Retrofit Approaches

There are two major approaches to implementing stormwater retrofits – the opportunistic approach and the retrofit planning approach (SNEP Network, 2022).[67] The two approaches can be used together in a complementary fashion to develop and implement a successful retrofit program.

Opportunistic Approach

The opportunistic approach involves integrating stormwater retrofits into already planned construction projects. Retrofits are generally more cost-effective when implemented in conjunction with planned infrastructure upgrades since construction of the retrofit can be coupled with other planned site disturbance and improvements. An example of an opportunistic retrofit is incorporation of bioretention planters, roadside bioswales, infiltrating catch basins, or underground infiltration chambers into a planned roadway improvement project. This approach

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[67] Southeast New England Program (SNEP) Network. 2022. *Stormwater Retrofit Manual.* Developed in conjunction with University of New Hampshire Stormwater Center, EPA Region 1, and state agencies.

is best suited to Connecticut municipalities and the Connecticut Department of Transportation (CTDOT), who are responsible for regular planned maintenance and improvement projects. Stormwater retrofits can be incorporated into infrastructure improvements as part of municipal and state capital improvement plans.

The opportunistic approach is most effective when the project owner:

- Proactively identifies upcoming retrofit opportunities, such as construction projects identified in capital improvement plans, and includes retrofits in the planning and design of these projects.
- Develops a targeted suite of preferred structural stormwater BMPs to be used with retrofit projects, including typical details, specifications, and installation approaches that work best for the project owner.
- Selects and designs retrofits such that the BMPs can be maintained using available staff resources and equipment.
- Allows for some changes, as necessary, to the base design to maximize stormwater treatment.
- Budgets for some increases in project costs to include the retrofit in a planned improvement project as a trade-off for more costly stand-alone retrofits in the future.
- Tailors the scale and type of stormwater BMPs to the project they are being paired with. Projects that already impact grading and the drainage system likely provide additional opportunities to incorporate more sophisticated controls by allowing for changes to the stormwater system and taking advantage of mobilization of the required construction equipment. In addition, projects with larger overall construction costs may provide more opportunity to absorb relatively lower-cost SCMs.
- Seeks low-cost creative solutions as the first option. Small, inexpensive modifications to site drainage patterns can have large impacts. For example, a simple curb cut can allow stormwater runoff from an impervious area to be treated over an adjoining pervious area.

Planning Approach

In the planning approach, stormwater retrofit opportunities are identified and prioritized through a proactive planning process. This approach results in the selection of retrofits that will have the greatest water quality or other benefits at the lowest cost. The planning approach is typically most effective for identifying retrofits to meet the requirements of a permit, watershed plan, or TMDL implementation plan.

In Connecticut, the MS4 General Permits require regulated municipalities and the CTDOT to develop stormwater retrofit plans to meet the DCIA disconnection and reduction goals specified in the permit. The retrofit plan must identify and prioritize sites that may be suitable for retrofit and include a prioritized list of retrofit projects.

The MS4 General Permits also requires regulated municipalities and the CTDOT to allow for off-site stormwater mitigation when a new development or redevelopment project cannot fully meet the retention or treatment requirements on-site. The retrofit planning process can be used to identify retrofit projects that could be implemented as part of an off-site stormwater mitigation program, as described in Chapter 4 - Stormwater Management Standards and Performance Criteria. Eligible retrofits are typically located on another site within the same CT DEEP Subregional Basin or USGS HUC12 watershed (and preferably the same municipality) as the project site. The proposed retrofit project can be funded directly by the project proponent, or the project proponent can propose a fee to be paid by the project proponent to be deposited into a dedicated account of the municipality for use by the municipality to fund in whole or in part the stormwater retrofit.

Developing and implementing a stormwater retrofit plan typically involves the following basic steps:

Step 1. Identify and Quantify Goals

This first step involves identifying and quantifying specific goals for the retrofit program. Goals may include making progress towards DCIA reduction targets specified in the MS4 General Permits, pollutant reduction targets identified in a watershed plan or TMDL, installation of a specific type and/or number of retrofits, or implementing retrofits within a specified budget and timeframe. Preferences for or avoidance of certain types of BMPs, maintenance capabilities and limitations, and planned infrastructure improvement projects should be identified at this stage. Other program goals should also be identified such as flood reduction, reduced heat island effect, and other social, economic and community benefits.

Step 2. Gather Background Information and Data

The next step in the process involves gathering background information and data that are used in the desktop screening process in Step 3. Background information and data typically include:

- Aerial imagery.
- Drainage system mapping.
- Mapping of priority areas based on MS4 regulated areas, impervious cover, and water quality impairments.
- Parcel ownership and land use.
- Road classification and width for right-of-way opportunities.
- Topography/slope, soils, and other mapped physical site characteristics.

Step 3. Conduct Desktop Screening

Using the geospatial information gathered in Step 2, conduct a desktop screening analysis to initially identify potential sites for retrofits. Potential sites for consideration could be sites where a construction project is already planned or sites that could be retrofitted independently of other projects. Sites with older or ineffective stormwater BMPs can also be considered for retrofits in the form of upgrades and improvements. The initial screening process typically involves a desktop analysis to identify parcels or areas within the public right-of-way that meet certain site suitability criteria for structural stormwater BMPs (soils, depth to groundwater, impervious cover, available space, etc.), land ownership (i.e., publicly owned land often provides greater opportunity for retrofits), and other factors like public visibility and demonstration value.

Step 4. Perform Detailed Site Assessment

Once potential retrofit sites are identified, a more detailed assessment of each site is performed to verify the feasibility of retrofits, identify specific areas on the site best suited for retrofits, and identify possible stormwater BMP types. Site opportunities and constraints are identified during this process including site drainage patterns and areas, storm drainage system configuration, available space, utility conflicts, and site operations. In addition to a site walk and visual observation, the site assessment may also involve field data collection such as field survey, soil investigation (test pits, soil borings, and field infiltration testing), utility research, etc.

Step 5. Develop Design Concepts

Once the site assessment process is completed, the list of potential retrofit sites is refined by eliminating sites that are not suitable for retrofits. Retrofit concepts are typically developed for the remaining sites with the greatest potential for retrofits. Retrofit design concepts are then developed to a level of detail, often consisting of a plan view sketch and typical construction details, required to estimate benefits and costs for planning purposes.

Step 6. Estimate Benefits and Costs

Once the retrofit design concepts are developed, preliminary order-of-magnitude cost estimates are developed for each retrofit concept along with initial estimates of pollutant load reductions and/or DCIA reduction. The stormwater BMP performance curves developed by EPA and the University of New Hampshire Stormwater Center (see Chapter 4 – Stormwater Management Standards and Performance Criteria) and the section at the end of this chapter) can be used to quantify the pollutant load reduction benefit of specific BMP retrofits, as well as to inform retrofit prioritization and final BMP selection and sizing.

Step 7. Prioritize Sites for Implementation

Retrofit sites and BMPs are prioritized based on criteria that reflect the retrofit goals identified in Step 1. These criteria may include but are not limited to:

- Estimated total cost and available budget.
- Estimated pollutant reduction achieved.
- Estimated cost per pollutant reduction (i.e., cost effectiveness).
- Feasibility (ownership, ease of construction, access, physical site constraints, maintenance burden, community acceptance, etc.)

- Degree to which the retrofit achieves other goals (flood reduction, heat island reduction, reduced heat island effect, demonstration value, and other social, economic and community benefits).

The prioritization method can be quantitative (i.e., scoring and weighing factors), semi-quantitative (scoring combined with non-numeric ratings), or qualitative.

Step 8. Implement Retrofit Projects

Stormwater retrofits should be implemented (i.e., design, permitting, and construction) according to the priorities identified in the planning process as funding and opportunities become available. The final stormwater retrofit designs may be different than the concepts developed during the retrofit planning phase due to the collection and analysis of more detailed site information. During the design process, site specific survey, soil analysis, and site evaluation can present factors that may change the size, type, or exact location of the retrofit BMPs.

The opportunistic and planning approaches to stormwater retrofitting can also be combined. For example, the stormwater retrofit planning process may serve as a pipeline for retrofit projects to be included in a capital infrastructure plan, while planned capital projects may be identified for inclusion in a retrofit plan.