Salvaging the Historical Nature of Nantucket:

Reducing Construction and Demolition Waste

Attic of the house at 6 Gull Island Lane, Nantucket currently being restored by Sarah McLane.

8 December 2021

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An Interactive Qualifying Project Submitted to the Faculty of
WORCESTER POLYTECHNIC INSTITUTE
in partial fulfilment of the requirements of the
Degree of Bachelor of Science

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Abstract

Each year on Nantucket, numerous houses are demolished, or substantially remodeled and valuable building materials are sent to landfills off island. The goal of this project was to evaluate construction and demolition (C&D) waste handling practices on Nantucket to determine ways to limit demolition and reduce C&D waste, while preserving the historical and architectural integrity of the island. We recommend that the Town modify its demolition approvals process and reach out to architects, realtors, and builders to discourage demolition, enable more structure relocations, and encourage deconstruction and reuse of valuable salvage materials. There is a rudimentary, informal market in salvage that needs to be expanded and promoted.

Acknowledgements

Our team would first like to thank our project sponsors, Holly Backus, and Graeme Durovich for helping us throughout the entire project by directing us towards information, relevant individuals on the island, and giving their knowledge on this subject.

We would also like to thank our advisors Dominic Goulding and Fred Looft for helping us through this entire process by providing continuous feedback and assistance.

Additionally, we would like to thank all the people who agreed to be interviewed for helping us get information for our project.

Finally, we would like to thank the Nantucket Yacht Club and Young's Bicycles for giving us a place to stay and providing bikes for us to use to get around the island, respectively. As well as ReMain Nantucket for organizing and funding for a treasure hunt that helped us get to know the island.

Executive Summary

Like many other communities, Nantucket wants to explore policies that promote deconstruction and reuse to reduce the island's C&D waste. The entire island is a historic district, however, and many structures hold significant historical and architectural value. Thus, the solutions will need to accommodate Nantucket's historic preservation requirements and spatial limitations. The Nantucket Historic District Commission (HDC), the Nantucket Historical Commission (NHC), and the Nantucket Preservation Trust (NPT) would like to limit the number of houses being demolished and instead encourage deconstruction and salvage of building materials to maintain the historical integrity of the island. The Nantucket Department of Public Works (DPW) is municipal responsible for waste management on Nantucket and is interested in limiting demolition and promoting deconstruction to reduce the amount of C&D waste that needs to be processed and shipped off island. There are no current requirements on Nantucket for deconstructing houses to salvage building materials, nor is there an established market on the island for buying or selling these building materials.

The goal of this project was to evaluate current C&D waste handling practices on Nantucket to determine ways to improve these practices and limit demolition to reduce C&D waste, while continuing to maintain the historical and architectural integrity of the island. We identified three objectives to address our project goal:

(1) Evaluate current and best practices to limit demolition and encourage house deconstruction and reuse in Massachusetts towns and elsewhere.
(2) Identify the current practices and procedures Nantucket uses to determine which houses and buildings (historic and non-historic) are moved, deconstructed, or demolished.
(3) Evaluate stakeholder perspectives on ways to limit house demolition and encourage deconstruction and reuse on Nantucket.

To achieve this goal, our group conducted interviews with town officials and representatives from organizations involved with building, deconstruction, and demolition policies and practices on Nantucket. We also conducted site visits to Nantucket's waste management site and relevant construction sites.

Findings:

During our interviews in conjunction with background research and conversations with our sponsors, we have the following fundamental findings:

(1) Architects, realtors, and builders play a key role in driving what homeowners and developers do with their properties.
(2) There are currently few disincentives to demolition and remodeling and incentives promoting more sustainable practices.
(3) A rudimentary market in salvaged building materials exists but is informal and under-developed.

Recommendations:

There is no single or simple way to reduce the C&D waste that enters the Nantucket landfill. Currently, there are many homes and building materials lost every year. Additionally, there are limited ways for organizations on Nantucket to control what a homeowner does with materials located in the interiors of their homes. Potential solutions to these problems include increased education, deterrents for demolition, incentives for more sustainable practices, and the creation of a market for materials and homes. We make the following 10 recommendations which will help Nantucket to reduce its C&D waste.

1. **The HDC should work with organizations including the NAREB and the NBA to create educational and outreach materials for realtors, architects, and builders to help encourage the more sustainable deconstruction and demolition practices.**

2. **The HDC and NHC should work with the Massachusetts Historical Commission and others on the island to increase public awareness of the historic tax credits and to guide homeowners through the process of obtaining historic tax credits.**

3. **The HDC should require homeowners to submit a deposit upon receipt of a CoA or building permit that will be returned to the homeowner if the project is completed to the standard required for historic preservation and C&D waste reduction.**

4. **The HDC should create a priority system for CoA review which allows for those using more sustainable practices, such as deconstruction or historic renovation, a quicker approval process.**

5. **The Town via Town Meeting amendment, in consultation with the HDC, should amend the demolition delay bylaw to increase the time a homeowner is required to advertise, the method by which an advertisement is implemented, and allow for a homeowner to move a home before it can be approved for a demolition.**

6. **The DPW should facilitate the creation of a physical marketplace for salvaged building materials.**

7. **Additionally, the DPW should facilitate the creation of an online marketplace for salvaged building materials.**

8. **The Town Administration with assistance from the HDC should create an online resource where houses that are going to be demolished can/need to be listed so the public can view what homes are on the market to be moved.**

9. **The pertinent Town entities (including PLUS and HDC) should modify ground cover policies to allow for temporary staging of homes.**

10. **The DPW should work with other organizations in the town to identify and allocate land that allows for temporary staging of homes while their new site is being prepared.**

Future Research:

This project has shown that there is still a substantial amount of work to be to reduce C&D waste. We identify the following six research areas for future research:

1. **Create educational programs and materials for builders, realtors, and architects to promote relocation, deconstruction, and salvage.**

2. **Develop a guide to teach homeowners about the history of Nantucket's homes and the importance of preserving the island's historical integrity.**

3. **Analyze the island's transportation routes for structure relocations.**
4. **Create virtual marketplaces for homes to be relocated and salvaged materials and evaluate their effectiveness.**
5. **Evaluate the effectiveness of Nantucket's demolition delay law.**
6. **Examine the role of Nantucket's waste contractors in the reduction of C&D waste.**

Authorship

Section	Writer	Editor	Editor	Editor
Abstract	JM	AC	AV	HO
Acknowledgements	JM	AC		
Executive Summary	JM	AC		
Authorship	All	All		
1. Introduction	AC	HO	JM	AV
2. U.S. C&D Waste Statistics	JM	HO	AC	AV
3. U.S. C&D Waste Reduction Efforts	JM	HO	AC	AV
4. C&D Waste on Nantucket	AC	HO	JM	AV
5. Nantucket House Demolition, Renovation, and Removal Data	AV	HO	AC	JM
6. Evaluation of Stakeholder Perspectives	AC	HO	AV	JM
7. Conclusions and Recommendations	AC	JM	HO	AV
8. Future Research	JM	AC	HO	AV
References	All	All		
Appendices	All	All		

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1. Introduction

Waste from construction and demolition (C&D) going into landfills is a concern on both the national and local scale; McMarthy (2018, as cited in Rypkema et al., 2021) estimates less than 1% of C&D waste is currently reused. Many communities in the United States (such as San Antonio, Texas; Portland, Oregon; Seattle, Washington; and Newton, Massachusetts) are implementing policies to reduce C&D waste by limiting demolition and encouraging deconstruction, reuse, and recycling of buildings and building materials. These policies promote sustainable practices while simultaneously aiding the preservation of local historic integrity. There are also many communities that have growing markets for salvaged materials, such as doors, windows, and flooring.

Like many other communities, Nantucket wants to explore policies that promote deconstruction and reuse to reduce the island's C&D waste. The entire island is a historic district, however, and many structures hold significant historical and architectural value. Thus, the solutions will need to accommodate Nantucket's historic preservation requirements and spatial limitations. The Nantucket Historic District Commission (HDC), the Nantucket Historical Commission (NHC), and the Nantucket Preservation Trust (NPT) would like to limit the number of houses being demolished and instead encourage deconstruction and salvage of building materials to maintain the historical integrity of the island. The Nantucket Department of Public Works (DPW) is responsible for municipal waste management on Nantucket and is interested in limiting demolition and promoting deconstruction to reduce the amount of C&D waste that needs to be processed and shipped off island. There are no current requirements on Nantucket for deconstructing houses to salvage building materials, nor is there an established market on the island for buying or selling these building materials.

The goal of this project was to evaluate current C&D waste handling practices on Nantucket to determine ways to improve these practices and limit demolition to reduce C&D waste, while continuing to maintain the historical and architectural integrity of the island. We identified three objectives to address our project goal:

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(6) Evaluate stakeholder perspectives on ways to limit house demolition and encourage deconstruction and reuse on Nantucket.

To achieve these objectives, our group conducted interviews with town officials and representatives from organizations involved with building, deconstruction, and demolition policies and practices on Nantucket. We also conducted site visits to Nantucket's landfill and relevant construction sites. Based on our findings, we developed a GIS data layer on house demolitions and recommendations for potential actions the HDC, DPW, and others can pursue to minimize C&D waste generation and promote building salvage and reuse instead.

2. U.S. C&D Waste Statistics

According to an Environmental Protection Agency (EPA) fact sheet, the United States produced around 600 million tons of C&D waste in 2018, more than twice the amount of municipal solid waste generated that year. The fact sheet claims that over 90% of C&D waste is generated from demolition, while under 10% is generated from construction (Environmental Protection Agency [EPA], n.d.). As shown in Figure 1, 68% of C&D waste is made up of concrete, and a further 18% is from asphalt concrete (U.S. Environmental Protection Agency, 2020). The remaining 15% of waste is made up of other materials, including wood products, asphalt shingles, drywall and plasters, bricks and clay tiles, and steel. Roads and bridges account for 46% of the C&D waste, although approximately 30% of all C&D waste comes from buildings (Table 1). These percentages were computed by either

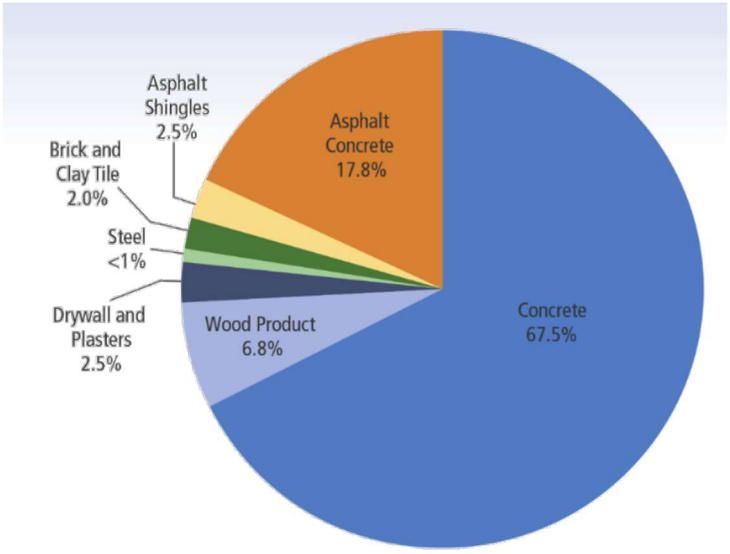

Figure 1 - Overall composition of C&D waste in the United States by weight (U.S. Environmental Protection Agency, 2020).

Given the time, effort, emissions, boat space, and expense of processing C&D waste and shipping it off island, the Nantucket DPW is exploring ways to reduce this part of the waste stream. In the upcoming sections, we will explore the national issue of C&D waste and provide insight into the C&D waste reduction efforts of San Antonio, Texas, Portland, Oregon, Seattle, Washington, and Connecticut.

Table 1 - C&D waste in the U.S. by source in millions of tons (U.S. Environmental Protection Agency, 2020).

	Buildings	Roads and Bridges	Other
Concrete	102.0	168.3	134.9
Wood Products[7]	39.5	0.0	1.3
Drywall and Plasters	15.2	0.0	0.0
Steel[8]	4.7	0.0	0.0
Brick and Clay Tile	12.3	0.0	0.0
Asphalt Shingles	15.1	0.0	0.0
Asphalt Concrete	0.0	107.0	0.0
Total	**188.8**	**275.3**	**136.2**

3. U.S. C&D Waste Reduction Efforts

Over the past 15 to 20 years, sales volume of reclaimed lumber in the U.S. has been increasing at a rapid rate (see Figure 2). This market is expected to continue growing over the next several years (see Figure 3). This growth is expected to be at a rate faster than the U.S. economy. This means that the demand is there for salvaged building materials, specifically lumber, and the market will increase in the future.

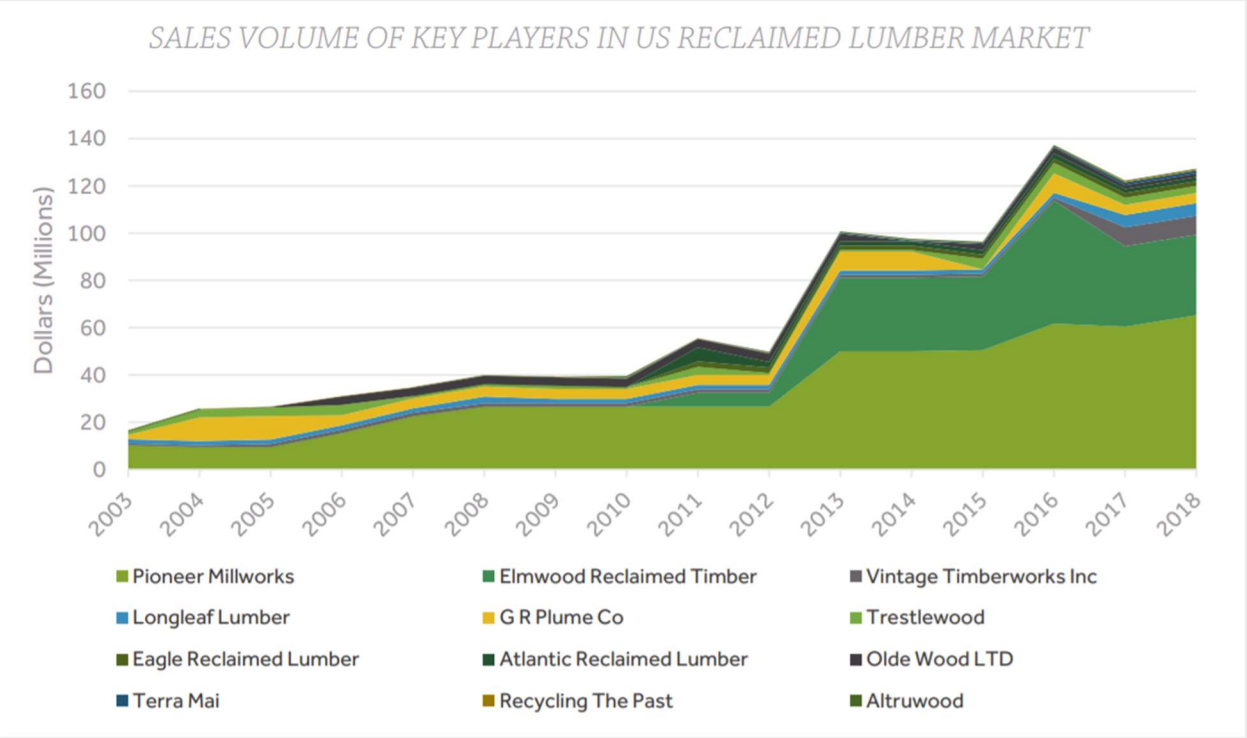

Figure 2 - Volume of sales per year in the US Reclaimed Lumber Market (*St. Louis Deconstruction Market Assessment,* 2019, 8).

As described in Rypkema et al. (2021), the demand for reclaimed building materials is typically local. Generally, homeowners near the sites creating these materials are the ones buying the materials. With reference to efforts in San Antonio, Rypkema et al. assume that "resale on site would allow for nearby property owners" to obtain materials like those they already have (Rypkema et al., 2021, 14). Members of San Antonio's Historic Districts, Neighborhood Conservation Districts, and communities with older housing stock claim that these older materials are of higher quality and are irreplaceable.

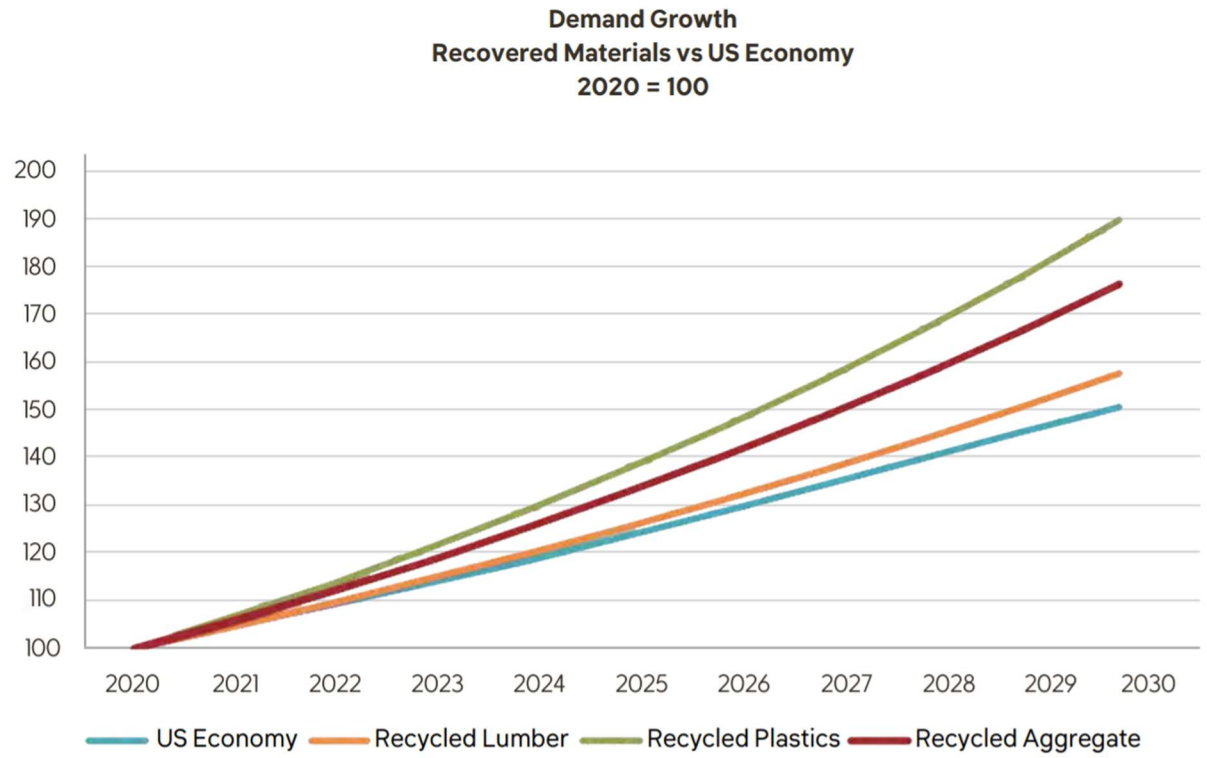

Figure 3 - Growth of demand for reclaimed materials compared to the US Economy (Rypkema et al., 2021, 14).

Lumber is not the only building material that can be salvaged. Table 2 shows several types of materials that can be recycled or reused, and examples of what would produce these types of materials. While not all materials can be directly reused, all can be recycled which is still accomplishing the goal of preventing waste from going into a landfill. Not all materials are of equal demand for reuse. “Wood, steel-stained glass, concrete, and architectural details and finishes” have a higher demand (Rypkema et al., 2021, 13). Other objects including doors are commonly reused, and windows can commonly be restored and used in a new project.

Table 2 - Types of materials and their viability for reuse and recycling (Rypkema et al., 2021, 12).

Material Type	Examples	Reuse	Recycling
Appliances	Fridges, stoves, washers, dryers	✓	✓
Architectural details	Columns, fireplaces mantels, mouldings	✓	✓
Bricks/blocks	Clay bricks, concrete precast, aerated blocks, stone blocks	✓	✓
Carpet	Carpet, carpet underlap	✗	✓
Concrete/Asphalt/Aggregates	Structural concrete, cinderblocks, asphalt pavement, washout from mixer trucks	✓	✓
Drywall	New gypsum wallboard off-cuts, asbestos-free used gypsum wallboard	✗	✓
Electrical equipment	Circuit breakers, breaker boxes, switches	✓	✓
Finished goods	Doors, windows, cabinets, countertops	✓	✓
Gates and railings	Security gates, decorative gates, handrails	✓	✓
Glass	Windows, structural glass, mirrors	✓	✓
Heating/cooling	HVAC ducts, AC units, furnaces	✓	✓
Lighting	Light fixtures, tracks	✓	✓
Metals	Piping, aluminum siding, banding, wire, cable, rebar, frames, metal shelves & cabinets	✓	✓
Wood	Forming lumber, dimensional lumber, painted wood, pallets, flooring	✓	✓
Paper	Cardboard, office paper, newspaper	✓	✓
Plastics	Pails & containers, plastic film, pipes	✗	✓
Plumbing	Sinks, faucets, tubs, shower stalls, fixtures	✓	✓
Land clearing debris	Stumps, branches, yard waste	✓	✓
Existing vegetation	Shrubs, small trees, plants, sod	✓	✓

Rypkema et al. (2021) emphasize that it is important to have a marketplace for salvaged materials to have a successful deconstruction program. The survey conducted by Rypkema et al (2021) revealed that deconstruction programs in cities are often a mix of private, non-profit, and government entities, although in a plurality of cases the deconstruction programs are run by private companies. In contrast, Rypkema et al., (2021) found that among cities with established markets non-profit entities commonly run the operations (see Figure 4).

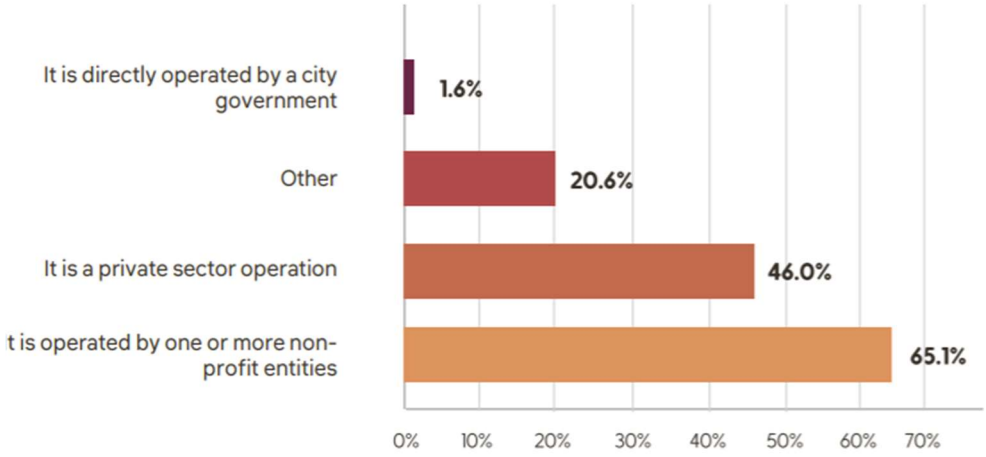

Figure 4 - Percentages of cities with markets for the resale of salvaged materials (Rypkema et al., 2021, 82).

Regarding local government involvement in deconstruction programs, Rypkema et al. found that 35% of cities are not involved in the deconstruction process and 34% of cities encourage but do not require deconstruction (see Figure 5). Almost 25% of cities in the survey, however, have regulations regarding deconstruction and many cities provide incentives, subsidize their programs, and otherwise fund deconstruction activities. Only 2.9% of cities run a deconstruction program.

Rypkema et al. (2021) present several recommendations to promote environmentally friendly building disposal practices. One suggestion is to provide deconstruction grants to encourage companies towards a path of deconstruction instead of demolition. Rypkema et al. (2021, p. 59) cite an example from Hennepin County, Minnesota, where a similar program offered "grants of up to $5,000 for the deconstruction of residential buildings." This program helped raise awareness about deconstruction while simultaneously offsetting the cost of deconstruction as opposed to demolition. Another recommendation is to increase the "demolition permit fee" (Rypkema et al., 2021, 59). Doing this would disincentivize demolition and promote deconstruction. In San Antonio, the current deconstruction fee for residential properties is $75. Increasing this fee to approximately "$5,000 to $10,000" will push companies towards deconstruction.

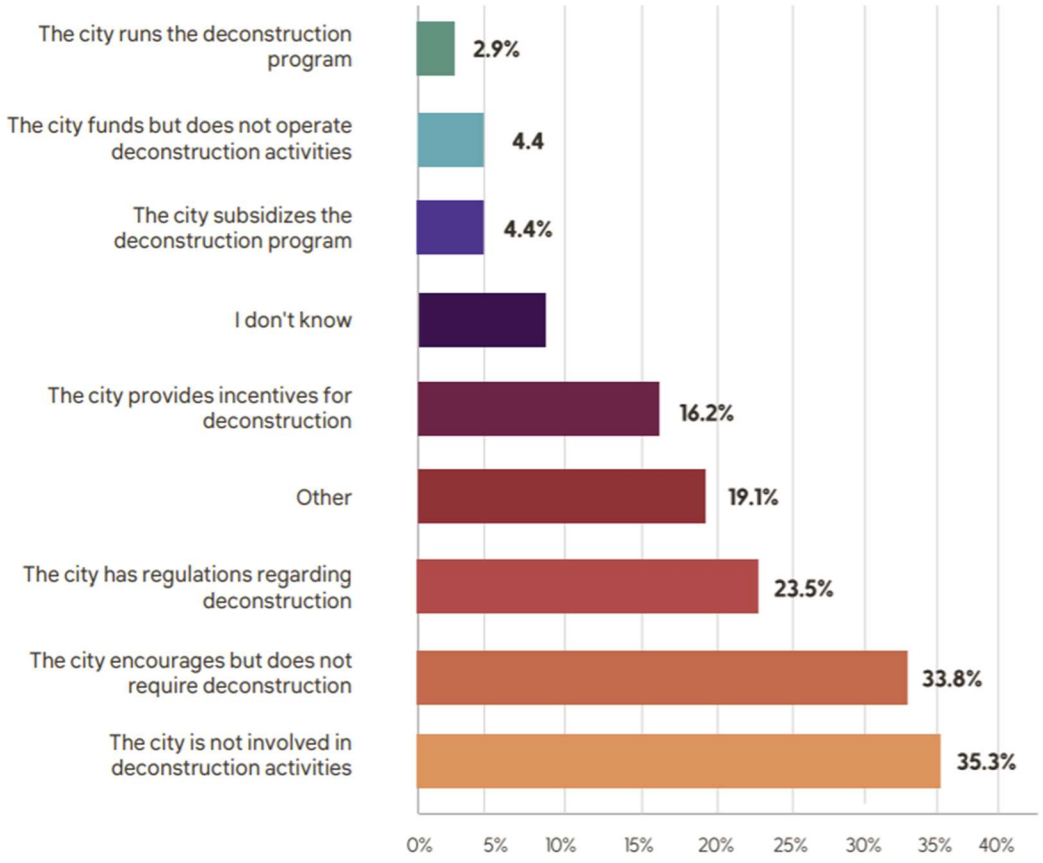

Figure 5 - Local governments involvement in deconstruction in various cities (Rypkema et al., 2021, 83).

3.1. San Antonio, TX

"As the 7th largest city in the U.S., [San Antonio] is seen as a leader in many respects" such as climate change readiness, celebrating and safeguarding living heritage, and waste management (Rypkema et al. 2021, 5). Due to the rapid growth of the city, San Antonio is also struggling in some areas, such as affordable housing. Transforming the handling of waste in the city is seen as one way to tackle different aspects of each of these seemingly different issues. For example, in the current linear system, an item is manufactured, used in a structure, then thrown in a landfill. This waste scheme has sent approximately $1.4 million worth of salvageable materials to landfills since 2009 (Rypkema et al. 2021, 1). Not only does this result in unnecessary carbon emissions, but it also destroys valuable historic materials. Additionally, the demolitions completed in 2020 could have provided structural framing materials for more than 600 1,500 square foot homes which would help alleviate the affordable housing problem.

San Antonio has begun developing an ordinance to discourage demolition and thereby encourage deconstruction and reuse (Rypkema et al., 2021, 27). This ordinance was created because "[San Antonio] and residents have placed a high priority on diverting materials from landfills" (Rypkema et al., 2021, 27). Additionally, current policies incentivize tearing down structures and building new have harmed the supply of affordable homes (Rypkema et al., 2021, 27). The ordinance will be released in three phases (see Figure 6). These phases would require deconstruction of structures that fall into each individual category. Each phase will affect an increasing number of homes, preventing a large amount of material from ending up in the landfill. In addition, the new ordinance will help to create more affordable housing, since "rehabilitation is usually the most cost-effective way to achieve affordable housing goals" (Rypkema et al., 2021, 61). This ordinance provides an alternative to deconstruction, like the practice of picking up and moving houses.

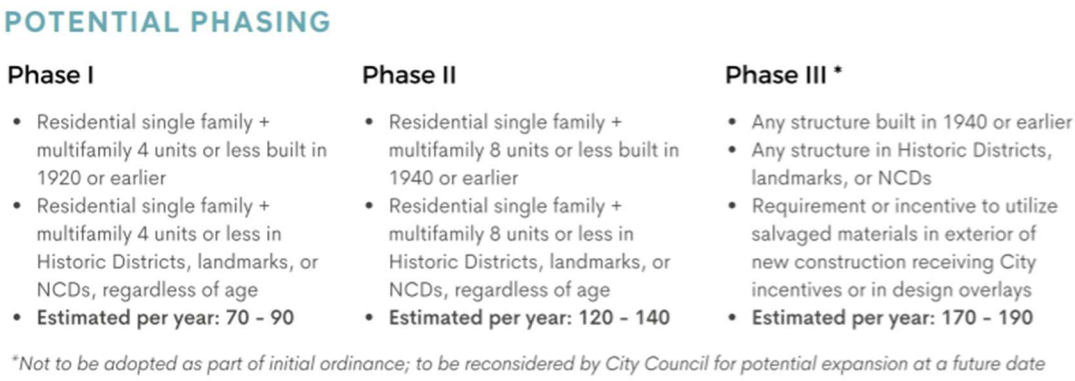

Figure 6 - Phases of the deconstruction ordinance drafted for San Antonio, Texas (Rypkema et al., 2021, 28).

3.2. Portland, OR

In 2016, "neighborhood organizations tired of 'crunch-and-dump' demolition" developed the nation's first deconstruction ordinance in Portland, Oregon (Christiana, 2021). This ordinance made 'piece-by-piece dismantling' required for all demolition-bound houses built prior to 1916. The program was considered successful and recently expanded to include all houses built before 1940 (Rypkema et al., 2021, 20). This ordinance has led to the deconstruction of more than 300 homes as of June 2021 (Christiana, 2021). Two of the main restrictions put in place by the ordinance are the prohibition of "heavy machinery for structural demolition" and the

requirement that city-certified deconstruction contractors work on a project (Christiana, 2021). In addition, the city ordinance requires that contractors submit receipts proving the "donation, sale, or proper recycling and disposal of all materials" (Christiana, 2021).

3.3. Seattle, WA

Another community which introduced legislation that encourages deconstruction is Seattle, Washington. The city has created a permit specifically for clients who plan to deconstruct at least a portion of their structures. Specifically, structures must "reuse a minimum of 20 percent of the building materials, by weight and excluding asphalt, brick and concrete" (Seattle Department of Construction & Inspections, n.d.). In addition, a minimum of 50 percent of non-ABC and 100% of ABC waste must be recycled or reused. To incentivize the use of these permits, Seattle allows consumers to begin the deconstruction process prior to receiving a new building permit (Seattle Department of Construction & Inspections, n.d.).

3.4. Massachusetts

While there is no statewide legislation regarding deconstruction in Massachusetts, several companies have completed projects deconstructing homes. Additionally, several communities have demolition delay programs which help to control which homes are being demolished (see Figure 7).

There are several companies that have completed deconstruction and salvage projects. In mid-2015, Hawthorn Builders completed its second deconstruction project in Needham. The builders were able to salvage between 70% and 90% of the material generated from this project. The process to complete this deconstruction began with a "soft strip," where items including "cabinetry, lighting, vanities appliances, interior doors, hardware, and other fixtures that do not impact the actual structure of the home" were removed (*Deconstruction part Two* 2015). A local ReStore sold the appliances salvaged from the soft strip, which led to some items being claimed within twenty-four hours.

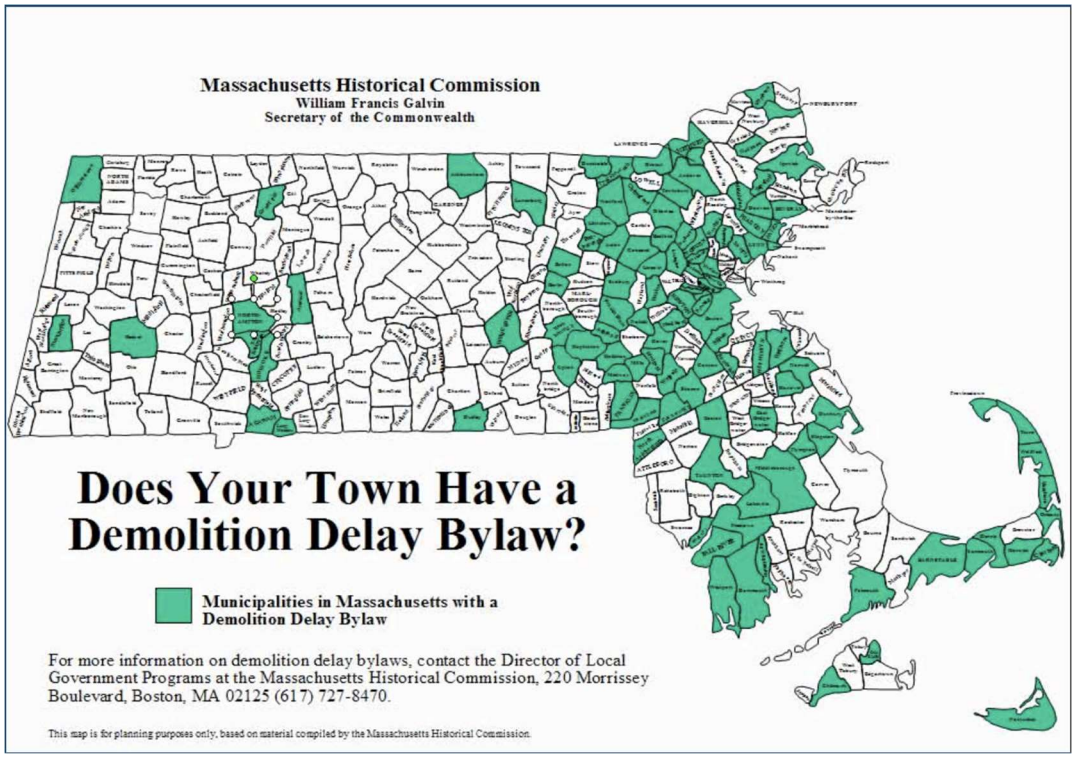

Figure 7 - Map of Massachusetts towns with demo delay bylaws (*Demolition Delay Bylaws and Ordinances in Massachusetts n.d.)*.

The moving company, Piece by Piece, sent a crew of 3-5 people to complete the deconstruction (*Deconstruction part Two* 2015). This crew removed siding, strapping, wood flooring, and lumber. Piece by Piece estimated that the lumber filled two dumpsters and salvaged approximately 1,500 square feet of flooring. Not every item that could have been salvaged was suitable for resale: windows must have been recently installed, and framing material must have shown no signs of pest damage.

This project identified several advantages and limitations for full deconstruction and soft stripping. Full deconstruction is most efficient when the entire home is to be removed, as it just leaves the foundation, brick, and stone components on the property. This process can work at a rate of up to 400 square feet of house per week with the crew of three to five mentioned above. The best candidates for this method of deconstruction are structures created between 1940 and 1980 (*Deconstruction part Two* 2015). Homes created prior to 1850 are also candidates if they contain valuable wood. Even though ReStore does accept this type of lumber, it does tend to sell at a slower rate than other types. Performing a soft strip is best when there is insufficient time for a full deconstruction, or when the framing of the house is not worth the extra time it would take

to deconstruct. The goal is to obtain the highest return for salvaged items. For this specific project, a nearby ReStore sold most items. For both deconstruction methods, Hawthorn Builders recommends that clients hire an appraiser to determine the value of materials they can salvage from their structure. Appraisals can typically cost between $1,000 and $4,000, which will likely be covered by the sale of recovered materials (*Deconstruction part Two* 2015).

Selling or donating materials received from deconstruction can help recover substantial value that would otherwise be lost. Estimates show that full deconstruction can recover materials valued between $30,000 and $100,000 (*Deconstruction part Two* 2015). Soft strips can generate materials valued at $15,000 and $50,000. RecycleWorksMA presents two case studies on homes that were fully deconstructed, where the homeowners were able to claim approximately $50,000 in tax deductions from donating the materials from deconstruction. In both cases, deconstruction allows for substantial value to be gained.

First adopted in 1985, the demolition delay ordinance created in Newton, Massachusetts' extends the period required before a structure was able to be demolished. The primary goal of the ordinance was to prevent the loss of historic buildings and resources in the city. The main restriction imposed by the ordinance applies to buildings listed or eligible to be listed on the National Register. Specifically, these buildings are subject to an 18-month delay. For structures which are preferably preserved, the delay is twelve months (Fram, 2015). A benefit of the longer demolition delay is an increase in the amount of time for the structure's historical relevance to be determined. Additionally, the longer delay allows for an increased amount of community input on how a structure contributes to the town, which is then used to evaluate its historical significance. Finally, the slower process allows for more time to explore alternatives to demolition. While Newton's ordinance has been successful in some respects, there are improvements that can be made. First, the current iteration of the legislation only allots 15 days for the committee to determine if the structure is historically significant (Fram, 2015). Additionally, if the committee has previously determined that a structure is not historically relevant, the policy allows the owner of the structure to bypass the delay process.

3.5. Habitat for Humanity

Many local Habitat for Humanity organizations operate ReStores, that accept donations of resalable C&D material usable in the construction or renovation of homes (Habitat for Humanity ReStores, n.d.). Five Habitat for Humanity volunteers in Winnipeg, Manitoba, created the first ReStore in 1991. There are now approximately 1,000 ReStores spanning six countries. These stores commonly accept "kitchen cabinets, doors and windows, flooring, unused limber, lighting fixtures, fencing, and bricks/blocks" (Habitat for Humanity ReStores, n.d.). Sales of these materials help to fund local Habitat for Humanity projects.

On Nantucket, Habitat for Humanity "seeks to make decent, affordable shelter...for all people" (Salt Air Designs LLC, n.d). The chapter "[advocates] for fair and just housing policies," constructs new homes, and provides resources for families to "improve their shelter conditions" (Salt Air Designs LLC, n.d). Monetary donations fund Habitat for Humanity of Nantucket, as do donations of land, professional service, and material. This chapter of Habitat for Humanity began in 2001 and has built a total of eleven homes to date. Each home has a restriction on its deed that makes it affordable and maintains its affordability upon resale.[1]

[1] We were unable to speak to Habitat for Humanity of Nantucket during our time on the island.

4. C&D Waste on Nantucket

In this section, we provide an overview of how C&D waste is handled on Nantucket and discuss Nantucket's current C&D waste data. In section 5, we review the processes that impact the generation of C&D waste, including house demolition, renovation/restoration, and deconstruction.

The DPW is responsible for the maintenance of Nantucket's infrastructure, facilities, and associated services, including the operation of the landfill (Appendix A). Nantucket's situation is unique in that it is an island with limited landfill capacity, meaning a substantial amount of waste must be shipped off the island to be recycled or landfilled elsewhere. To reduce the volume of landfilled material, Nantucket established a Solid Waste and Recycling Program in 1996, which mandates that Nantucket residents and visitors recycle (Solid Waste & Recycling, 2019). As shown in Figure 8, in 2020 recyclables including metals, plastic, shipping boxes, electronics, mattresses, and tires composed 4% of the waste stream, compostable materials composed 51%, reused materials (or beneficial use materials) including asphalt, brick, concrete, glass, and mixed excavation waste composed 27%, and the remaining 18% was landfilled off-island. C&D waste comprised most of the waste landfilled off-island, totaling over 9000 tons.

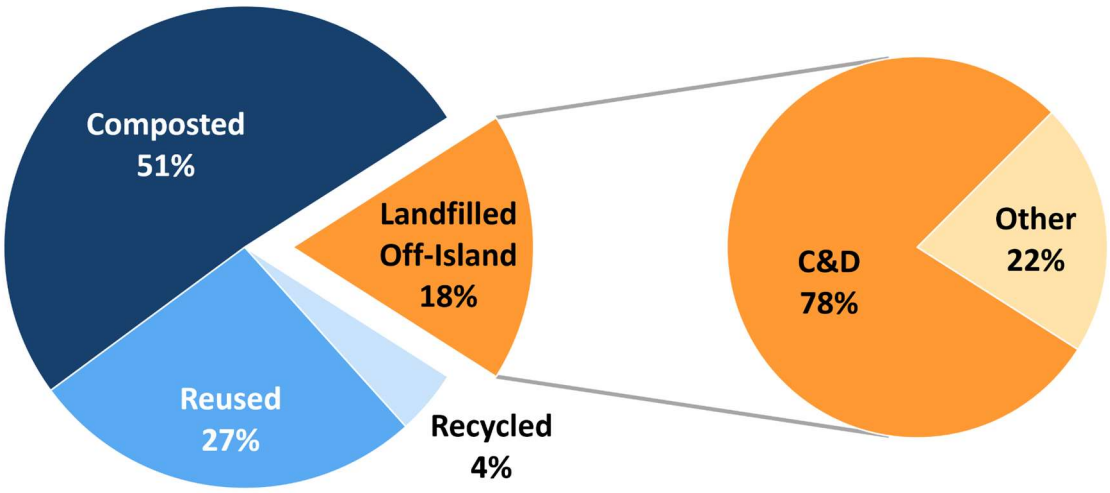

Figure 8 - Nantucket waste management system data summary as of 2020 (Adapted from *Where is away when you throw it away?* 2020, and *Waste streams,* 2020).

Massachusetts waste disposal regulations and the landfill's operating permit limit the capacity and use of the Nantucket landfill; the only materials the landfill can accept are plastics

and other non-compostable waste that the composter filters out. The one exception to this restriction is glass, which is crushed and used as a required daily cover for the landfill. The Town's waste management vendor, Waste Options, composts all leaf and yard waste; mulches brush and clean wood waste; crushes asphalt, brick, and concrete (ABC) to use as aggregate; and uses mixed excavation waste (MEW) for grading and shaping. As part of the C&D waste handling process, Waste Options separates 'clean wood' and scrap metal from the C&D waste stream and recycles it. Any C&D waste materials that Waste Options cannot recycle go to the mainland. Other wastes shipped to the mainland include baled recyclables from the Materials Recovery Facility (MRF), appliances, scrap metal, e-waste, mattresses, tires, and source separated Non-Recyclable, Non-Compostable waste (NRNC) (*Existing & Emerging Waste Management Technologies*, 2019).

We used data taken from the DPW to calculate the amount of C&D waste that is shipped off-island each year. From 2003-2020, the average annual C&D waste output was 9,800 tons with a standard error of 2000, or 20%. Overall, C&D debris composed 22% of all waste produced on island and 78% of material shipped to mainland dumps. Figure 9 displays the raw data we incorporated into our calculations. This data does not include waste from private waste facilities located on Nantucket, so these numbers are likely higher.

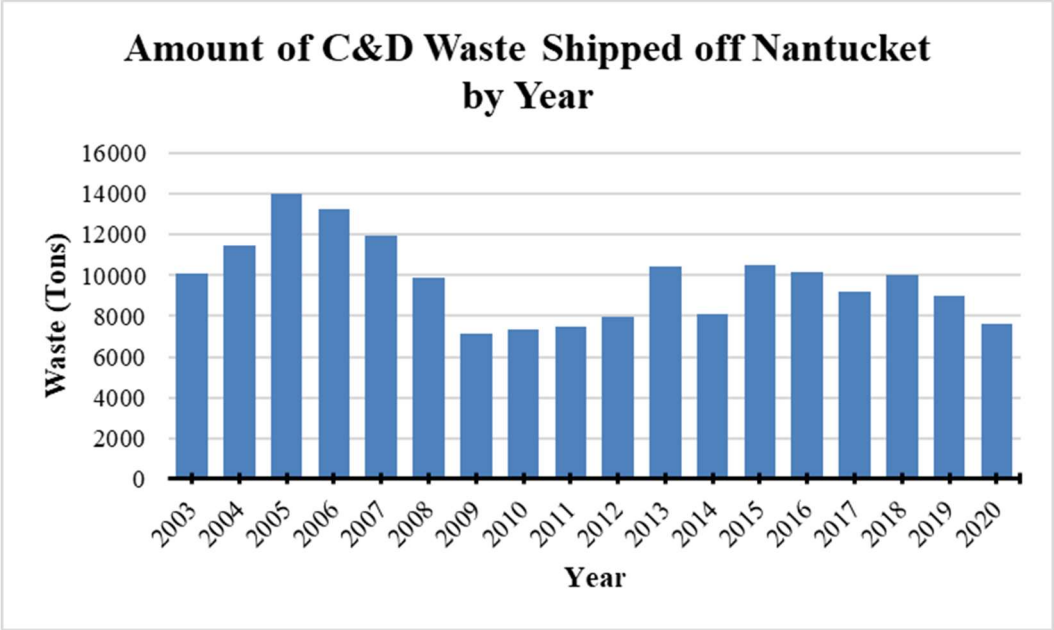

Figure 9 - The amount of Nantucket C&D waste shipped to mainland landfills annually from 2003 to 2020 (*Where is away when you throw it away?* 2020)

5. Nantucket House Demolition, Renovation, and Removal

The NHC, HDC, and Housing Nantucket, are interested in reducing demolitions, especially of historical and contributing structures[2] on the island. However, these organizations have different perspectives on the problem than the DPW. Housing Nantucket works to provide affordable housing on the island by moving donated houses to new locations and renting the homes at affordable prices to year-round islanders. The more houses Housing Nantucket can move, the less waste will be generated from house demolitions on the island. The primary goal of the HDC is to maintain the integrity of the historic district and the island's historic atmosphere. The HDC oversees accepting, processing, and approving (or rejecting) Certificates of Appropriateness (CoAs), which are required to be submitted for any proposed construction, including all renovation, relocation, deconstruction, and demolition.

The HDC keeps a record of all demolitions and other construction projects that occur on-island; building project information from 2016 to 2021 is displayed in Table 3. In this six-year period, there were 690 new structures built, not including 279 extra dwellings (second dwellings, tertiary dwellings, and multi-family dwellings) and 3,470 other waste-producing projects (garages, sheds, and assorted hardscaping). Within this time, 442 total and partial demolitions took place, while 71 houses underwent historical renovations and 154 were relocated to new land.

[2] For a building to be considered historically significant, the structure must add to the historical context of its location.

Table 3 - HDC statistics for housing alterations across a six-year period (Adapted from *HDC monthly data*, 2021).

	2016	2017	2018	2019	2020	2021	2016-Present
New Dwellings	131	127	115	123	98	96	**690**
Revisions	380	568	425	466	317	223	**2379**
2nd Dwellings	45	45	39	24	33	29	**215**
Tertiary Dwelling	2	3	1	2	1	1	**10**
Multi-Family Dwelling	1	7	26	7	1	12	**54**
Demo/Move Off	99	159	101	76	99	62	**596**
Move On	29	39	26	16	21	23	**154**
Mixed-use building	9	5	10	8	3	7	**42**
Garage	58	67	55	71	39	48	**338**
Shed	100	98	110	104	91	90	**593**
Hardscaping	482	413	499	397	390	316	**2497**

We used ArcGIS to display and analyze tax parcels on Nantucket. ArcGIS is a web application that can display different sets - or "layers" - of location-based data on a single map. Users can upload spreadsheets of information that the application then parses and places as markers on the map. Different data fields can be filtered so that the map displays information only from a target location or that fits a specific attribute. Our GIS layer uses a spreadsheet of Nantucket tax parcels we received from Nantucket's GIS Coordinator, Nathan Porter, and a file log of HDC permit data from Holly Backus, Preservation Planner. We developed a complete listing of all HDC-regulated demolitions, relocations, and major additions for the years 2019-2021 by inserting data from HDC permits into their associated parcels. The map we generated from this composite spreadsheet displays all listed tax parcels, and we can apply filters to sort through any HDC-approved projects in the last three years.

The data layer displays 125 total and partial demolitions, 141 relocations with 48 off-site, and 8 additions that have occurred over the last three years. Although the relocations and additions were approximately uniformly spread across the island, there was a high concentration of demolitions in the Nantucket downtown historic district. An example of our GIS map is shown in Figure 10.

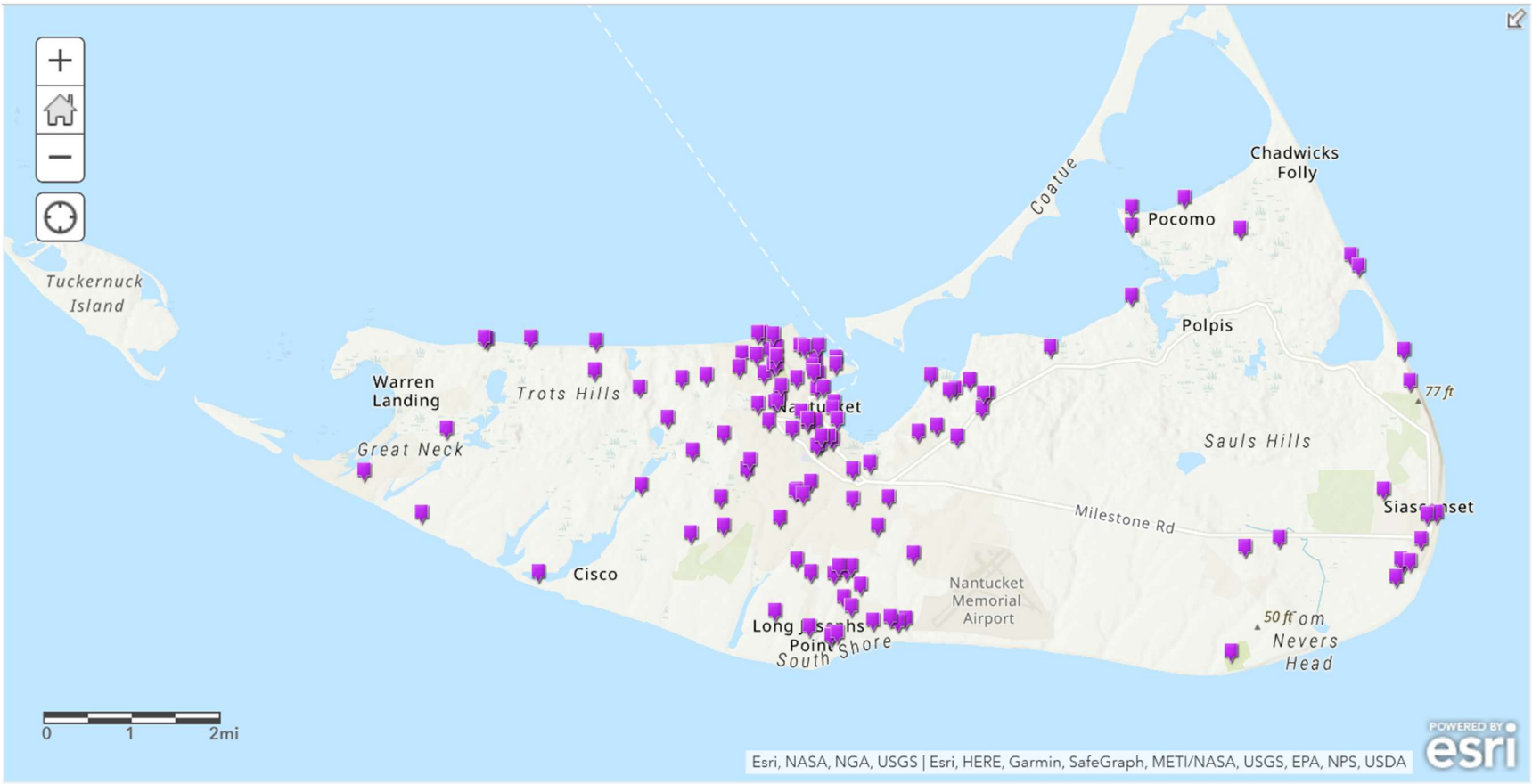

Figure 10 - ArcGIS map displaying demolitions on Nantucket between 2018 and 2021.

5.1. Demolition Processes on Nantucket

To obtain approval to demolish a building on Nantucket, the party who wishes to demolish the structure must submit an application to the HDC. The Commission then goes through their required process for demolition approval. The first part of this process requires the exploration of all reasonable alternatives to demolition of a structure prior to the approval of any CoA. One alternative for demolition involves moving the structure to a new location. Additionally, buildings that are under this approval process undergo a "stay of execution" of at least 60 days prior to a public hearing, however this is just customary and there is no enforcement of this guideline (Lang & Stout, 1995). During this time, the Commission weighs public interest in the building to determine whether demolition would be an appropriate course of action. Additionally, the individual filing for demolition must provide documentation for the structure, including black and white photos of the structure, drawings of the as-built structure with measurements, and proof of construction date. There are four categories that a structure can fall under: protected, significant, non-contributing, or contributing. A protected structure is one that is in the public interest to preserve, and the Commission will not approve its demolition unless it is an insignificant or non-contributing structure. Any building associated with a historic figure/event or that has an important architectural history is one the Nantucket HDC deems as a significant structure. The final categorization of a structure is either contributing or non-contributing structure. A building that does not add to the historic nature of the district and does not intrude on the region's historical context is a non-contributing structure. Conversely, for a structure to be contributing, the building must add to the historical context of its location. The HDC rarely approves the demolition of contributing structures unless the structure is a public safety hazard (Lang & Stout, 1995).

5.2. Renovation/Restoration Processes on Nantucket

Renovating a structure to fit an owner's new preferences is a popular alternative to demolition, which can be seen with HDC data collected since 2016. As seen in Table 3, in the last six years, the number of renovations on Nantucket totaled 2,379, which is just over 20% of all housing related operations. Most construction projects since 2016 involved changes to

already-existing residential structures (see Table 3). Another 279 of those projects were centered on building additional, smaller dwellings on occupied property (*HDC monthly data*, 2021).

For historic buildings, the HDC outlines four primary methods available for renovation (see Figure 11). These are not sequential steps applied to a building but are instead different approaches that attempt to preserve a historic structure, although more than one method can be applied to any construction project. These methods also apply only to the exterior of the house, as the HDC has no jurisdiction over changes an owner makes on the interior. One option is engaging in "preservation" to ensure that all intact features of the building are secure; this process may include stabilization and original feature maintenance, essentially protecting what is already there. Another method is "restoration," which rebuilds or removes damages from after the structure was originally built. An additional option is using "reconstruction" to rebuild previously demolished structures; this not only returns the structure to a state that retains its historical components, but it also allows the architects involved to re-envision and reproduce additional structures lost to time. Reconstruction and restoration exhibit much overlap. The last method the HDC employs is "rehabilitation," which restores usability and represents the final transition into becoming a contributing structure; this use may differ from that of the building originally, and the structure may be renovated for modern housing restrictions (Lang & Stout, 1995).

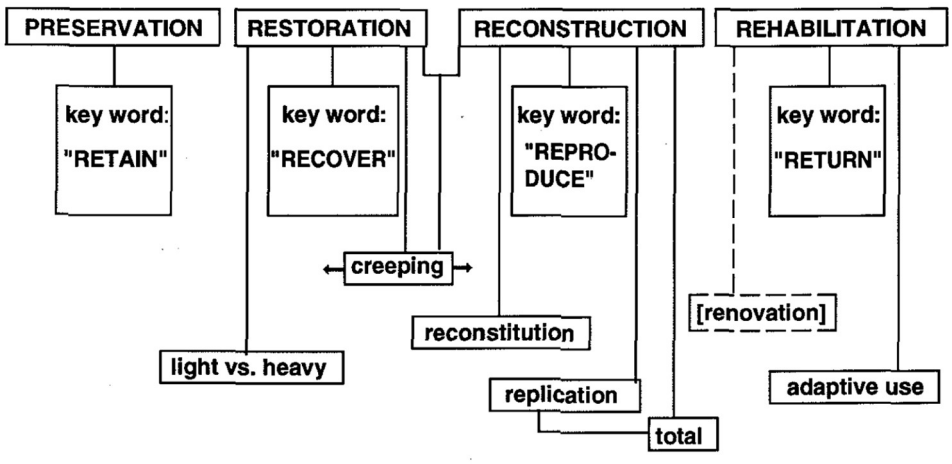

Figure 11 - The HDC's Four Categories for Historic Preservation (Lang & Stout, 1995).

A house built in the late 1700s at Nantucket's 6 Gull Island Lane is currently undergoing a historic restoration project by its homeowner, Sarah McLane. After a previous owner allowed further deterioration in the hopes of receiving HDC approval for a "demo by neglect," McLane purchased the home with the intent of restoring the building. To accomplish this, McLane is restoring and minimally modifying the home while maintaining its historic feel and many of the historic elements of the structure. The restored home will serve as a livable and income producing rental property. McLane is taking special care to keep major elements like windows with historic wavy glass intact by restoring as many of the original windows, that date back to the 1800s, as possible. Along with windows, McLane is using as much reclaimed material as possible to keep the historic integrity of the house intact while simultaneously reducing the waste being sent to the landfill from this restoration project.

5.3. Relocation Processes on Nantucket

Nantucket residents have been relocating structures throughout its history. Historic structures were often moved to preserve their architecture, especially certain design techniques that could not be replicated in a rebuilding process as well as to preserve rare and expensive materials that were used in their construction. For older projects, the high quality of the building's material composition and the high expenses of hiring workers made relocation preferable to demolition when feasible (Gilmore, 2016). The Old North Vestry, part of a chapel built in 1725, was moved from Old Sherburne to Centre Street after forty years. The 1829 Dreamland Theater was moved not once, but twice; after its initial migration from Main Street to Brant Point in 1883, it was brought across open water to its final location on Water Street in 1905 (*Infamous buildings on Nantucket,* 2021).

Currently, structure relocation on Nantucket is not as popular as demolition. Housing Nantucket and other organizations on the island use the relocation process for houses that are donated to them with the specific purpose of creating affordable housing. One reason Nantucketers do not always elect to move a building is because parts of a building may need to be removed and reconstructed. Depending on the original location and the destination of a structure up for relocation there are additional challenges for the owner that can make the project financially unfeasible. These challenges include finding a transportation route for the structure

that avoids rotaries, narrow roads, and low hanging power lines. Fixing these problems is sometimes possible but requires homeowners to take more time and spend more money.

6. Evaluation of Stakeholder Perspectives

We conducted sixteen interviews to gather the opinions of a variety of stakeholders (see Appendix C). During these interviews, we gathered information about the island's policies and customs around construction, demolition, relocations, and deconstructions. We solicited the perspectives and opinions of the individuals our recommendations would affect most. From these interviews, we compiled opinions on three major categories: the knowledge and awareness of architects, realtors, and builders; incentives for demolition alternatives; and potential for a salvaged building materials market. We found that realtors, architects, and builders play a key role in determining whether a building is demolished, deconstructed, or moved. Two major categories of incentives include monetary and time-based. Finally, we learned that a market for salvaged materials is essential for a successful deconstruction program. In speaking with stakeholders, we learned that there is a private market for materials on the island, but it is not easy for the average person to locate materials.

6.1. Knowledge and Attitudes of Architects, Realtors, and Builders

Maintaining the historic integrity of Nantucket relies on preserving historically contributing homes and keeping them within their historical context. To do this, Nantucket homeowners must want to maintain the historical elements of their homes, especially since the Town has little control of building interiors. Realtors, architects, and builders are hired to execute a client's vision. Preventing the destruction of the historic aspects of Nantucket homes depends on the attitude of the homeowner, which can be shaped by realtors and architects (and to a lesser degree by builders). Mickey Rowland, an architect, and current member of the HDC's Historic Structures Advisory Board (HSAB), said that many clients do want to keep the historic feel, but many are interested in gutting their homes and renovating for a more modern look and amenities.

According to Rowland, if the historic integrity of a house could be used to measure the house's resale value, then prospective buyers would be less inclined to remove historic material within the house. This can't be dictated, but it could become more accepted if the public and especially prospective home buyers were made more aware of Nantucket's reputation for having

a wealth of 18th and 19th century historic homes. The NPT is developing a database of many historic houses they tour. For every location the NPT logs, the organization notes the amount of original material in the building. The trust then ranks each house by historical accuracy according to its component percentages (this should be verified by the NPT). Rowland's proposition was to apply those measurements to a house's value; if having more original material would make the house appeal more to clients, owners might be more inclined to request a restoration over a redesign or demolition. In most cases, he avers realtors would be the first to sell this idea to clients.

Rowland feels that "realtors are the front lines" to starting the conversation about protecting a home's historic elements because they help influence the mindset of prospective homeowners. Realtors, however, need to be more aware of the major historic elements in a particular home, so they can promote restoration and repair instead of partial and complete demolitions and renovations. Buyers need to be made aware that they are about to become the stewards of a historic property for a relatively short part of its life. If previous homeowners were able to protect and maintain historic materials, then they should also hold that responsibility, and pass it forward to future generations. Nantucket real estate broker and former Chairman of the Nantucket Association of Real Estate Brokers (NAREB) Education Committee, Dawn Holdgate, told us that in order to sell real estate on Nantucket, an aspiring realtor only needs to complete real estate certification courses for selling property in the state of Massachusetts. They are not required to complete any local courses that teach the intricacies of selling homes on Nantucket, let alone historic homes. While Holdgate did say that Nantucket realtors can elect to take continuing education courses on Nantucket zoning laws and the selling of historic homes, the courses put little emphasis on the significance of a 'contributing' home. These courses focus more on making buyers aware of the HDC restrictions they will face when updating the outside of the home. In Holdgate's experience selling historic homes, the main historic district in Nantucket is incredibly popular; however, many buyers want the historic label but opt to renovate with modern amenities.

Like realtors, architects are integral in the homeowner's decisions about deconstruction, renovation, and restoration of a historic house. According to Rowland, hiring an architect that has experience with historic homes can be critical in designing a space to highlight the historic elements already present in the structure. Elements like trim, paneling, brickwork, windows,

floors, doors, and even staircases can hold historic significance. NHC commissioner Angus MacLeod emphasized the importance of an architect knowing the value and possible uses of materials already present in a home. MacLeod also mentioned the need for the education of architects, tradespeople, and homeowners on how to preserve the interiors of significant historic structures. Sarah McLane, the owner of the home at 6 Gull Island Lane, is working to restore the house using as many salvaged materials from the original structure as possible. McLane told us that her work on the home will be publicized upon completion of the project to encourage and educate others to follow in her footsteps. The hope is that through education like this, more homeowners will be encouraged to salvage historic elements and old materials, which will reduce the number of homes that homeowners want to demolish.

Architects, like Mickey Rowland, and restorers, like Sarah McLane, that pride themselves on maintaining and highlighting the historic elements for homes on Nantucket want to work with builders who are sensitive to the intricacies of the projects they are completing. Builders must follow the lead of any hired architect and the preference of the homeowner while working within the constraints of building codes and HDC requirements. Education is a major key for builders to have the knowledge necessary to handle historic materials. Frank Daily, the president of the Nantucket Builders' Association (NBA), told us that the NBA is a great way to educate and disseminate information to builders because the builders' association already offers frequent classes for its members about new building codes, available materials, resources, etc. However, Daily emphasized the absence of classes and information for the NBA's members on topics such as deconstruction and historic restoration.

6.2. Incentives for Demolition Alternatives

There are several ways to disincentivize demolition and incentivize more sustainable practices. The first of these is to implement measures which make it more cost prohibitive to demolish a structure. Alternatively, programs can be implemented which provide monetary incentives to push homeowners in the direction of deconstruction, restoration, renovation, or relocations. Another way to encourage more sustainable practices is to make demolition take longer. On Nantucket, time is key so if a project using deconstruction or another sustainable practice can happen faster, homeowners will be more likely to choose these routes.

6.2.1. Monetary Incentives

One method to reduce the number of house demolitions is to provide monetary incentives that encourage homeowners to move, renovate, or deconstruct their homes. The National Park Service (NPS) has such incentives in place, one of which is the historic tax credit program which allows for both Federal and State tax credits for qualifying expenses. Through this program, owners of historic homes can receive tax credits provided they maintain the historic integrity of the structure and meet NPS rehabilitation standards. The process to obtain these tax credits is not simple, however; as Sarah McLane explained, the application process requires a significant initial investment as well as a detailed explanation of the restoration/rehabilitation plans for the structure, both of which must be done without any assurance that the application will be approved. Another monetary incentive in place for Nantucket homeowners is the opportunity to donate a house and receive a tax write-off in return. As an example, a homeowner could donate a house to Housing Nantucket, a non-profit organization that would then take that home and move it to a different property to convert it to affordable housing. This approach has its own problems, however, due to the lack of space to put the structure during the interim between moving a structure off one property and onto another.

In addition to these incentives, the town also charges fees when a homeowner applies for a permit to move, renovate, or demolish part or all a structure to discourage the demolition of historic homes. However, as pointed out by several interviewees, these fees are insignificant compared to the cost of the projects they are associated with, and as such they do not serve as an effective demolition deterrent. Additionally, these permit fees were never intended to be significant compared to the project cost; as Building Commissioner Paul Murphy explained, the fees are designed to reflect the amount of work done to generate the permit. Additionally, fees are based on the area of the structure. In either case, fees would not be able to be altered based on the type of permit being requested and therefore would not be a valid way to further disincentivize house demolitions. An issue that came up throughout almost all our interviews was the wealth of many owners engaging in C&D projects. The amount of money going into these projects makes any fees that would be associated with them appear miniscule. Unless the increase in fees was prohibitively high, it would have no impact on the project. Additionally, raising fees of any kind will harm the year-round Nantucketers, who are not building multi-million-dollar homes. This issue is further compounded by the fact that year-round Nantucketers

are those voting for amendments to legislation, making it likely that fee increases will not pass. If increased fees are not a deterrent for Nantucket property owners that are demolishing their homes, increasing the time it takes to complete these projects might be a more effective way to disincentivize this practice (see Section 6.2.2).

One issue to consider when implementing any of these incentives is the importance of clearly defining and differentiating between full and partial deconstructions, demolitions, and renovations. When designing new and updating existing demolition regulations, the HDC will have to ensure that the wording prevents homeowners from easily finding workarounds and that incentives go to the homeowners who opt to preserve their homes over demolishing them.

Another issue to consider is recognizing what parts of a structure the HDC and others have jurisdiction over. The HDC's control only covers exterior architectural features of the house that can be seen from the street, meaning that while the exterior is subject to the commission's regulations, the interior is not (unless special restrictions have been placed on the individual properties by previous owners or organizations like NPT for example). According to Val Oliver, if there are no preservation restrictions set on a house, renovations often result in the interior being torn out and the historic materials being disposed of.

One idea for an incentive came from Hillary Hedges Rayport, current chair of the NHC, who suggested that a demolition fee such as the one adopted by the town of Lexington, MA, could encourage homeowners to salvage their houses in order to have the fee waived. If the homeowner preferred to pay the fee and demolish the house, that money could be given to help organizations focused on solving the housing shortage, such as the Affordable Housing Trust (AHT). Along similar lines, DPW Recycling and Solid Waste Coordinator Graeme Durovich shared that some communities use a demolition deposit system to achieve a similar outcome. A homeowner would make a deposit prior to the deconstruction or demolition of the house, a certain percentage of which would be returned to the homeowner based on the amount of material that was reused or recycled.

6.2.2 Time-Based Incentives

A topic common to several interviews was the amount of money being spent on real estate on the island. Because of the large amounts of money invested in property purchases and renovations, any form of monetary disincentive is likely to be ineffective, unless the amount

involved is considerable. Ray Pohl, HDC chair and architect, said changing fees would be challenging because those voting on legislation are those that the fees would impact the most.

One current practice used to discourage demolitions is instituting demolition delay laws. This concept was brought up in several interviews, including those with Ray Pohl and Hillary Hedges Rayport. Rayport noted that, while Nantucket does have a form of demolition delay, the actual delay period is not long enough to allow the homeowner to find another location to move the structure to or to find someone else interested in taking the structure. She suggested that if the delay period were to begin after the homeowner receives the demolition permit, and if it were to be extended from thirty days to six months or more, that would provide the necessary time and motivation for the homeowner to move the structure.

There are two major applications a homeowner must submit when they want their house to be demolished, moved on/off, renovated, restored, or deconstructed: a CoA from the HDC and a building permit from the building commissioner. Obtaining a CoA from Nantucket's HDC is a long process. The HDC agendas are, in almost all cases, substantially longer than what can be covered in the commission's two weekly meetings that last for a total of 6.5 hours every week. With Nantucket's HDC being the busiest in the entire country, homeowners must wait a long time for the HDC to review their CoA application. This does not account for the time it may take to resubmit if the original application is rejected or be reviewed again if it is accepted with conditions. According to Paul Murphy, obtaining a building permit is a quicker process. All of the prerequisites necessary for permit approval should already be acquired when submitting for a building permit. Generally, the approval process takes two weeks, but Murphy is able to expedite the process if it is necessary for certain projects.

6.3. Reused Materials Markets

Salvaging and reusing building materials is not a new concept on Nantucket, nor is the idea of a market for these materials. One of the DPW's well-known ways to control waste is the management of a Take-it-or-Leave-it (TIOLI) facility that allows residents to shop for other islanders' unwanted items with the intended goal of supporting local reuse and reducing the amount of material entering Nantucket's waste stream. However, the TIOLI does not deal with any building materials because there is limited space and few staff to maintain the facility. A study done by Kristiana Ringer in partnership with the NPT identified that the practices of

salvaging, reusing, and trading materials used to be quite common on Nantucket, but are seldom used now. For example, the NPT study discussed the discontinued practice of laying lumber out at the landfill on Sundays for the public to take. Graeme Durovich of the DPW talked about several reasons why this practice had to be stopped. Mainly, it was a liability to the town due to the safety hazards it created.

The desire to create a market for building materials was present in almost all of our interviews. When asked about potential markets for building materials, interviewees explained that salvage markets already exist, and they expressed their desire to see an expanded market for these materials. In our interview with Frank Daily from the NBA, Daily mentioned that he is already storing materials that he thinks he may be able to reuse. This is a practice several other builders around the island employ; however, in doing this, there is no way for the general public to view and purchase materials for various projects. Daily noted that a program similar to the NBA's free firewood program may be a successful way to create a public market for materials. However, he did observe that there were complaints about the "eye sore" created by placing firewood on the street by a construction site; these concerns would make it difficult to implement this as a common practice for building material exchange. Even though many are eager to expand the practice of salvaging materials, one interviewee stated that a market for materials is not profitable because the process of making the salvaged materials usable is too labor-intensive.

Builders and homeowners on the island currently use online resources such as Facebook to find historic building materials to use in their projects. Sarah McLane, the homeowner, and restorer of the historic home at 6 Gull Island Lane, told us about the many windows and other historic materials she was able to get from Facebook Marketplace and private local Facebook Groups. And much like Frank Daily, McLane mentioned that she was able to store salvaged materials from this house project that she will either be able to use in another one of her restoration projects or give to someone else who can use the materials in their project.

While Nantucket has a long history of moving homes, and this is still a somewhat common practice; several problems were identified in our interviews that limit the number of homes that can be moved each year. In many of our conversations, the marketing practices for moving a home were brought up. Currently, a home that is going to be demolished must be advertised in the newspaper. Most interviewees agreed that this practice would rarely yield desired results. This was in part due to the demographics of those who read the paper as well as

the limited requirements for things like the size and placement of the advertisement. This meant that the advertisement could be put in a small box buried among other advertisements. This was not a unanimous opinion though; Ray Pohl said that customers will contact his architectural firm looking for homes that could be moved to their property; however, due to logistical complications that will arise during the transit of the home, it is often impossible to move these structures. Another idea is to salvage materials from the house, if not able to move, so that there is less construction debris entering the landfill. There are often many things that could be kept for reuse, such as doors, windows, cabinetry, flooring, etc., but there needs to be a place to store them, perhaps for resale at lower prices.

7. Conclusions and Recommendations

There is no single or simple way to reduce the C&D waste that is entering the Nantucket landfill. Currently, there are many homes and building materials that enter the waste stream every year. Additionally, there are limited ways for organizations on Nantucket to control what a homeowner does with materials located in the interiors of their homes. Potential solutions to these problems include increased education, deterrents for demolition, incentives for more sustainable practices, and the creation of a market for materials and homes. We make the following 10 recommendations which will help Nantucket to reduce its C&D waste. These recommendations span many groups and methods for reducing waste due to the broad nature of the problem.

1. The HDC should work with organizations including the NAREB and the NBA to create educational and outreach materials for realtors, architects, and builders to help encourage the more sustainable deconstruction and demolition practices.

For realtors, the NAREB already offers continuing education courses for selling historic homes, but with a greater emphasis on identifying and marketing the historic aspects of homes on Nantucket. By showcasing the value of keeping the historical elements intact and the benefits of showcasing them. Designing a curriculum for architects is about encouraging the maintenance of historical elements and designing a space around highlighting the historical elements. The purpose of these designs being to salvage as much original building material as possible. NBA President Frank Daily was encouraged by the idea of designing a course or bringing in an expert

to speak to the members of the NBA about deconstruction. This course can include discussions on how a homeowner or builder can save money on construction fees, tipping fees at the landfill, etc. when materials are salvaged from a deconstructed building.

2. The HDC and NHC should work with the Massachusetts Historical Commission and others on the island to increase public awareness of the historic tax credits and to guide homeowners through the process of obtaining historic tax credits.

Navigating the historic tax credit application process is lengthy and can be challenging, so to increase the number of applicants and in doing so decrease the amount of historic house demolitions, steps must be taken to make the process more accessible to the average homeowner.

3. The HDC and building department should require homeowners to submit a deposit upon receipt of a CoA or building permit that will be returned to the homeowner if the project is completed to the standard required for historic preservation and C&D waste reduction.

Implementing a deposit system like this would provide another positive incentive for homeowners to preserve the historic integrity of their houses, and in the cases where the project is not completed to satisfaction, it would help provide funding needed to run various housing organizations on Nantucket.

4. The HDC should create a priority system for CoA review which allows for those using sustainable practices, such as deconstruction, or completing a historic restoration a quicker approval process.

The general idea of this proposed system is that those who are deconstructing, moving, or restoring a home using more sustainable practices would be able to "cut the line," as Ray Pohl put it. This would allow those applying for CoA approval for these projects to get through the application and approval process faster than those who apply for demolitions, for example, and offset some of the additional time it takes to carry out these projects using sustainable methods. However, this idea does not come without its caveats. The HDC will need to ensure the program is robust to prevent legal loopholes that could circumvent the nature of the program. The HDC will need to create solid definitions for deconstruction and restoration to prevent homeowners from exploiting loopholes. For example, one potential loophole is applying for a deconstruction CoA while actually only deconstructing part of their home and demolishing the rest. Defining a deconstruction project can be modeled on a program that has been implemented in Seattle,

Washington. The program requires a set amount of building materials to be reused, and proof of reuse through a Waste Diversion Plan. Historical restoration, however, is more difficult for the HDC to regulate because the commission has no power over the interior of the structure.

5. The Town via Town Meeting amendment, in consultation with the HDC, should amend the demolition delay bylaw to increase the time a homeowner is required to advertise, the method by which an advertisement is implemented, and allow for a homeowner to move a home before it can be approved for a demolition.

In addition to increasing the length of time needed to wait prior to demolition, another way to reduce the number of houses being demolished is to create a space for houses to temporarily reside while the next house owner prepares to move it to a more permanent location. By doing this, the property owner who is getting rid of the house will not have to demolish it, they will be able to expedite the construction process for a new house, and C&D waste from the entire process will be reduced. Much like the priority system, there are potential loopholes for homeowners that need to be closed before this can be implemented. An example of a loophole, given by Ray Pohl, involved a demolition delay law that was instituted in Chatham, MA. After the law was implemented, homeowners began taking advantage by applying for demolition permits many years in advance to be able to sell the home with a pre-approved demolition permit. This allowed the buyers of the homes to bypass the waiting period undermining the purpose of demolition delay bylaw.

6. The DPW should facilitate the creation of a physical marketplace for salvaged building materials.

Bringing a physical marketplace like Habitat for Humanity's ReStore to the island would make it possible to donate and/or purchase building materials for various projects. These donations would be tax deductible, and customers would be able to purchase items for less than market value. Additionally, this would benefit Nantucket's chapter of Habitat for Humanity by providing additional funding from the sale of these building materials. The main challenges with implementing this recommendation are the requirement of a dedicated physical location for materials to be bought and sold and the trained staff required to maintain the facility. For these reasons, we recommend that this ReStore is created in partnership with the Nantucket DPW. This allows the DPW to find the required land, so that Habitat for Humanity Nantucket can operate

the marketplace. Since the contract with Waste Options is up for renewal in 2025, the Town might consider making the creation of a marketplace for salvage materials part of the new contract up for bid.

7. Additionally, the town should work with the DPW to facilitate the creation of an online marketplace for salvaged building materials.

Due to the potential issue with allocating land for a large building materials marketplace and the issues with staffing, it may be more feasible to create a Nantucket-specific online marketplace for building materials. This kind of marketplace currently exists on various private Facebook groups and Nantucket Reuse Exchange. However, a more dedicated and focused website, likely run by the DPW and hosted on the town website, would be beneficial for ensuring everyone knows what materials are available on the island already.

8. The Town Administration with assistance from the HDC should create an online resource where houses that are going to be demolished can/need to be listed so the public can view what homes are on the market to be moved.

This online market would be similar to what would be created for building materials. This webpage should be part of the town website to allow for the general public to easily locate the resource. Further arguments could allow for sorting of homes to help potential buyers easily identify what they may be interested in.

9. The pertinent Town entities (including PLUS and HDC) should modify ground cover policies to allow for temporary staging of homes.

This alteration to policy would allow for homes to be staged on a property with an existing structure, or a structure being constructed, while a new home is being constructed to allow for those who are moving homes to have enough time to relocate the structure.

10. The Town should work with other organizations in the town to identify and allocate land that allows for temporary staging of homes while their new site is being prepared.

Similar to the previous recommendation, this would allow for additional time to prepare a new site for a home move.

8. Further Research

This project has shown that there is still a substantial amount of work to be done in the area of reducing C&D waste, including the following six research projects:

1. Create educational programs and materials for builders, realtors, and architects to promote relocation, deconstruction, and salvage.

The first opportunity for future project work is developing several curricula for Nantucket's builders, realtors, and architects. A curriculum for builders, developed in partnership with the NBA, could include information on how to maximize salvage materials from homes, as well as how to work with historic homes and materials. Similarly, a curriculum developed for realtors in conjunction with the NAREB could include information on how best to market the historical elements of historic homes to potential buyers. Furthermore, curricula could be developed for architects working in Nantucket that cover the intricacies of highlighting historic elements and preserving the historic integrity of Nantucket's historic homes. There is no organization for the island's architects, so work will need to be done to determine how best to distribute this material.

2. Develop a guide to teach homeowners about the history of Nantucket's homes and the importance of preserving the island's historical integrity.

Another future project could work to create a booklet for homeowners explaining the significance of the historical homes on the island and detail the best practices for protecting and preserving historical structures. This booklet should include case studies of successful restorations completed on the island including Sarah McLane's restoration of 6 Gull Island Lane. Modeled off of *Building with Nantucket in Mind,* the informational booklet can provide an updated and modern perspective.

3. Analyze the island's transportation routes for structure relocations.

Many houses and structures on Nantucket are deemed impossible to move due to physical obstacles present on the necessary transportation routes making the move financially and logistically impractical. These obstacles include barriers such as power lines, roundabouts, and narrow roadways. A future research project could find optimal routes for the transportation of

structures and make recommendations for areas that present moving challenges. This project could determine ways to modify or remove obstacles present on routes that would be commonly used to transport buildings. This could include recommending what areas need to move power lines underground. Even further research into this topic could include investigating the feasibility of alternative transportation methods like moving homes over the ocean by barge.

4. Create virtual marketplaces for homes to be relocated and salvaged materials and evaluate their effectiveness.

One recommendation we formulated from our research was to create an online market on the town website for salvaged building materials. A future project could build this website and ensure it is easy to find and navigate for anyone who wants and needs to use it. A similar website could be set up for listing homes and structures that are being advertised for relocation. Following the creation of these marketplaces, as well as the creation of any physical marketplaces, a future project team could evaluate the success and shortcomings of the completed websites to determine the effectiveness of various marketplaces and recommend any necessary updates that need to be made. This project would look at the analytics of the websites, like how many people are using them, as well as gauging public opinion and identifying any logistical issues with the marketplaces.

5. Evaluate the effectiveness of Nantucket's demolition delay law.

Demolition delay laws have been a part of Nantucket's permitting process for a long time, but the bylaws should be expanded to provide additional protection for historic and non-historic structures. A future project should evaluate the current demolition delay law on Nantucket and identify potential loopholes. The project team will need to make recommendations for improving the enforcement of the existing law and the regulation itself to better realize the goal of reducing C&D waste by limiting demolitions.

6. Examine the role of Nantucket's waste contractors in the reduction of C&D waste.

With the Nantucket DPW's contract with Waste Options expires in 2025, there is room for negotiation of new terms and finding new contractors that can support the DPW in the creation of a physical salvaged building materials market. Nantucket could vendors to run a facility on the island for these reusable materials or require them to provide an additional stream for waste to be sold off island. A future project team could work with the DPW to assess other

potential options and recommend which stipulations any contract would need to ensure the successful reduction of C&D waste going to the island's landfill.

References

Christiana, A. (2021, June). *A Better Way to Demo*. Fine Homebuilding. Retrieved November 3, 2021, from https://www.finehomebuilding.com/2021/04/28/a-better-way-to-demo.

(n.d.). Demolition Delay Bylaws and Ordinances in Massachusetts [PowerPoint slides]. https://capecodcommission.org/resource-library/file/?url=/dept/commission/team/Website_Resources/historicpreservation/Workshop2009Skelly.pdf

Department of Public Works. (2020). *Waste streams.* Retrieved November 30, 2021, from https://dpw.nantucketdataplatform.com/waste-streams.

Department of Public Works. (2020). *Where is away when you throw it away?* Retrieved November 30, 2021, from https://dpw.nantucketdataplatform.com/where-is-away

Environmental Protection Agency. (n.d.). *Sustainable Management of Construction and Demolition Materials*. EPA. https://www.epa.gov/smm/sustainable-management-construction-and-demolition-materials.

Fram, V. (2015) *A Policy Analysis of the City of Newton, Massachusetts' Demolition Delay Ordinance* [Historic Preservation Capstone Projects. Paper 9]. http://docs.rwu.edu/hp_capstone_project/9.

Gibson, E. C. (2021). (rep.). *Town of Nantucket Fiscal Year 2022 Budget Message*. Town of Nantucket, Mass. Retrieved from https://nantucket-ma.gov/DocumentCenter/View/38287/General-Fund-Budget-essage-from-Town-Administration-PDF.

Gilmore, M., & Williams, K. P. (2016). Moving buildings: The case of the Burrows Farmhouse. *Washington History*, 28(2), 49–52.

Habitat for Humanity. (n.d.). *Habitat for Humanity ReStores*. Habitat for Humanity. Retrieved November 3, 2021, from https://www.habitat.org/restores.

Hawthorn Builders. (2015, August 13). *Deconstruction part Two*. Retrieved November 3, 2021, from https://www.hawthorn-builders.com/deconstruction-part-two/.

Hill, L. (2020). *Shell Recycling*. Shell Recycling | Nantucket, MA - Official Website. https://nantucket-ma.gov/1425/Shell-Recycling-Program.

Historic District Commission. Town & County of Nantucket, MA. (n.d.). from https://www.nantucket-ma.gov/283/Historic-District-Commission.

Lang, J.C., & Stout, K. (1995). *Building with Nantucket in mind: Guidelines for protecting the historic architecture and landscape of Nantucket island.* Nantucket Historic District Commission.

Loung, T. (2019). *Excavators slowly pull En Fin via a cable wire attached to the steel beams underneath it*. The Wall Street Journal. Retrieved September 14, 2021, from https://www.wsj.com/articles/need-to-relocate-bring-the-house-too-11564070995.

McMarthy, T. (2018). *Deconstructing the culture of demolition: exploring deconstruction as a strategy for historic preservation*. Boston Architectural College

Merlino, K. R. (2018). Environment: Greening existing buildings. In *Building reuse: Sustainability, preservation, and the value of design* (pp. 49–67). *University of Washington Press*.

Nantucket Department of Public Works. (n.d.). *Public works*. Town & County of Nantucket, MA. https://www.nantucket-ma.gov/237/Public-Works.

Nantucket Historical Commission. Town and County of Nantucket, MA. (n.d.). Retrieved November 30, 2021, from https://www.nantucket-ma.gov/439/Nantucket-Historical-Commission.

Nantucket Preservation Trust. (n.d.). Retrieved November 30, 2021, from https://www.nantucketpreservation.org/.

OpenGov. (n.d.). *Nantucket Finance and budget visualization*. County and Town of Nantucket. https://nantucketma.opengov.com/transparency.

RecyclingWorks Massachusetts. (n.d.). *Deconstruction and Building Materials Reuse Case Study*. Retrieved November 30, 2021, from https://recyclingworksma.com/wp-content/uploads/2012/01/Deconstruction-and-Building-Materials-Reuse.pdf

Rypkema, D., Grosicki, B., Swink, R., Cotton, K., Frystak, A., Bruni, C., & Herr-Cardillo, S. (2021). (rep.). *Treasure in the walls* (pp. 1–101). San Antonio, Texas: PlaceEconomics.

Salt Air Designs LLC. (n.d.). *Home page: Nantucket, MA: Habitat for humanity*. Habitat for Humanity of Nantucket. Retrieved November 3, 2021, from https://www.habitatnantucket.org/.

Seattle Department of Construction & Inspections. (n.d.). *Residential deconstruction*. Residential Deconstruction - SDCI. http://www.seattle.gov/sdci/permits/permits-we-issue-(a-z)/residential-deconstruction.

St. Louis Deconstruction Market Assessment. Delta Institute. (2019, April). from https://delta-institute.org/wp-content/uploads/2019/05/St.-Louis-Deconstruction-Market-Assessment.pdf.

The Mercer Group, Inc. (2009). Management and operations review of the department of public works and review of the need for a central town garage. http://www.nantucket-ma.gov/DocumentCenter/Home/View/661.

Torgelson, N. (n.d.) *Residential deconstruction*. Seattle Department of Construction and Inspections. http://www.seattle.gov/sdci/permits/permits-we-issue-(a-z)/residential-deconstruction.

Town & County of Nantucket, MA. (2019). *Solid Waste & Recycling*. Solid Waste & Recycling | Nantucket, MA - Official Website. https://www.nantucket-ma.gov/242/Solid-Waste-Recycling.

Town & County of Nantucket, MA. (2019, February 22). *Infamous buildings on Nantucket.* Nantucket, MA - Official Website. https://www.nantucket-ma.gov/DocumentCenter/View/23602/inFamous-Buildings-on-Nantucket?bidId=.

Town & County of Nantucket, MA. (2019, October 1). *Existing & emerging waste management technologies*. Nantucket, MA - Official Website. https://www.nantucket-ma.gov/1469/Existing-Emerging-Waste-Management-Techn.

Town & County of Nantucket, MA. (n.d.). *FAQs*. Nantucket, MA - Official Website. https://www.nantucket-ma.gov/Faq.aspx?QID=289.

Town & County of Nantucket, MA. (2021) *HDC monthly data.* Nantucket, MA – Official Website. https://www.nantucket-ma.gov/DocumentCenter/View/37621/HDC-Monthly-Data-2016---Present-PDF?bidId=.

Town & County of Nantucket, MA. (n.d.). *Hazardous waste*. Nantucket, MA - Official Website. https://www.nantucket-ma.gov/243/Hazardous-Waste.

Town & County of Nantucket, MA. (n.d.). *Staff directory*. Staff Directory • Nantucket, MA CivicEngage. https://www.nantucket-ma.gov/Directory.aspx.

Town & County of Nantucket, MA. (n.d.). *Take-it-or-leave-it*. Take-It-or-Leave-It | Nantucket, MA - Official Website. https://nantucket-ma.gov/2072/Take-It-or-Leave-It.

United States Environmental Protection Agency. (2003). (tech.). *Estimating 2003 Building Related Construction and Demolition Materials Amounts* (pp. 8–9). Washington, D.C.

U.S. Environmental Protection Agency. (2020, December) *Advanced Sustainable Materials Management: 2018 Fact Sheet*. EPA. https://www.epa.gov/sites/default/files/2021-01/documents/2018_ff_fact_sheet_dec_2020_fnl_508.pdf.

Appendix A - Methodology

The goal of this project was to determine how house demolition, deconstruction, and reuse practices on Nantucket could be improved to limit C&D waste generation while encouraging historical preservation. To accomplish our goal, we followed three objectives: (1) evaluate current and best practices to limit demolition and encourage house deconstruction and reuse in Massachusetts towns and elsewhere; (2) identify the current practices Nantucket uses to determine which houses and buildings (historic and non-historic) are moved, deconstructed, or demolished; and (3) evaluate stakeholder perspectives on ways to limit house demolition and encourage deconstruction and reuse on Nantucket.

1. Current Demolition and Reuse Practices on Nantucket

Our first objective was to assess current procedures in Nantucket for building relocation, deconstruction, and demolition. We collected and analyzed statistics about the types and locations of buildings that have been demolished, relocated, or renovated. We also devised a plan for interviewing relevant individuals and organizations on-island about their perspectives regarding how residents and organizations generate and handle C&D waste. Using this data, we presented our findings and made a series of recommendations on how the island can better handle and reduce waste from construction and demolition projects.

1.1. GIS Layer

We created a GIS layer of house moves, demolitions, and deconstructions based on records maintained by the Nantucket Historic District Commission (HDC) and the Nantucket Building Department. The HDC has compiled summary data on the number of houses that have been deconstructed, demolished, and moved over the past 6 years (see Table 2). We reviewed the data in Table 2 and other records kept by the HDC and Building Department. We used this data as we constructed a GIS layer that includes location and cost information on each house that has been deconstructed, demolished, or moved over the past three years. Using the GIS data layer in conjunction with a statistical analysis application we developed specifically for C&D waste weight calculation, we estimated the annual C&D waste generation from demolished and

renovated houses on the island. We were also able to use it to demonstrate trends in demolition and building relocation on Nantucket in recent years.

We used industry estimates to predict the amounts of materials generated each year by the deconstruction and demolition activities recorded in the database above. We determined what portion of those materials might be salvageable and available for reuse (e.g., windows, doors, flooring, etc.) based on data from other reuse and recycling programs elsewhere in the US. These estimates will be approximate without a more detailed analysis of the specific materials generated from different types of houses on Nantucket.

2. Evaluation of Demolition Practices Outside of Nantucket

We evaluated the current and best practices other communities use for limiting demolition and encouraging house deconstruction and reuse. In our initial background research, we identified San Antonio, Texas; Portland, Oregon; Seattle, Washington; and Newton, Massachusetts, as cities with model practices for C&D waste reduction. Our group mapped out the advantages and disadvantages of the practices and regulations in these communities. These comparisons support our final recommendations to our sponsors for limiting Nantucket's C&D waste.

3. Evaluation of Stakeholder Perspectives

Our final objective was to evaluate stakeholders' perspectives on ways to limit demolition and encourage deconstruction, preservation, and the reuse of buildings on Nantucket. The purpose of this objective was to determine what the major limitations are to implementing a building deconstruction, preservation, and reuse program on Nantucket. This objective was fulfilled primarily through interviews with stakeholders and professionals in the field of construction. This list included individuals from the NBA, the HDC, and the NHC. To facilitate these interviews, we used the interview procedure described previously. Our primary focus for these interviews was to determine what obstacles prevent buildings from being moved or deconstructed rather than demolished.

3.1. Interviews

We interviewed representatives of the HDC, DPW, Planning and Land Use Services (PLUS), Building Department, NHC, NHA, NBA, and other individuals in the industry to verify details of the current procedures, rules, and regulations regarding demolition, deconstruction, and relocation of historic and non-historic houses on the island. Appendix C is a comprehensive list of contact information for the individuals and organizations we interviewed. It also contains the purpose of conducting each of the interviews we completed.

We developed a set of questions for each interview (Appendices E-R) to match the role, expertise, and interests of our interviewees. We conducted the interviews in person when possible, following appropriate COVID protocols, or over Zoom if our interviewee preferred. We began each interview by reading a preamble (Appendix D) explaining the purpose of the research and protocols for the interview. We took notes on responses and asked for permission to record the interaction in order to ensure a complete record of the conversation. We gave all interviewees the opportunity to review any materials we used from the interview prior to the publication of our final report.

Appendix B - Sponsor Description

Making the Great Outdoors Even Better: The Role of the Department of Public Works in Nantucket

The Nantucket Department of Public Works (DPW) is responsible for the maintenance of the town's infrastructure, facilities, and associated services. Because Nantucket is both a town and an island, its DPW has a more expanded role than the average town's DPW, especially during the summer months when the population of the island increases from around 11,000 year-round to over 50,000 in the summer months (FAQs, n.d.). The DPW's mission is "to provide and maintain Public Services necessary for the economy, growth and quality of life for the citizens and visitors to Nantucket" (Nantucket Department of Public Works, n.d.). The range of responsibilities of Nantucket's DPW are shown down below in Figure B1 (The Mercer Group, Inc., 2009). Part of these services involves the operations of the landfill, which includes managing the operators of the island's C&D waste. There are two sites where C&D waste is accepted to be transported off island, one is run by Waste Options and supervised by the DPW, while the other is privately owned by P&M Reis Trucking, Inc. However, the contract between the Town and Waste Options is set to expire in 2025, and the Town will open up competitive bidding for a new waste contractor (*Existing & Emerging Waste Management Technologies,* 2019).

DPW programs target specific public areas and control both usage and maintenance of Nantucket resources. Of great importance is the Solid Waste and Recycling Program, established in 1996, which mandates that Nantucket residents recycle (Solid Waste and Recycling, n.d.). Through this program, waste is divided into three categories: Recyclable Waste (R), Compostable Waste (C), and Non-Recyclable, Non-Compostable Waste (or NRNC). NRNC is generally shipped off-island, but the first two are each handled separately at the Town of Nantucket Recycling Facility and Landfill (*Existing & Emerging Waste Management Technologies,* 2019).

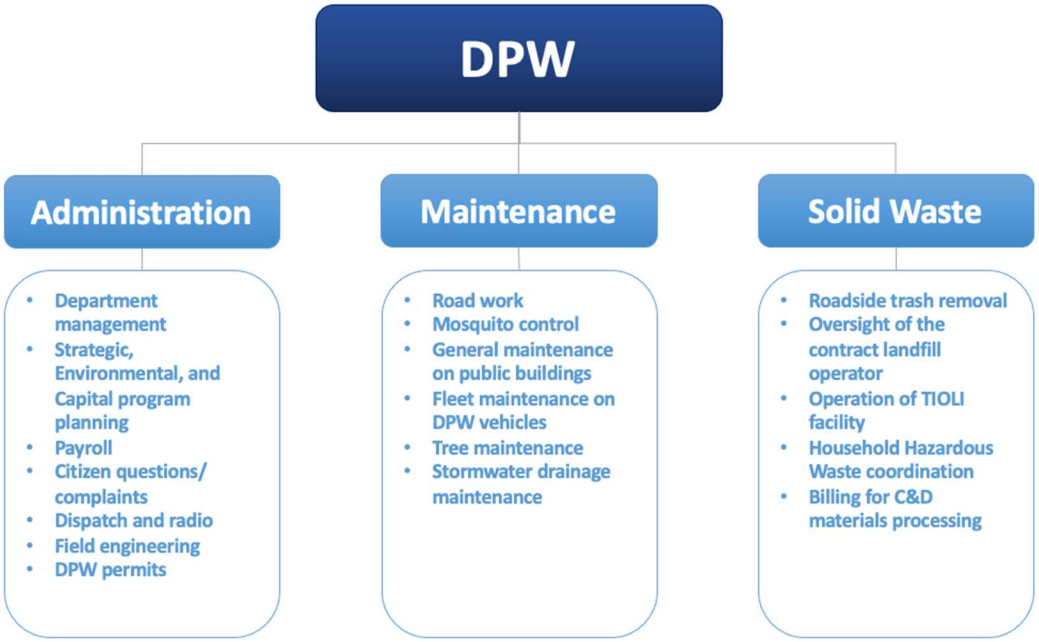

Figure B1 - Overview of DPW services, divided into 4 categories. Derived from (The Mercer Group, Inc., 2009).

"Recyclable Waste" includes shipping boxes, plastics, tin, aluminum, and glass and is handled by the Materials Recycling Facility (MRF). The MRF accepts recyclable materials that have been separated from any non-recyclable materials, and that recyclable material is shipped off-island to be handled by material brokers. "Compostable Waste", which includes food scraps and mixed paper, is sent to the Waste Options Composter; once there, it is combined with animal manure and sewage sludge, screened, and destoned at various stages along the process to remove contamination, and then what remains is fully composted. The town landfill, also considered under public works, is the final destination for contamination removed from Compostable Waste. Contamination from Compostable Waste, regardless of size is the only material landfilled on Nantucket. NRNC that is presorted by residents and businesses is shipped off-island (*Existing & Emerging Waste Management Technologies,* 2019).

As part of the Solid Waste and Recycling Program, the DPW through its hazardous waste vendor holds Hazardous Waste Collection events throughout the year, allowing residents to dispose of a variety of items ranging from household cleaning agents and oil-based paints to car fluids (*Hazardous Waste*, n.d.). Another recycling program, the Shell Recycling Program, which is managed by the Natural Resources Department, has collected 200,000 pounds of shells for

processing and curing since 2014. The shells will be reintroduced to the seabed after some time to encourage growth of local oyster populations (Hill, 2020).

In conjunction with the recycling program, the DPW also oversees the Take-It-Or-Leave-It (TIOLI) program, a free exchange center that allows residents to drop off belongings or products they no longer need for others to take, thus reducing waste at the convenience of locals (*Take-it-or-leave-it*, n.d.). As of October 2020, certain changes have been suggested to improve the overall function of the Take-It-or-Leave-It program, including the following: an increase in staff; separate locations for the "take-it" and "leave-it" components of the process; the construction of additional storage facilities to accommodate future program expansion as well as similar reuse programs; an upgrade in available parking for TIOLI customers so there are separate lots for those visiting the recycling center and those visiting TIOLI (see Figure B2); and the removal of unwanted items in good condition to a reuse market at an off-island location, but only after Nantucketers have been given first choice at said items (*Take-it-or-leave-it*, n.d.).

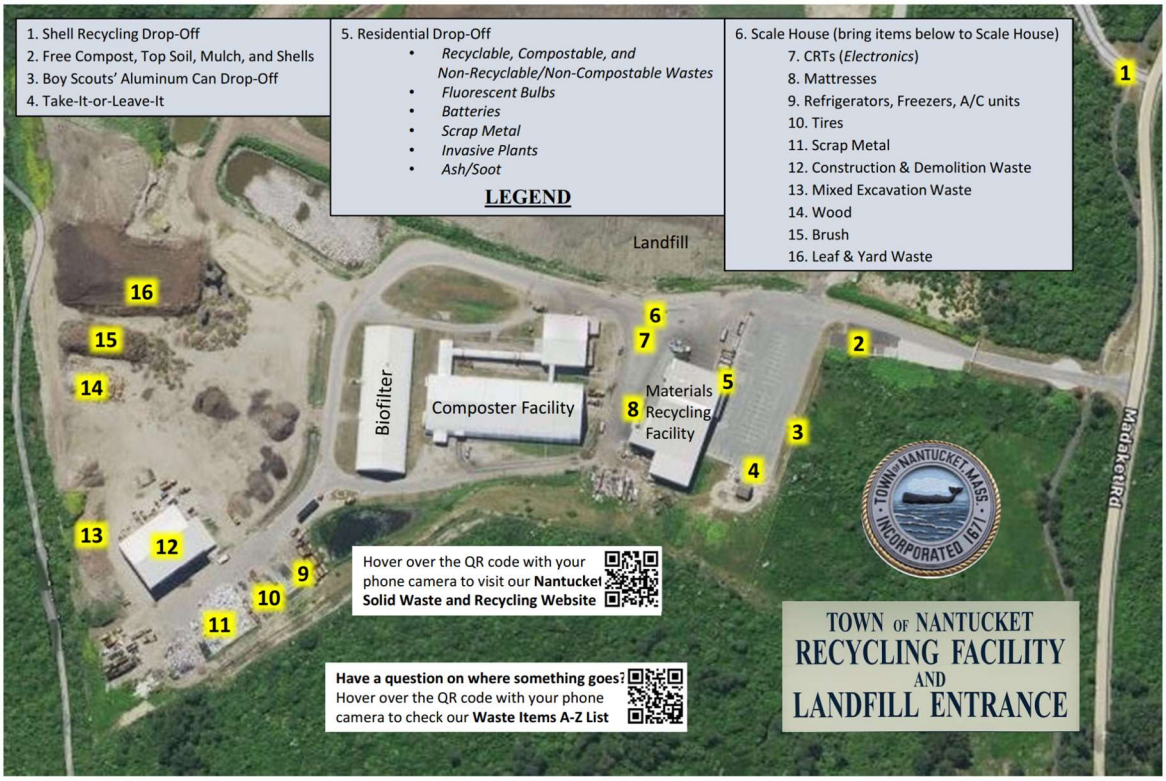

Figure B2 - Map of Nantucket's waste management facility. Included is the TIOLI building (marked with a 4) (*Solid Waste & Recycling,* n.d.).

The Nantucket Department of Public Works is one of the largest organizations on the island in terms of financial expenses (see Figure B3). In 2016-2017, the department spent just over $2.3 million, or around 16.7% of the town's annual budget. This number has been increasing recently as well with a budget of a little over $3.1 million approved for 2021 and a proposed budget of just under $3.5 million for 2022 (OpenGov, n.d.). This budget can be split into 2 primary categories: payroll and operating costs. Between these two, payroll takes up a much larger portion of the budget, making up around 80%. Additionally, there is a separate budget for Solid Waste that is funded through the Solid Waste Enterprise Fund (SWEF) which has an operating budget well over $10 million.

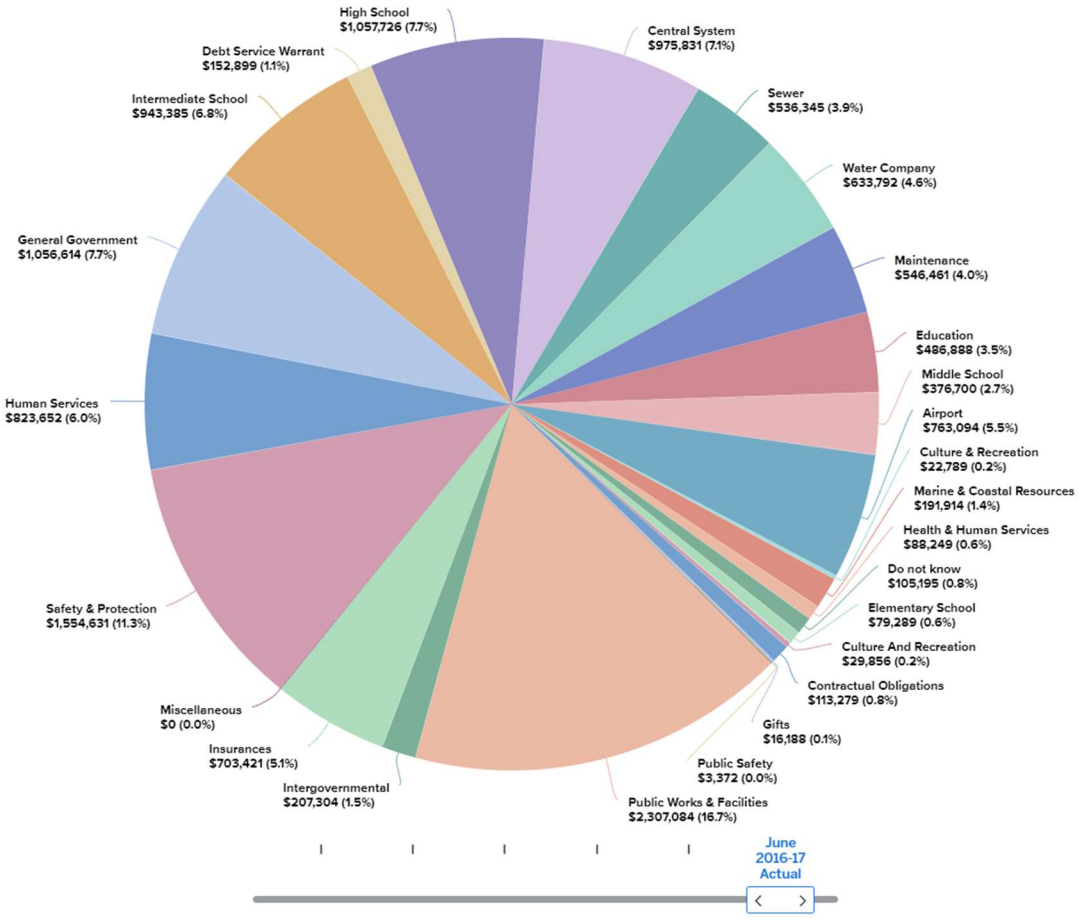

Figure B3 - The budget distribution for Nantucket in June of the 2016-2017 fiscal year (OpenGov, n.d.).

The Nantucket Department of Public Works staffs 31 full-time, titled employees including a Director, Operations Manager, General Foreman, Recycling/Solid Waste Coordinator, Central Fleet Manager, and a Facilities Maintenance Manager (*Staff directory*, n.d.). SWEF staff is separate from DPW staff although both operate out of the DPW campus and rely on DPW administration staff. SWEF staff includes Graeme Durovich the Recycling/Solid Waste Coordinator, 2 full time and one part time TIOLI attendants, and 2 seasonal waste reduction interns. In addition, the budget allocates around 5% of its budget to seasonal workers (OpenGov, n.d.). In 2020, the DPW hired three seasonal workers. The Fiscal Year 2022 Budget Message mentions a DPW requested budget increase to hire three new employees, two new Facilities Maintenance Workers, and a Construction Inspector (Gibson, 2021). The Facilities Maintenance Workers will be responsible for the upkeep of the 51 municipal buildings on the island, and the Construction Inspector will be responsible for ensuring that buildings being created on the island do not create significant interference with existing infrastructure such as roadways, sidewalks, and drainage systems.

Appendix C - Contact List for Interviewees

Organization	Individual(s)	Reason for Interview
Coastal Resilience	Vince Murphy	Specifics on Coastal Resiliency Plan, how to approach public incentives for following the guidelines outlined in the CRP
Nantucket Preservation Trust		Determine what the NPT is doing as part of their research into this issue
Housing Nantucket	Anne Kuszpa	Get information from an organization who moves many houses and has a potential market for moved structures
Land Bank	Jesse Bell	Learn about the Land Bank's preservation goals & methods
Affordable Housing Trust	Tucker Holland	Learn about the AHT's preservation efforts
Construction, Demolition, and Structure Relocation Companies	Bernie Perkins, Toscana	Learn about the building companies' perspectives on demolition, relocation, and deconstruction on-island
Historic District Commission	Val Oliver	Get information on the HDC's position on deconstruction, preservation, and relocation.
	Ray Pohl (Architect from Botticelli & Pohl)	
Nantucket Historical Commission	Hillary Hedges Rayport	Get information on the NHC's position on deconstruction, preservation, and relocation. Given some ideas on how the problem could be solved
	Angus MacLeod	

GIS Coordinator	Nathan Porter	Obtain data layers and get a better understanding of the GIS system
Building Coordinator	Paul Murphy	Learn about the deconstruction, salvage, and recycling process, building permits
Real Estate Broker (Select Board Member/liaison for NHC)	Dawn Hill Holdgate	Determine if there is a market to sell moved houses/better advertising
6 Gull Island House Restorer	Sarah Noelle McLane	Find out about the process she is going through as she deconstructs and restores a historic home; ask about her experiences with the HDC approval process
Builders' Association	Frank Daily	Determine the builders' perspective on deconstruction, salvage, and relocation
Architect (Member of Historic Structures Advisory Board (for HDC), NHC Member)	Mickey Rowland	Determine how historical features of homes are incorporated into new construction or renovations
Hanley Wood (former CEO) (Referred by Hillary Hedges Rayport)	Frank Anton	He has some good ideas and resources for our project, and he knows people who have started building reuse centers elsewhere

Appendix D - Standard Interview Preamble

We are a group of students from Worcester Polytechnic Institute (WPI), and we are on Nantucket conducting a research project in conjunction with the Nantucket Department of Public Works to reduce the island's C&D waste by limiting demolitions of houses and other buildings.

We would be delighted if you would take some time to answer some questions, we have about reducing C&D waste on Nantucket. This interview is completely voluntary, and you can withdraw at any time. We will be taking notes throughout this interview, and we may quote you in our final report. Would you prefer we use your responses anonymously, or may we quote you by name? We will give you the opportunity to review any quotations prior to publication, and we would also be happy to provide you with a copy of our completed report. Thank you for your help and support of our research.

Do you have any questions before we start? If you have any questions or concerns about the interview, we can be reached at gr-ACK21-DPW@wpi.edu, and our faculty advisors, Dominic Golding and Fred Looft, can be reached at golding@wpi.edu and fjlooft@wpi.edu respectively.

Appendix E - Coastal Resilience Interview Script

Main Questions

- How would a private homeowner choose which strategic method (protection, adaptation, and relocation) from the Coastal Resiliency Framework to use in different situations on the island?
    - What about a town official?
    - What is the significant difference(s) between relocating a house away from coastal risk and general relocation of a structure?
    - How much of the cost for relocating a house from coastal risk falls on the homeowner?
        - How much does that impact what action private homeowners take to protect their homes and other structures right now?
        - How can private homeowners be incentivized to follow the recommendations that the CRP lays out?
- Even if a homeowner wants to relocate their home to retreat from coastal risk, they are still required to apply and get approval for a Certificate of Appropriateness (CoA) with the HDC and hire a company to perform the relocation, which can be a rather lengthy process.
    - Is there any potential way you can think of to expedite this process for structures in Priority Action Areas?

Wrap-Up Questions

- Which organizations did you work closely with when developing the CRP?
    - Are there other organizations you are going to work with or plan to consult in the future?
- Is there anything else about the CRP that would be beneficial for our team to know going forward?
- Is there anyone else that you think would be beneficial for us to speak with as we move further into our project?
- Thank you!

Appendix F - NPT Interview Script

Main Questions

- Our sponsors, Graeme Durovich and Holly Backus, have mentioned that the NPT is working on a project, like ours, in the realm of deconstruction and salvage. Could you elaborate on this project and its end goal?
- The NPT works to educate homeowners, prospective homeowners, and realtors (among others) to rehabilitate and protect the historic nature of structures on the island.
    - How well would this work for promoting deconstruction over demolition?
    - Are there other methods you can think of to incentivize the protection of historic structures/features and their context?
- What kinds of houses do you most frequently visit?
- What are the most common reasons for a client to contact you for a house visit?
- What renovation recommendations do you make to clients most often?
- Is it currently possible for the public to view the NPT's in-progress historical database?
    - If not, will this data be made publicly available sometime in the future?

Wrap Up Questions

- What other organizations on the island do you work with?
- Is there anything else about the NPT and its work that we should know about going forward?
- Is there anyone else that you think would be beneficial for us to speak with as we move further into our project?
- Thank you!

Appendix G - Housing Nantucket Interview Script

Main Questions

- Does Housing Nantucket build new houses or just move them?
- How does Housing Nantucket find houses to move?
- How many people are currently waiting on housing?
- What is the process Housing Nantucket goes through for moving a house?
    - How do you prepare for a house move?
    - What agencies are involved in moving the house?
        - Do you use a private contractor to move the houses?

Wrap-Up Questions

- What other organizations on the island do you work with?
- Is there anything else about Housing Nantucket or its work that would be beneficial for us to know going forward?
- Is there anyone else that you think would be beneficial for us to speak with as we move further into our project?
- Thank you!

Appendix H - Land Bank Interview Script

Main Questions

- What is the Land Bank's position on the deconstruction of historic (or non-historic) structures?
- Does the Land Bank have any plans for the land it owns and is obtaining outside of preserving open spaces on Nantucket?
    - Is there any opportunity for the Land Bank to use its land as a sort of holding area for structures that are moved off someone's property until another plot of land can be acquired for a permanent move?
- If there is a structure on a property that the Land Bank has acquired, how does the Land Bank handle the removal of the structure?
    - How does the Land Bank go about advertising houses they'd like to move?
    - What does the Land Bank do with houses that cannot be moved?
    - Would the Land Bank consider deconstructing that structure?

Wrap-up Questions

- What other organizations on the island do you work with?
- Is there anything else about the Land Bank or its work that would be beneficial for us to know going forward?
- Is there anyone else that you think would be beneficial for us to speak with as we move further into our project?
- Thank you!

Appendix I - Affordable Housing Trust Interview Script

Main Questions

- What is the Affordable Housing Trust's position on deconstruction versus demolition of structures on Nantucket?
- How does the Affordable Housing Trust acquire existing structures to move onto new land?
    - Biggest obstacle?
- Is the AHT currently working on any major affordable housing projects?
- Possible incentives?

Wrap-Up Questions

- What other organizations on the island do you work with?
- Is there anything else about the Affordable Housing Trust or its work that would be beneficial for us to know going forward?
- Is there anyone else that you think would be beneficial for us to speak with as we move further into our project?
- Thank you!

Follow-Up Questions

- Why does the AHT build new units for year-round renters when there are ample houses on the island that are already built with homeowners that want to move them off their land?
- Where is the current revenue stream for the AHT coming from, is it entirely from ATM or are there other sources?

Appendix J - Toscana Corporation Interview Script

Main Questions

- How many projects (demo/move/new buildings) does Toscana typically work on every year?
    - How frequently does Toscana perform structural deconstruction?
- What factors do you consider when giving an estimate for how long it will take to relocate a house?
- How do you determine whether a structure is fit to be relocated?
    - When you bring in a structural engineer to inspect a building, what are the main characteristics they assess to determine whether it can be relocated?
- How much C&D waste is generated during a demolition/deconstruction/relocation?
    - How are different waste materials sorted on site and how do you handle each "pile"?
- Is there currently any market on Nantucket for buying and selling salvaged building materials from deconstructed buildings?
- What is the biggest obstacle for working on structures with historical designation?
    - (Specify policies that raise costs, long time periods for construction work, societal pushback of how Toscana manages waste)
- Does Toscana have any ongoing relocations/demolitions?

Wrap-Up Questions

- What other organizations on the island do you work with?
- Is there anything else about Toscana or its work that would be beneficial for us to know going forward?
- Is there anyone else that you think would be beneficial for us to speak with as we move further into our project?
- Thank you!

Appendix K - HDC Interview Script

Main Questions

- What is the HDC's position on demolition, deconstruction, and salvage on Nantucket when it comes to historic properties? Non-historic properties?
- What are the biggest obstacles for preserving structures, limiting demolition, and promoting moving/reuse of structures, especially those with historical designation?
    - What policies and best practices has Nantucket already tried to overcome these obstacles?
    - What other programs or legislation do you think Nantucket should put in place to prevent demolitions, promote deconstructions, and reduce the amount of C&D waste generated on-island?
- Do you feel that a more streamlined process for homeowners to preserve their houses would help to discourage demolition?
- Are there any incentives (tax breaks for example) available for homeowners who preserve historical structures to take advantage of? (and how do they work?)
- Do you think that an increase in the fee to obtain a demolition permit would encourage preservation and salvage?
    - How high would that fee need to be?
- We know that you approve CoAs for structures with conditions (under staff approval). What are some of the usual conditions, and how do you handle people who repeatedly do not meet those conditions?

Wrap-Up Questions

- What other organizations on the island do you work with?
- Is there anything else about the HDC or its work that would be beneficial for us to know going forward?
- Is there anyone else that you think would be beneficial for us to speak with as we move further into our project?
- Thank you!

Appendix L - NHC Interview Script

Main Questions

- What is the NHC's position on demolition, deconstruction, and salvage on Nantucket when it comes to historic properties? Non-historic properties?
- What policies, programs, and regulations do you think should be put in place to reduce the amount of C&D waste generated on-island and to promote house moving, deconstruction, and salvage instead?
- What are the biggest obstacles for preserving structures, limiting demolition, and promoting moving/reuse of structures, especially those with historical designation?
    - What policies and best practices have other towns developed to overcome these obstacles?
- We are aware that there is a class being held by the Nantucket Association of Real Estate Brokers in conjunction with the NHC in Spring 2022 with the goal of bringing awareness for the already existing Historic Preservation Tax Credits. What other incentives can Nantucket implement for homeowners who preserve historical structures/fixtures?
    - How effectively would an increase in the demolition permit fee encourage preservation and salvage?
        - How high would that fee need to be?

Wrap-Up Questions

- What other organizations on the island do you work with?
- Is there anything else about the NHC or its work that would be beneficial for us to know going forward?
- Is there anyone else that you think would be beneficial for us to speak with as we move further into our project?
- Thank you!

Appendix M - Building Coordinator Interview Script

Main Questions

- What is the process that a homeowner goes through to get a building permit after they have HDC approval?
    - Is this just a formality or is there any reason a homeowner could have their building permit rejected?
    - Are there any differences for demolition, deconstruction, move on, move off?
- How many building permits get issued in a year on average?
    - If there is permit approval, how long does that approval last?
    - What are some things that are often missed in applications?
    - How long does it take to get approved?
- Are there any policies that call for new structures to be built in such a way that they could be easily deconstructed?
        - What are the specifics of the demo delay bylaw?
- How much available space is left to build on the island?
- What are the fees for demolition/relocation/etc.?
- Do you think that an increase in the fee to obtain a demolition permit would encourage preservation and salvage?
    - How high would that fee need to be?
- Are there any building demos or moves that are going on right now?

Wrap Up:

- What other organizations on the island do you work with?
- Is there anything else about your work as the Building Coordinator that would be beneficial for us to know going forward?
- Is there anyone else that you think would be beneficial for us to speak with as we move further into our project?
- Thank you!

Appendix N - Realtor Interview Script

Main Questions:

- When getting your realtors license in Nantucket, are there any required programs that you need to take to sell historic homes? Or is it just general courses for Massachusetts realty?
    - If yes, is there any emphasis on selling historic homes with the intention of restoring and/or preserving them?
    - If not, do you believe there is enough intricacy to this practice that it should be taught to new Nantucket realtors?
- What additional information do you get from that class?
- What has been your experience with selling historic houses?
    - Are these homes being sold to people who want to remodel/renovate them?
    - Do people tend to buy properties just to rebuild on the land?
- Are realtors ever involved in the advertising process for homes that a homeowner wants to move off a piece of land?
    - If yes, how does this process work?
    - How effective is it?

Wrap up:

- What other organizations on the island do you work with?
- Is there anything else about the Nantucket Association of Real Estate Brokers or your work that would be beneficial for us to know going forward?
- Is there anyone else that you think would be beneficial for us to speak with as we move further into our project?
- Thank you!

Appendix O - House Restoration Interview Script

Main Questions

- What process did you have to go through to obtain the permits you need to deconstruct and do the rehabilitation work?
- Is the house being restored using new or reclaimed materials?
    - How are you getting the reclaimed materials?
- Looking at the building plans, you are adding onto the front of the house; is this something that had been a part of the house before or is this a completely new addition?
- What is being done with materials you salvaged but are not using in the renovation?
- How did you locate contractors interested in historical preservation?
- What is your motivation for restoring a historic home like 6 Gull Island?
    - Do you have any connection to the 6 Gull Island home?
- How is a restoration project like this funded? (if comfortable answering)
- How did you get into restoring historic properties?
    - Do you have any ideas for how to get more people into this field?
- How many properties have you restored?

Wrap-Up Questions

- Are you working with any organizations or (building) companies on the island?
- Is there anything else about your deconstruction and restoration work that would be beneficial for us to know as we continue our project work?
- Is there anyone else that you think would be beneficial for us to speak with as we move further into our project?
- Thank you!

Appendix P - Builders' Association Interview Script

Main questions

- What is the Nantucket Builders' Association's position on deconstruction versus demolition of structures on Nantucket?
- Which current C&D policies would you like to see change?
    - How would those changes alter current costs for builders and homeowners?
- Are there many builders on the island that are deconstructing historic structures and using the salvaged materials?
    - If any material can be saved during a deconstruction, where are the salvaged materials going to be reused (i.e., holding area or market)?
    - Are these stored materials marketable in your opinion?
- Is deconstructing a building a longer/more challenging process than demolishing the structure?
    - If so, in what ways is the process longer/more challenging?
    - Is there extra cost, time, and/or labor required?
- What is the Free Firewood Program?

      Offsetting the environmental impact of removal of C&D waste, transport, and such
    - How do people get access to the firewood?
    - Is there room to expand this program for other salvaged building materials?
- On the education aspect of the builder's association is there any deconstruction education that you do already?

Wrap-Up Questions

- What other organizations on the island do you work with?
- Is there anything else about the Builders' Association or its work that would be beneficial for us to know going forward?
- Is there anyone else that you think would be beneficial for us to speak with as we move further into our project?
- Thank you!

Appendix Q - Architect Interview Script

Main Questions:

- Did you often find that clients wanted to keep the historic feel of their homes?
    - How would you help a client preserve the historical elements of their home?
    - How would you showcase the historical elements?
    - Are there cost wise benefits to restoration?
- How much of the restoration process would an architect be responsible for?
    - Are builders easy to work with in restoration?
- Have you done anything to educate clients on the historical value in their homes?
- What goes into restoring a historic structure?
- What do you think can be done to make more clients restore historic homes as opposed to demoing or relocating them to build new?
- What is the overall goal of the Historic Structures Advisory Board?
    - How does the HSAB determine what recommendations to make to the HDC?
        - What is the purpose of these recommendations (upholding historic integrity, structural issues, etc.)?
    - Does the HDC use the recommendations the HSAB makes when issuing CoA application approval with conditions?

Wrap up:

- What other organizations on the island do you work with?
- Is there anything else about your work as an architect or the HSAB that would be beneficial for us to know going forward?
- Is there anyone else that you think would be beneficial for us to speak with as we move further into our project?
- Thank you!

Appendix R - Hanley Wood Interview Script

Main Questions

- What is the goal of the Hanley Wood company?
    - How is this goal accomplished?
- Hillary Hedges Rayport told us you had some ideas for our project, and we would love to hear your thoughts on the issue.

Wrap-Up Questions

- What other organizations on the island do you work with?
- Is there anything else that you think would be beneficial for us to know as we continue our project work?
- Thank you!