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To: Sharon Rooney and Heather McElroy, Cape Cod Commission
CC: Tamara Mitten, U.S. EPA; John Kosco, Tetra Tech
From: Tham Saravanapavan and Russ Dudley, Tetra Tech
Subject: Contract EP-C 11-009, Cape Cod
Constructability Assessment of Potential Project Sites

The Cape Cod Commission (CCC) utilized the previously developed siting criteria matrix tool to identify potential sites for low impact development (LID) and green infrastructure (GI) technologies. A total of 17 parameters were used as positive siting criteria within the tool and several sites were identified that contained 8 or more of these parameters. After careful analysis of the tool results, 14 sites were selected for further feasibility assessment within the field. These 14 sites were located in environmental justice communities in both Barnstable and Yarmouth. Potential siting constraints were evaluated during the field assessment rather than in the tool.

Following the field assessment, CCC and Tetra Tech collectively reviewed the 14 tool-identified sites to select 6 potential GI or LID sites. These 6 sites were split evenly between Barnstable and Yarmouth. Based on GIS data of the sites and information provided by CCC from field assessments, Tetra Tech performed a constructability assessment of the 6 potential sites, evaluating a variety of physical, social, and economic factors. The constructability assessment of each of the 6 potential sites is presented within this memo. Pictures from the field assessments (if available) are presented along with aerial imagery obtained from Google Earth for each of the six sites. A discussion of the physical, social, and economic considerations is included based on an evaluation of factors by both CCC and Tetra Tech. This evaluation leads to a constructability assessment to determine the feasibility of implementing GI or LID techniques on each site. This assessment does not select specific techniques to be implemented; it discusses the potential for implementation and any potential barriers to be resolved.

1 South Street – Barnstable

Both the Anchor-In Hotel (at 1 South Street) and an adjacent public boat ramp appear to be suitable for small scale LID techniques.



Physical Considerations

This site is located within a highly urban area and is bounded by the Hyannis Harbor. Although this results in potentially greater treatment it limits the size of GI or LID techniques. The Anchor-In Hotel has a high percentage of impervious area and a minimal amount of available open space, limiting the options to small scale LID techniques. There is an open, unused parcel as part of the public boat ramp but it has a small footprint, considerable land slope, and is contained by a bulkhead. The drainage area for this site is currently unknown but the field visit identified a ~24" stormwater outfall within the bulkhead.

Public Outreach and Education Considerations

The location of the boat ramp on the Hyannis Harbor, near both the Hyannis-Nantucket Ferry and the Hyannis Marina, results in high visibility and an opportunity to provide public exposure to GI techniques.

Economic Considerations

Anchor Inn is privately owned; any proposed techniques would require support from the landowner which could be difficult at this site. The boat ramp is publicly owned and although property is highly valued in this area, the site identified is small and would not impact other uses.

Constructability Assessment

This site has a high potential for small scale LID techniques to treat stormwater runoff from the surrounding parcels.

4 Bay View Street – Barnstable

The Cape Cod Hospital employee parking area contains an extensive impervious area along with a large, mounded, unused median.



Physical Considerations

At ~6,500 SF, the grassy median area is large enough to support LID techniques to address stormwater runoff from the parking area. A further examination of the site topography and stormwater infrastructure is needed to determine the potential treatment area available. As shown in the aerial photography, the southern parking area appears to be in need of repair; future rehabilitation of the parking area could help direct more runoff to the median. The Zone II boundary and cranberry bogs in the SE corner of the site would need to be delineated to ensure that any potential techniques proposed in the open area south of the parking area would avoid these areas.

Public Outreach and Education Considerations

The Cape Cod Hospital is a single entity with a large amount of impervious area. Treating this impervious area with LID techniques would serve as a model of community responsibility.

Economic Considerations

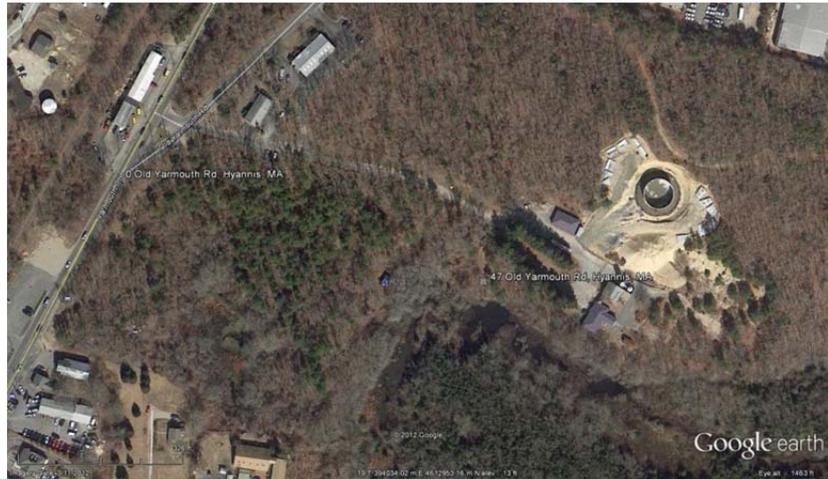
By utilizing unused areas of a parking lot, it is assumed that land costs would be negligible. Tying into an already existing stormwater network or re-grading/re-paving areas to expand the treatment area could lead to increased retrofit costs. These potential costs can be minimized by using in-situ design methods.

Constructability Assessment

This site has a high potential for a small scale LID technique to treat stormwater runoff from the employee parking area, assuming runoff could be directed to the median area. Wastewater could potential be addressed in the SE corner of the site by intercepting groundwater but the groundwater source load is unclear at this location.

0 and 47 Old Yarmouth Road – Barnstable

Both 0 and 47 Old Yarmouth Road are fairly open parcels located near a major arterial roadway and large impervious areas.



Physical Considerations

These sites are located within a drinking water supply area, limiting the suitability for infiltration techniques. Significant open area is available surrounding the drinking water tower and a major arterial roadway and quasi-industrial area is located nearby, providing a potentially high source load. Further investigation of topography and any stormwater infrastructure is needed to determine if runoff could be directed to these sites. An investigation into groundwater flow would also help determine if GI techniques could be implemented to intercept and treat groundwater before it reaches the drinking water wells.

Public Outreach and Education Considerations

These sites have very minimal public exposure.

Economic Considerations

There should be enough open area surrounding the drinking water tower to place a small LID technique without impacting land costs and to avoid major retrofit costs. Any larger facility would potential impact usable land. Significant costs could also be incurred to direct water to the LID facility.

Constructability Assessment

Although these sites have a large amount of open space and a potentially large treatment area, directing flows to the site could be difficult. Also, the location within a drinking water supply area significantly limits the type of suitable techniques. Depending on the stormwater and groundwater flow paths, a GI technique such as a constructed wetland could be implemented outside of the drinking water supply area.

122 Camp Street – Yarmouth

This site consists of condo units as part of an affordable housing project. The site is ~50% developed and includes a RUCK wastewater system with high O&M costs.



Physical Considerations

Since the majority of the site is not yet developed, there is significant opportunity to integrate LID or GI techniques into the future development plans. An investigation of any stormwater infrastructure would be necessary to properly locate any treatment techniques. This site is also adjacent to the 47 Old Yarmouth Road site, which contains several drinking water wells.

Public Outreach and Education Considerations

With more than 100 total housing units planned, this site represents a high exposure area within an environmental justice community.

Economic Considerations

Since this site is privately owned and yet to be fully developed, any potential GI or LID technique will have to be sited with input from the developer. Although it is outside of the scope of this project, working with the developer to help address the high operation and maintenance costs associated with the existing RUCK system might provide a financial incentive to implement alternative treatment techniques.

Constructability Assessment

Implementation in this area is dependent on buy-in from the developer. Since the majority of the site is not currently built out, there are great opportunities available for several GI or LID techniques.

669 Route 28 (Drive-in) – Yarmouth

This site is a former drive-in movie theater where historic wetlands were filled with poor-quality soil. The site is currently unused but redevelopment plans have been discussed.



Physical Considerations

The former parking area represents ample open space to implement a LID or GI technique although this area is partially located within a hazardous floodplain. A high groundwater table prevents the implementation of infiltration-based stormwater LID techniques but is highly suitable for GI techniques that intercept groundwater, such as constructed wetlands or permeable reactive barriers. The fact that historic wetlands were once present on the site makes this type of technique more desirable. The location along a channel running from Swan Pond to the coast makes this area a high priority for treatment.

Public Outreach and Education Considerations

The existing drive-in is a high exposure site that is currently being underutilized. Including innovative treatment GI or LID techniques into any potential redevelopment of the site would greatly expand the public perception of these types of techniques.

Economic Considerations

Although construction on this site could involve significant excavation and off-site removal due to the existing fill material, construction costs are lowered due to the easy access and already cleared site. Implementing a GI or LID facility (like a permeable reactive barrier with a small footprint) that would not impact future development plans would be important to reduce opportunity costs.

Constructability Assessment

Assuming it could be incorporated into the redevelopment plan of the drive-in, this site has high potential for a GI technique that treats stormwater runoff and intercepts and treats groundwater flows. If the necessary space is not available as part of the redevelopment, a smaller LID facility to treat stormwater only could be implemented.

674 Route 28 (Zooquarium) – Yarmouth

This privately owned site has been a popular marine tourist attraction for over 40 years. Water quality research is currently being performed at an on-site greenhouse.



Physical Considerations

The buildings, driveway, and parking area represent a significant amount of impervious area that can be treated. Open space is available but potential placement is limited by impervious and wetland areas on site. There is evidence of a high groundwater table on the site, limiting the use of infiltration-type LID techniques. In-situ design techniques for LID can help address high groundwater concerns and the large amount of open space available might be more suitable for vegetative buffers. No stormwater infrastructure appears to be present although a further investigation into the topography and groundwater table will be necessary to determine possible locations.

Public Outreach and Education Considerations

GI or LID techniques associated with popular tourist attractions have high visibility within the community to both residents and visitors.

Economic Considerations

This site is privately owned so any proposed technique would need approval from the property owner. Since a research greenhouse is located on site, the property owner seems committed to environmental causes and could be a strong partner. Access to the site and possible facility locations are fairly open, reducing the cost to retrofit the site. Long term maintenance responsibility should be addressed; LID techniques with low maintenance costs might provide additional motivation to the property owner.

Constructability Assessment

Assuming the property owner buys in to the project, this site represents a good opportunity for a GI or LID technique. The high groundwater table and the presence of wetlands significantly limits both the type and location of GI or LID techniques but does not exclude the implementation of a treatment technique on this site.

165 Bearse's Way – Barnstable

This elementary school has significant open space and impervious area, along with high public exposure. Additional potential at adjacent community center.



Physical Considerations

This is the only school located within the two targeted watersheds in these communities. Considerable impervious cover is present on the school site and the area is surrounded by medium density residential land, resulting in significant nitrogen sources within the treatment area. Open areas are present on the site but large GI techniques could potentially impact the usability of the site. Undisturbed forested area in the NW portion of the site and potential wetlands in the southern portion should be avoided. Several LID techniques could be implemented throughout the site without greatly impacting the existing use. A recently redeveloped community center south of the school has already implemented techniques such as bioretention and pervious pavement, additional techniques on the school site would be a natural extension.

Public Outreach and Education Considerations

Schools have very high visibility and represent excellent opportunities to promote GI throughout the community. In addition, on-site LID facilities can be integrated into environmental education curriculum for the students.

Economic Considerations

The school is publicly-owned, reducing any land costs associated with the site. Economic considerations should include any potential redevelopment or expansion planned for the site. Larger scale techniques such as constructed wetlands could incur significant construction costs due to excavation and off-site removal.

Constructability Assessment

This site is an excellent opportunity for small-scale LID practices such as bioretention or pervious pavement, or a groundwater technique such as a permeable reactive barrier. Larger techniques such as constructed wetlands will require a greater amount of open space and will incur significant construction costs.

65 Long Pond Drive – Yarmouth

This site consists of high-density residential bordered by open water, commercial area, and a driving range.



Physical Considerations

High density residential area is separated from Swan Pond by a forested buffer. Impervious areas such as roads and sidewalks within the residential area seem to discharge to grassed median areas but drainage of the large commercial area to the SE is unknown. The high quality of the forested buffer and the limited amount of open space limits the suitability for large scale techniques such as constructed wetlands. Smaller scale LID techniques can help reduce nitrogen entering Swan Pond but a further investigation into stormwater infrastructure and drainage is needed. A large open area is located SW of the residential area but any GI or LID techniques in this area could affect the existing use of the driving range. Still, if stormwater could be directed to this open area from the surrounding impervious areas, a significant amount of treatment is possible. A publicly owned parcel is located north of the residential area but this parcel is a well-established natural area and retrofits should be avoided.

Public Outreach and Education Considerations

Potential GI techniques would be located away from community centers and major roadways and have limited visibility, reducing the public exposure.

Economic Considerations

The residential area and the driving range are both privately owned and any implemented GI or LID techniques could greatly impact opportunity costs, driving up the total cost of the project.

Constructability Assessment

The limited amount of open space prevents the implementation of large scale GI techniques and encourages small-scale techniques such as bioretention. Space constraints and private ownership make siting potential techniques difficult and potentially costly but the amount of impervious area available to treat increases the priority of this site.