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Appendix XIV

PERMITEE-OWNED PROPERTY INVENTORY AND GREEN INFRASTRUCTURE RETROFIT PLAN

Permittee-owned Properties Inventory and Green Infrastructure Retrofit Plan

Marblehead, MA

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Section 1 – Report Overview

1.1 Introduction

Bobrek Engineering & Construction, LLC (BEC), on behalf of the Town of Marblehead, MA has prepared this municipal-owned properties inventory and green infrastructure retrofit plan as required for Year 4 as part of Minimum Control Measure (MCM) 5: Post-Construction Stormwater Management in New Development and Redevelopment. The intent of this report is to identify a minimum of five (5) town-owned properties that could be modified or retrofitted with Stormwater Best Management Practices (BMPs) designed to reduce the frequency, volume, and pollutant loads of stormwater discharges.

The properties that are the focus of this assessment are town-owned parking lots, because they are typically impervious land cover. Any material or structure on or above the ground that prevents water from infiltrating the underlying soil is considered an impervious surface. Pavement or compacted gravel, which are the common material of the municipal parking areas in Marblehead, do not allow water to absorb into the soil, causing water to rapidly enter storm drains and streams, which may cause flooding or erosion. Pollutants, such as gas and oil, also accumulate in parking areas and get washed away down storm drains to then immediately enter natural systems without getting filtered out.

To mitigate the impacts of impervious cover on stormwater and water resources, Low Impact Development (LID) methods can be integrated into existing parking area designs. LID is an approach to community development and management of stormwater that focuses on the conservation of natural features, minimization of impermeable surfaces, and creation of green infrastructure to aid in the absorption and filtration of stormwater. Using green infrastructure, such as green roofs, bioswales or rain gardens, permeable paving, and preserving or reestablishing vegetation on a site, helps rain to be captured and absorbed by soil and plants, rather than relying solely on a conventional storm drain system. Parking areas can be modified or retrofitted with green infrastructure to reduce the impervious surface area and to better manage stormwater.

For this assessment, all municipal-owned parking lots were inventoried, and town officials prioritized five initial properties to retrofit with green infrastructure. The Marblehead Department of Public Works (DPW) as well as the Planning and Conservation Departments discussed drainage issues that have been observed in each parking lot, upcoming improvement projects that have been planned or there has been interest in commencing, and other criteria that would make the parking lots feasible for retrofit projects in the next few years. The parking lots were scored on these criteria in a checklist (Appendix A) to gauge the needs of each parking lot and the feasibility of implementing a retrofit project. Five sites were then subjectively chosen, and recommendations are provided with Stormwater BMP options for improving the sites. Finally, a proposed schedule of implementation and maintenance plan are provided for each parking lot.

Section 2 – Inventory and Prioritization Process

2.1 Methods of Prioritization

Marblehead DPW provided a list of sixteen (17) town-owned parking areas. Each of these parking lots were visited and surveyed for existing stormwater infrastructure and signs of drainage issues, such as pooling or erosion. The slope of the sites and the adjacent properties were also concerns when considering how the site drainage could be improved.

Next, town officials from the DPW, Planning Department, and Conservation Department reviewed the information that was collected through the site visits and offered more background about known drainage issues and already planned redevelopment projects on or near these sites. To organize this information about the inventoried parking lots, a scoring system was created to aid in prioritizing the properties for future retrofit projects. Scores were given to each parking lot for the following factors which affected how they were ranked for future green infrastructure improvements: Waterbody Impairment, Site Redevelopment, and Drainage Issues.

The Waterbody Impairment score reflects the contamination of the water body or priority of the outfall to which the site drains. The highest score of two (2) is given to sites where the connected outfall has tested high with contaminants with the most recent outfall data. A score of one (1) is given to sites within a problem catchment area, such as the Riverhead catchment area. A score of zero (0) goes to a site that drains to an outfall that has no known contamination or is low or medium priority.

The Site Redevelopment score demonstrates the town's interest or plans to redevelop a site. A score of two (2) means that plans are already in place for improving the site. If plans are already in place, it becomes more feasible to add green infrastructure concurrently. A score of one (1) goes to parking lots that town officials are very interested in making improvements, either because of drainage issues or they see some other benefit or opportunity. A score of zero (0) goes to sites where no redevelopment projects are planned and there is no interest currently for prioritizing a project.

The Drainage Issue score indicates the observed issues with drainage at each parking area. A score of three (3) represents both flooding and erosion, two (2) represents known flooding, one (1) represents signs of erosion, and zero (0) represents no known drainage issues.

The Total Score is the cumulation of all three scores. The score is used as guidance for prioritizing the sixteen sites, where higher scores tend to have a higher prioritization. However, the final determination is a subjective decision made by town officials.

2.2 Priority Parking Areas for LID Modifications

The list of sixteen town-owned parking areas were narrowed down to five that will be retrofitted with green infrastructure beginning in Year 5 of the MS4 permit.

2.2.1 Village Street Lot

This parking lot is the parking area for the Village Street Public Landing. It is a large gravel parking lot that slopes towards the neighboring property which has experienced flooding in the past as a result. There are three catch basins that are unmapped in the Marblehead GIS system on the site. The catch basins are likely to connect to those in the street that drain to OF29 (Previous ID-1997), which is a high priority outfall with high bacteria counts found in 2021 screenings. There are existing islands of vegetation between parking rows that may currently aid in reducing the rate of stormwater discharge. The Harbormaster also has plans to improve the site soon, therefore additional LID improvements could be implemented simultaneously.

2.2.2 Abbot Library

The paved parking area behind the Abbot Library slopes down from the street into a low-lying area. Signs of pooling stormwater are apparent by a double catch basin several feet away from the side of the brick

building. There is a long catch basin on the sloped driveway that also connects to this lower catch basin. Also, the rain gutters on the library empty into this parking lot which may also be contributing to the flooding. At the far end of the parking lot and behind the library is a garden that is elevated above the pavement. Within the garden may be a buried or covered drainage manhole, as they were mapped in the GIS system but not found upon initial inspection of the site. The stormwater from this site eventually drains to the double outfall at Riverhead Beach, which has been prioritized due to a history of contamination. The town does have plans to redesign the parking area, so this site would be a good candidate for adding green infrastructure.

2.2.3 Marblehead Light Department

The municipal light plant parking area has had recent updates with the addition of granite curbing, vegetated islands, and two bioretention sites at the bottom of the slope on either side of the parking lot. One of the retention areas without a catch basin does not appear to be effective due to signs of pooling and erosion on the adjacent pavement. The second retention area with a catch basin could also be improved due to observed staining from pooling on the pavement that seems to overflow to a second catch basin beside the building. This catch basin is downslope from the building's rain gutter, which is causing mulch to be eroded and discharged down the drain. All the catch basins on this site drain immediately to a high priority ranked outfall on the other side of a retaining wall. There are currently no design plans for this site, but the town is interested in resolving the drainage issues.

2.2.4 Roundhouse Road Lot

The parking area on Roundhouse Rd is a long, narrow, paved lot with two steep slopes of rock and vegetation coming down from the street and neighboring properties. These slopes have visible erosion, seen notably on the slope coming down from Anderson St. The parking lot is slightly sloped going down towards School Street with no catch basins despite the storm drain running down the length of the area. There are several drain manholes in the middle of the parking area. The lot is located within the Riverhead catchment area, which is ranked as high priority for improving the quality of stormwater. While there are no plans to make improvements on the site, there is a strong interest in this site for adding green stormwater infrastructure.

2.2.5 School Street

The parking lot behind the restaurant School Street is a small, paved area that seems to partially drain towards a catch basin next to a building on the neighboring property. There is also a second long catch basin at the top of the driveway next to the street. These catch basins and drainpipe need to be investigated and mapped more accurately. There does not seem to be erosion, but the vegetation around the perimeter of the site seems to be overgrown and not maintained. While there is no schedule work for this parking lot, there is construction planned at the Shrine of St. Nicholas, the neighboring property. It could be beneficial to also improve this site around the same time as this other planned work.

Section 3 – Low Impact Development Infrastructure (LID) Considered

The following LID stormwater management techniques are encouraged by the Environmental Protection Agency (EPA), Metropolitan Area Planning Commission (MAPC), Massachusetts Stormwater Handbook, the Greenscapes LID Toolkit, and other stormwater management experts and advocates.

3.1 Bioretention Areas

Bioretention areas are a method of stormwater management that uses soil, plants, and microbes to filter runoff before it infiltrates as groundwater or is discharged. These areas are usually depressions in the ground filled with sand or gravel and topped with mulch as a substrate for dense plantings. They are typically designed to hold 6-8 inches of ponded water, and some have an overflow outlet to prevent flooding during heavy rain. Bioretention areas are effective at removing pollutants, such as phosphorus, nitrogen, metals, organics, bacteria, and suspended solids. Not only do they improve water quality and slow the discharge rate, bioretention areas also can be aesthetically pleasing, offering landscaping within impervious areas. A rain garden is a simplified bioretention technique that is usually smaller and shallower, using plants such as grasses and flowering perennials[1].

Bioretention areas should be inspected, cleaned of debris or dead vegetation, mulched, fertilized, and pruned on a yearly basis. They should also be mowed as needed throughout the year[2].

3.2 Porous Pavement

Porous or permeable paving can replace impermeable concrete or pavement. Permeable paving allows rainwater to percolate through and absorb into the subsoil, reducing the amount of stormwater runoff. Since the volume of water can be reduced with water infiltrating into a porous surface so can the amount of pollutants that get washed down the storm drains. Types of permeable paving include porous asphalt or concrete, paving stones, or other alternative "grass" pavers made of concrete or plastic grids that can hold soil for grass growth[3].

Porous pavement or pavers require regular maintenance and monitoring as needed to ensure it is draining properly. They should be power washed to remove clogs and vacuum swept to remove the dislodged sediment. Any joint material between pavers should also be replaced[2].

3.3 Vegetated Filter Strips

Grass filter strips can be installed next to impervious areas, such as parking lots or buildings, to slow sheet flow and provide pretreatment of runoff by removing suspended solids. They can be constructed as a low-angle, grassy slope along the length of a small- to medium- sized parking lot to filter the stormwater before reaching a bioretention area, vegetated swale, or a buffer strip. Filter strips are built as planar or convex to prevent the flow from concentrating and channeling[4].

Annually, filter strips should be inspected for sediment build-up, erosion, and overall health of vegetation, with more attention during the first year of establishment. The grass should be regularly mowed, and sediment should be removed from the toe of the slope as needed[2].

3.4 Catch Basin Filters and Hydrodynamic Separators

Stormwater filtration devices can either be inserted into existing catch basins or be installed as retrofits to remove contaminants in stormwater runoff. Catch basin inserts can be placed directly into catch basins or be retrofitted in the place of catch basins. The devices accumulate sediment and debris to be collected and disposed of. Hydrodynamic separators are a type of stormwater inlet device that can be retrofitted in

[1] LID Toolkit Factsheets (mapc.org)
[2] MA Stormwater Handbook Volume 2 (mass.gov)
[3] Fact Sheet: Permeable Paving – MAPC
[4] Fact Sheet: Grass Filter Strips – MAPC

the place of a catch basin, and they are cylindrical chambers that swirl the stormwater as it enters to settle out sediment. Some hydrodynamic separators also have a chamber for oil and other chemicals or objects that float.

Catch basin inserts and hydrodynamic separators are typically used in areas with limited space for other stormwater BMPs. The sediment trapped in filters is typically removed manually and in separators with vacuum trucks[5].

3.5 Stormwater Tree Box Filters

Stormwater tree boxy filters consist of above ground plantings, such as street trees, as well as underground concrete structures that can be interconnected and are filled with mulch soil and root systems where water can be infiltrated. The filtered water then can either recharge as groundwater if its site-appropriate, or it can be discharged into another storm drainage system via an underdrain[6].

Each year, the tree should be checked for health and pruning. Twice a year, soil or mulch should be raked to make sure water can drain. If the tree needs to be replaced, the gravel, soil and mulch should also be replaced[2].

3.6 Water Quality Swales

Water quality swales, or bioswales, are graded depressions that consist of trees, vegetation, and soil which filter, absorb and slow runoff before it enters a storm drain system. The longitudinal slope of bioswales allows water to slowly move across the surface to allow pollutants to settle out. Bioswales can be incorporated into medians, cul-de-sacs, curb extensions, or vegetated islands of parking lots[7].

Vegetated swales should be inspected annually for clogging of pretreatment areas, erosion or gullies, and trash and debris. Seasonally, the grass should be mowed to maintain a height of three to four inches. As the vegetation is being established in the first year, the vegetation health should be monitored and replaced with alternative grass species as necessary. If water is ponding, the swale may be rototilled as needed. Sediment may also need to be removed if it is accumulating to greater than 25% of the original design[8].

3.7 Planter Boxes

Raised planter boxes are retaining and filtering systems for stormwater runoff. A common use for planter boxes is to collect runoff from roofs since they can be placed along the side of buildings due to their compact size. They have four vertical walls with either open or closed bottoms. Typically, the boxes are lined with permeable fabric, filled with gravel or stone, and topped with soil and plantings. Planter boxes may also have an underdrain or overflow pipe to connect the runoff to the drain system if the site does not allow infiltration below[9].

[5] NPDES: Stormwater Best Management Practices, Stormwater Inlet Controls (epa.gov)
[6] Stormwater Planter | Charles River Watershed Association (crwa.org)
[7] Bioswales | National Association of City Transportation Officials (nacto.org)
[8] NPDES: Stormwater Best Management Practice, Grassed Swales (epa.gov)
[9] Stormwater Planter | PhillyWatersheds.org

Planter boxes should be inspected monthly to make sure the inlet and outlets are flowing and sediment is not accumulating. It should also be inspected for trash and plant health and be pruned back as necessary[10].

Section 4 –Recommendations

4.1 Village Street Lot

The flooding on the neighboring property could be prevented with LID techniques. For example, a bioswale that can run down the entire length of the fence would capture the sheet flow of the parking area, filtering the runoff before entering the existing catch basins. The existing vegetated islands, which are acting as grass filter strips, may also be improved with additional bioswales or perhaps even interconnected tree pits that are also connected to the storm drain with an underdrain.

4.2 Abbott Library

Compact LID techniques were considered for the library parking area since space is limited and it is closely abutting the building and neighboring properties. Planter boxes could be installed along the length of the building to temporarily store and filter the rainwater exiting the gutters that are contributing to the flooding. Permeable paving could be an option for slowing down and absorbing the water depending on the filtration characteristics of the soil on the site and the water table. The existing curb bump out as one enters the parking lot could be modified as a bioswale or tree box filter. The perimeter of the parking area, if space allows, could also be retrofitted with a bio swale to filter and slow the conveyance of water to the storm drain. The catch basins at the bottom of the driveway that collect most of the water could be modified into a rain garden with an overflow catch basin to slow the discharge rate. The rain garden could be an aesthetic addition to the existing garden and be an educational opportunity for visitors. However, the proximity to the building, soil characteristics, and water table must be factored into the final design.

4.3 Roundhouse Road Lot

Each side of the parking area currently acts as a vegetative buffer since it includes dense vegetation and trees. However, the steep slope must be additionally stabilized, or the stormwater diverted on Anderson Street to prevent erosion of this slope. Along the length of the sides of the parking lot could also have bio swales or tree pits. Vegetated islands with bio swales going perpendicular to the slope of the pavement could also slow the flow of water going down the length of the parking area. The drain manholes in the middle of the parking lot could also be retrofitted with hydrodynamic separators to help collect sediment, oil, and grease. The grassy area at the bottom of the slope that contains the granite blocks could be modified into a rain garden with an overflow catch basin. The addition of green infrastructure in this area could drastically improve the aesthetics and stormwater management of Roundhouse Road.

4.4 Marblehead Light Department

The two retention areas at the bottom of the sloping parking lot should be redesigned to better collect and contain stormwater. The depths of the beds are very shallow and may be dug deeper if it is appropriate for the site. The retention areas should also be planted with more dense vegetation to aid in absorbing and filtering the stormwater. The garden beds and curbed islands could be modified into bio swales with curb cuts or planter boxes that prevent washout of the mulch and soil. The catch basin at the

[10] https://www.3riverswetweather.org/green/green-solution-planter-box

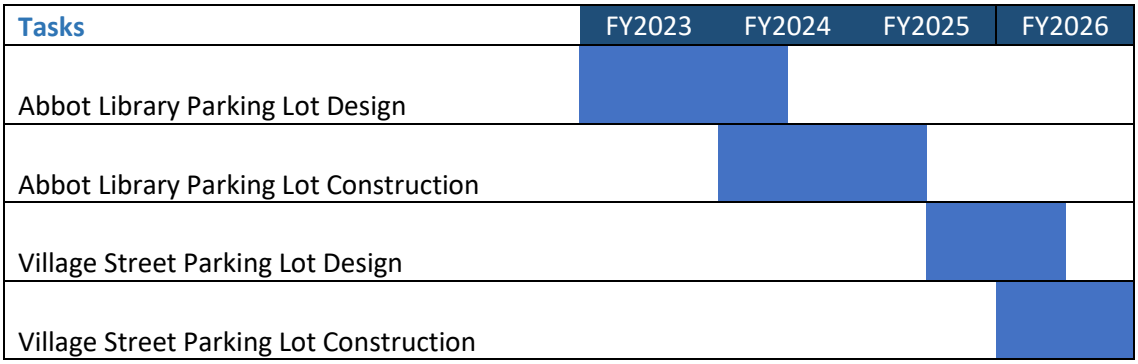
bottom of the parking lot on the corner of the building could also be retrofitted with a filtration insert, since there are signs of sediment on the pavement left by stormwater entering this catch basin.

4.5 School Street

The parking lot behind School Street may be a good candidate for permeable paving, because it is small and low traffic. A bioswale or tree pit system could be constructed around the perimeter that leads to one of the catch basins on the site.

Section 5 – Schedule of Implementation

The following table shows the schedule for implementing the redevelopment plans for the parking areas of highest priority:



The Abbot Library parking area will be a 2.5 year project that will consist of a design phase and a construction phase, with the goal of being completed by FY 2025. The Village Street parking area is the next retrofit project prioritized by the town, which the Town aims to be started by FY2026. The Town of Marblehead will assess which parking areas will be designed and retrofitted next while preparing the Capital Improvement Plan.

Section 6 – Conclusion

The Environmental Protection Agency (EPA) is encouraging municipal separate storm sewer system (MS4) communities to begin planning and implementing Low Impact Development (LID) practices within municipal-owned properties. These green infrastructure projects will set a precedent for the town as well as private developers to also integrate LID stormwater management into site designs throughout the town of Marblehead. LID practices, such as bioretention areas, bioswales, and porous pavement, slow the rate and volume of stormwater while also filtering it, taking pressure off natural water resources. There are also many other community benefits such as improved aesthetics, educational opportunities, and improved air quality that make green infrastructure a great alternative to conventional stormwater management systems. The town should initiate planning the future fiscal budgets to consider a capital improvement project on one of the following two sites:

6.1 Village Street Lot

The Village Street Lot would benefit from green infrastructure improvements that could be executed along with other improvement plans by the Harbormaster. This site was ranked high by the scoring system detailed in the Prioritization Process section. The large, gravel parking lot contributes to flooding

on the neighboring property and the stormwater that leaves the catch basin on site directly drains to a high priority outfall. A bioswale along the entire length of the fence at the bottom of the slope is recommended at a minimum to address the drainage issues.

6.2 Abbott Library

Stormwater concentrates at a low point in the parking area behind the Abbot Library, causing flooding during heavy rain events at a catch basin directly next to the building. The parking lot was ranked as high priority due to these drainage issues. The designs for the new parking lot should be modified to implement planter boxes along the building to handle the rain gutter runoff and bioswales along the perimeter and in the curb bump out to slow the rate and volume of stormwater discharge. The catch basin receiving most of the sheet flow may also need to be replaced with a rain garden with an overflow catch basin to slow the discharge rate while preventing flooding.

Appendix A – Site Inventory and Prioritization Checklist

Marblehead Municipal Parking Lot Inventory and Assessment

Prioritized in Year 4	Prioritization Score	Parcel Number	Property Name	Property Address	Reponsible Department	Current Site Use	Waterbody Site Drains To	Waterbody Impairment Score	Waterbody Impairment	Site Redevelopment Score	Site Redevelopment Planned	Drainage Issues	Recommended BMP
*	7	104-23-0	Village St Lot	0 Village St	Harbor & Waters Board	Public Parking for Village Street Public Landing	Salem Harbor	2	High Enterococci (OF29), High Priority Outfall	2	Yes, Harbormaster has plans	3	bioswale, bioretention basin, vegetated islands
*	6	86-47-0	Abbot Library	235 Pleasant St	DPW	Public Parking for Abbot Library	Marblehead Harbor	2	Riverhead Catchment	2	Yes	2	planter boxes, bioswales, rain garden
*	3	113-22-0	Muncipal Light Plant	80 Commercial St	DPW	Parking for Municipal Light Plant	Marblehead Harbor	1	High Priority Outfall Ranking	1	No	1	bioretention areas, planter box, filtration insert, bioswales
*	5	117-56-0	Roundhouse Rd Lot	0 School St	DPW	Public Parking for downtown and commuter parking	Marblehead Harbor	2	Riverhead Catchment	1	No	2	bioswales, hydrodynamic separator or catch basin installed with filtration insert, rain garden
*	3	116-63-0	School Street Lot	0 School St	DPW	Public Parking	Marblehead Harbor	2	Riverhead Catchment	1	No	0	permeable paving, bioswales, tree pit
	2	113-17-0	Parker's Boatyard	3 R Redstone Ln	Harbor & Waters Board	Boatyard	Marblehead Harbor	1	High Priority Catchment	0	No	1	
	1	113-24-0	Yacht Club	6 A Cliff St	Harbor & Waters Board	Boatyard	Marblehead Harbor	1	High Priority Catchment	0	No	0	
	2	96-51-0	Police Station	11 Gerry St	DPW	Parking for Police Station and Church	Marblehead Harbor	2	Riverhead Catchment	0	No	0	
	3	92-2-0	Deveraux Beach	0 Ocean Av	DPW	Parking for beach and playground	Marblehead Harbor	2	Riverhead Catchment	0	No	1	
	2	71-26-0	Widger Rd Lot	7 9 Widger Rd	DPW	Parking for municipal building	Marblehead Harbor	2	Riverhead Catchment	0	No	0	
	0	167-18-0	Fort Sewall	166 Front St	DPW	Visitor parking for Fort Sewall	Marblehead Harbor	0		0	No	0	
	2	148-60-0	Landing	75 Front St	DPW	Public parking downtown	Marblehead Harbor	2	High Enterococci (OF70), High Priority Outfall	0	No	0	
	2	923-8-0	Lighthouse Ln	0 Lighthouse Pt	DPW	Public Parking for Chandler Hovey Park	Marblehead Harbor	2	High Enterococci (OF86), High Priority Outfall	0	No	0	
	2	59-10-0	Gatchell Park	0 Lafayette St	DPW	Public Parking for sports fields	Marblehead Harbor	2	Riverhead Catchment	0	No	0	
	2	61-15-0	High School	2 Humphrey St	DPW	Parking for Marblehead High School	Marblehead Harbor	2	Riverhead Catchment	0	No	0	
	2	97-30-0	Middle School	217 Pleasant St	DPW	Parking for Marblehead Middle School	Marblehead Harbor	2	Riverhead Catchment	0	No	0	
	0	82-2-0	Brown Elementary School	40 Baldwin Rd	DPW	Parking for Brown School	Intermediate	0		0	No	0	

0- not impaired
1- Outfall/ Catchment Ranked High Priority
2- Tested High Bacteria

2- Redevelopment planned
1- Town interest in redevelopment
0- no redevelopment planned

3- Flooding and erosion
2- Flooding/ Pooling
1- Erosion
0- no known issues

Appendix B - Photo Log

Village Street Parking Lot

Parking area slopes towards neighboring property along the fence, causing flooding.

Along the fence, a structural BMP such as a bioswale may be installed to collect, infiltrate, and guide stormwater to catch basins.

Existing double catch basin at the bottom of the sloped, gravel parking lot.

Another catch basin by the entrance of the parking lot. These drain to a nearby priority outfall.

Abbot Library

Water pools at the catch basins next to the library building. An elevated garden area at the far end of the lot could potentially be utilized for green infrastructure.

Complaints of flooding in this parking area make it a high priority for redevelopment.

A long catch basin on the steep sloped driveway collects some runoff from the street. On the left, a vegetated island could be utilized for green infrastructure.

The building's gutter system discharges to the parking lot. Planter boxes could be placed along the edge of the building to collect and slow the discharge of roof runoff.

Neighboring properties are close to the edge of the parking area, and the slope of the parking areas goes towards the library building.

Roundhouse Road

There are no catch basins or stormwater controls on this site. A vegetated island at the bottom of the parking lot could be utilized for green infrastructure.

There is existing green space along the edge of the parking area that could be used for a bioswale.

The steep slope along one edge is eroding.

A drainpipe runs through the length of the parking lot, allowing for the opportunity to add stormwater infrastructure.

Marblehead Light Department

The parking area slopes down towards the harbor, with two catch basins on the paved section of the lot.

One of two bioretention areas that appears to not infiltrate due to signs of sediment setting on the pavement.

The building's gutter system discharges to the parking lot, causing erosion of the mulch in the garden bed. The bioretention area at the far end also seems to drain to the catch basin, causing discoloration of the pavement.

The second bioretention area does not seem to collect and infiltrate runoff effectively. An overflow catch basin also exists in this area.

Café Italia

There is one catch basin in this parking area next to a neighboring building. There is another long catch in the driveway next to the main street.

The parking area is small with some green space along the perimeter.