challenge is drought or floods, The Conversation, January 20, 2022. https://tinyurl.com/mwaxynj5

difficult for humans to use and move through the landscape, they provide great downstream protection. Restoring wetlands bordering streams and protecting forested wetlands from clearing helps store more carbon and water in the long term.

Development Typologies

A coarse preliminary assessment of development patterns in the focus area, their influence on storm and flood dynamics, and opportunities for nature-based solutions in each were discussed at the first design workshop. (*Active agricultural fields have been omitted from this assessment.)*



Developed or Modified Uplands: ~59 acres
Characteristics: Areas above the floodplain-wetland complex with built infrastructure, impervious surface, and/or significant grading. These areas have diminished capacity to slow, infiltrate, and store water and nutrients higher in the landscape and are often designed to shuttle water off-site as quickly as possible—exacerbating downstream dynamics, especially in prolonged or extreme rain events.

Opportunities: Nature based solutions like reforestation, permeable paving and pathways, rain gardens, vegetated swales, and ecological lawn management can restore some of the lost ecosystem function of modified uplands, leading to better water quality, stormwater dynamics, and habitat diversity. These solutions also have the benefit of enhancing educational, public, and community spaces.

Developed Floodplains: ~20 acres

Characteristics: Much of the Four Corners area is located in the floodplain of the Hudson Brook and its tributaries. Significant portions of this floodplain have been developed, resulting in a patchwork of agricultural and residential parcels, crisscrossed by roadways. Much of this floodplain is underlain by hydric soils with poor to very poor drainage capabilities. These inherent soil properties combined with impervious land cover and undersized or compromised culverts exacerbate the inevitable flooding that is predicted to occur with greater intensity and frequency.

Opportunities: Residents located in the floodplain should have emergency evacuation plans in place for both human and domestic animals and strategies to keep basements dry between and after flood events. Consider increasing flood storage capacity of non-developed floodplains (e.g., through wetland restoration and retention ponds), upgrading culverts to bridges, and elevating houses in most severe flood zones (10 year flood plain).

Developed, Filled, and/or Modified Wetlands ~11 acres

Characteristics: The floodplain wetlands of the Four Corners store and filter stormwater, mitigate flooding, sequester carbon, provide habitat, and offer recreational opportunities for the community. Throughout the focus area, approximately 11 wetland acres have been compromised through filling, draining, or development. This lost ecosystem function contributes to flooding, ponding, and field saturation, and is likely to become more persistent as the region gets wetter.

Opportunities: Restore wetlands to the greatest extent possible. Combine with ecological recreation like wetland walks and innovative agriculture that can thrive in wetland conditions.

**See the Mapping + Analysis Appendices for supporting documents*

Site Visits + Community Engagement

Clarksburg Elementary School Site Visit (Sub-task 3.2)

Site Visit Dates: 2/09/24 and 4/25/24

Characteristics/Key Challenges	Preliminary Design Directions/NbS/BMPs
• Majority impervious cover on excessively drained soils • Driveway grade limits visibility, accessibility, and infiltration of stormwater • Parking layout + lack of sidewalks limits efficient, legible use of the space • Lack of stormwater infrastructure contributes to hillside and trail erosion along the NE slope • Staircase and trail into the wetland complex aren't universally accessible • Some trail portions may conflict with wetland regulations	• Revise parking lot layout for safer vehicular + pedestrian flow, more efficient use of available parking areas while reducing impervious areas and increased greenspace. • Incorporate permeable hardscape where appropriate • Integrate bioswales and/or rain gardens for stormwater infiltration • Create at least one universally accessible access route into the wetland complex

From L to R: Driveway grade limits visibility, accessibility, and infiltration of stormwater; staircase and trail into the wetland complex aren't universally accessible; some trail portions may conflict with wetland regulations.

Community/Senior Center Site Visit (Sub-task 3.3)

Site Visit Dates: 2/09/24 and 4/25/24

Characteristics/Key Challenges	Preliminary Design Directions/NbS/BMPs
• Detention basin south of building may not be functioning as intended • Grades around building don't allow stormwater to be diverted or infiltrated effectively • Surrounding landscape and parking lot could be used more effectively/efficiently • Not universally accessible from other points in the project focus areas	• Resize/reshape and vegetate bioretention basin • Route stormwater from the north end of the parking lot to the bioretention basin. Regrade the parking lot to allow for positive drainage away from the building and to the south into the existing stormwater basin. • Improve grading at the north end to prevent sediment laden stormwater from running into the parking lot. Divert upgradient stormwater running down Gravel Bank Road into the existing channel located north of the parking lot. Construct a settling/filtration area to be located at the head of the channel. • Replace undersized and failing culverts along Gravel Bank Road • Identify recreational elements that could fit in this location

From L to R: Grades around the building don't allow stormwater to be diverted or infiltrated effectively; the detention basin may not be functioning as intended; not universally accessible from other points in the project area.

Town Field Site Visit (Sub-task 3.4)

Site Visit Dates: 2/09/24, 3/12/24, 4/25/24

Characteristics/Key Challenges	Preliminary Design Directions/NbS/BMPs
Access + Circulation • Single parking lot is poorly defined and underused day-to-day; no adequate parking for big events • Lack of accessible pathways throughout the field and to the pavilion • Emergency route cuts through significant ponding area • No sidewalks or other safe pedestrian access along W Cross Rd • Culverts are undersized Recreation + Gathering • Persistent ponding and soil saturation limits the use and enjoyment of the Town Field	Access + Circulation • Revise parking layout to maximize usable space • Upgrade existing pathways + boardwalks for universal access • Integrate parallel parking, pedestrian access, and green stormwater infrastructure along W Cross Road • Enlarge culverts Recreation + Gathering • Make grading, soil, and subsurface improvements to the portion of Town Field not identified as wetlands • Manage areas with persistent ponding as restoration and catchment zones • Restore wetlands located around the field pavilion

From L to R: There are no sidewalks along W Cross Road; persistent saturation of Town Field limits use; the Town Field parking lot is poorly defined and has no accessible spots or access.

Private Landowner's Site Visits (Sub-task 3.5)

Site Visit Dates: 3/12/24 and 5/14/24

Characteristics/Key Challenges	Preliminary Design Directions/NbS/BMPs
Private Residences ● Extensive and frequent flooding reported and observed at four residences ● Chance of flood stranding is high for Lescarbeau and Maynard properties Road + Flood Infrastructure ● Culverts are undersized, damaged, or sedimented ● Sediment and stormwater flows reported from Lincoln Drive ● Large berm on Hudson Brook provides flood protection to Stoneybrook Dr homes ● Backflow preventer observed on culvert draining the Wilson Property to Hudson Brook ● Middle Road reported as main emergency route Fields + Farm Ditches ● Haying is the predominant use ● Two landowners are actively maintaining ditches ● Historic changes ca. 1990 by town on Harvey property reported to have changed flood dynamics at confluence of Tamarac + Hudson Brook	Private Residences ● Conduct detailed HEC-RAS study of Hudson + Tamarac Brook ● Investigate stream reconfiguration ● Create evacuation notification system for anticipated flood events ● Explore options for structure elevation and transfer of HVAC systems to attic ● Public buy-outs for frequently flooded properties as last resort Road + Flood Infrastructure ● Replace or repair culverts on Tamarac Brook and from Pierce farm ditch at Cross Road ● Ensure emergency management plan is in place to maintain Middle Road in all situations ● Assess purpose and impact of backflow preventer. Remove to allow flood diversion if feasible. Fields + Farm Ditches ● Assist farmers in filing all necessary paperwork to allow for ongoing ditch maintenance ● Evaluate restoration opportunities for abandoned ditches ● Explore possibilities for pond creation and public access on unmanaged areas

From L to R: The Tamarac Brook culvert at Cross Road appears to be impeding flow following 2" rainstorm (Lescarbeau). A berm along Hudson Brook provides some flood protection, but would be difficult to build in today's regulatory environment. .

Design Workshop #1 (Sub-task 2.5)

Design Workshop #1 was held at the Community Center on April 11th, 2024; approximately 40 community members attended. The aims of this presentation-style workshop were to build a shared understanding of the challenges and opportunities in the Four Corners area related to stormwater and flooding, accessibility and safety, and recreation.

The presentation included the following:

- Review of the inherent and dynamic influences that contribute to and exacerbate problematic stormwater and flooding issues
- Review of specific challenges and preliminary design directions at each of the Town Sites
- Overview of design and management precedents such as:
    - Flood friendly culverts
    - Retentions/detention ponds
    - Green infrastructure
    - Adaption of flood prone sports fields

Design Workshop #1 was a presentation-style workshop that reviewed the broad ecological and hydrological patterns that contribute to stormwater and flooding challenges in the Four Corners.

Design Workshop #1 gave an overview of several BMPs that were relevant to the Four Corners project.

Design Workshop #2 (Sub-task 2.5)

Design Workshop #2 was held at the Clarksburg Elementary School on May 30th, 2024; approximately 20 community members attended. The aims of this interactive workshop were to discuss, locate, and prioritize solutions for managing water, improving accessibility, and expanding recreational opportunities in the Four Corners, using custom playing cards, maps, and follow-up questionnaires.

A full list of priorities that emerged can be found in the Appendix. The top three priority interventions for each goal category are as follows:

Manage Stormwater + Floodwater

1. Culvert Repair/Improvement
2. Ponds that hold floodwaters
3. Stream Channel Modification

Improve Accessibility + Safety

1. Accessible Trails
2. Wetland Boardwalks
3. Safe Pedestrian Access between the School and Community Center

Improve + Expand Recreational Opportunities

1. Better recreation fields and courts
2. Community Garden/Edible Landscaping
3. Playgrounds

Design Workshop #2 focused on prioritizing and siting interventions for each of the project's goal categories.

'Playing Cards' developed for Design Workshop #2 allowed participants to discuss pros and cons of various interventions and locate where such interventions would be appropriate or desired in the project area.

**See the Site Visits + Community Engagement Appendices for supporting documents*

List of Appendices

All of the linked appendices can be found in this Shared Folder.

Mapping + Analysis

- Analysis Map Set: Four Corners
- Analysis Map Set: Town Sites
- Watershed Land Cover Map
- Summary Analysis Map
- Development Overlay Map/Narrative
- Wetland Scientist Assessment
- Accessibility Assessment
- Historic Aerials

Site Visits + Community Engagement

- Slide Deck DW#1
- Slide Deck DW#2
- Interventions Cards
- Facilitator Guides + Summary Forms
- Priority Interventions