CHAPTER 6

Incorporating Practices into Existing Development - Retrofits

6.1 RETROFIT PLANNING

While new development may be required to manage stormwater on-site, older developments may have been constructed before stormwater management was required or modern criteria were established. Retrofits include new installations or upgrades to existing BMPs in developed areas where there is a lack of adequate stormwater treatment. Stormwater retrofit goals may include, among other things, correcting prior design or performance deficiencies, mitigating flood impacts, disconnecting impervious areas, improving recharge and infiltration performance, addressing pollutants of concern, demonstrating new technologies, and supporting stream restoration activities. Retrofits can be designed to target trash, sediment, nutrients, or other concerns. Common retrofit locations include public open spaces and large parking lots. Often, retrofits can be completed in tandem with other capital projects including roads and parks to achieve multiple benefits and manage cost.

Many grant opportunities for funding retrofit projects exist. Please see Appendix E in this guidance manual for a list of potential grant partners.

While all retrofit sites are unique and no single solution fits all, preferred practices generally provide for increased infiltration, evapotranspiration and rainwater harvesting. Practices such as these reduce stormwater runoff volume while also providing water quality and supply benefits. Retrofits that provide for infiltration (e.g., infiltration basins and trenches, bioretention systems, rain gardens, and swales) where little or no infiltration currently exists are likely to improve site hydrology. Infiltration practices also help to recharge groundwater aquifers, although practices located near public drinking water sources should carefully consider the impact of infiltrating stormwater discharges on drinking water sources. In many cases, retrofits provide an opportunity to remedy past design and/or performance deficiencies.

Depending on the water quality goals for the watershed, communities should also consider retrofitting existing BMPs to maximize pollutant removal. The retrofitting of dry detention ponds, for instance, may provide the most cost-effective approach to capture and treat large drainage areas.

Most of the content in this section is from the EPA Retrofit Guidance.

Table 6-1: Purpose of the Eight Steps in the Stormwater Retrofitting Process

Step and Purpose	Key Tasks
Step 1: Retrofit Scoping Refine the retrofit strategy to meet local restoration objectives	• Screen for subwatershed retrofit potential • Review past, current and future stormwater • Define core retrofitting objectives • Translate into minimum performance criteria • Define preferred retrofit treatment options • Scope out retrofit effort needed
Step 2: Desktop Retrofit Analysis Search for potential retrofit sites across the subwatershed	• Secure GIS and other mapping • Conduct desktop search for retrofit sites • Prepare base maps for RRI
Step 3 : Retrofit Reconnaissance Investigation Investigate feasibility of retrofit sites in the field	• Advanced preparation • Evaluate individual sites during RRI • Finalize RRI sheets back in office
Step 4: Compile Retrofit Inventory Develop initial concepts for best retrofit sites	• Complete storage retrofit concept designs • Finalize on-site retrofit delivery methods • Assemble retrofit inventory
Step 5: Retrofit Evaluation and Ranking Choose the most feasible and cost-effective sites	• Neighborhood consultation • Develop retrofit screening criteria • Create retrofit project priority list
Step 6: Subwatershed Treatment Analysis Determine if retrofits can achieve subwatershed restoration objective	• Compute pollutant removal by storage retrofits • Compute pollutant removal by on-site retrofits • Compare against restoration objective
Step 7: Final Design and Construction Assemble design package to lead to successful retrofit construction	• Secure environmental permits • Obtain landowner approval and easements • Perform special engineering studies • Put together final design package • Contract and project management
Step 8: Inspection, Maintenance & Evaluation Ensure retrofits are working properly and achieving subwatershed objectives	• Construction inspection • Retrofit maintenance • Project tracking and monitoring

Figure 6-1: Adding a Bioretention basin (rain garden) in a municipal park

Figure 6-2: Adding a bioswale at edge of a parking lot

Figure 6-3: Adding a sand filter to treat parking lot runoff

THE STORMWATER RETROFIT PROCESS

1. Evaluate the need and capacity for retrofitting in your community. Determine if your jurisdiction falls within an ongoing or planned Watershed Protection Plan or other Total Maximum Daily Load (TMDL) watersheds and identify your pollutant reduction requirements. If there are redevelopment projects in the planning stage, identify any local requirements for improving on-site stormwater management and assess grant opportunities to support the inclusion of water quality treatment into the project. See Appendix E for a list of potential grant resources.

2. Using Geographic Information System (GIS) software, institutional knowledge and construction plans as appropriate, identify potential retrofit locations at publicly-owned properties (e.g., parks, schools, and municipal maintenance yards), street rights-of-way, culverts/outfalls, and existing detention practices. Target large parking lots, rooftops, or other impervious areas (public or privately-owned) that lack stormwater management and are considered directly connected to creeks and tidal waters. Identify sites that are prone to flooding, chronic contamination, and/or have a high maintenance burden.

3. Conduct a retrofit investigation by visiting each location to verify current conditions and identify potential retrofit treatment options and constraints. Use this opportunity to verify if impervious cover on site is directly-connected to the streams or tidal waters. Eliminate sites where retrofitting is infeasible or impractical due to existing constraints (e.g., land use, environmental conditions, presence of utilities, or other limitations).

4. Develop an inventory of potential retrofit candidates, with illustrative concept sketches, site photos, and basic drainage calculations. Concept sketches can be done by hand. Once priorities have been identified, concepts can be further advanced to engineering design and construction plans.

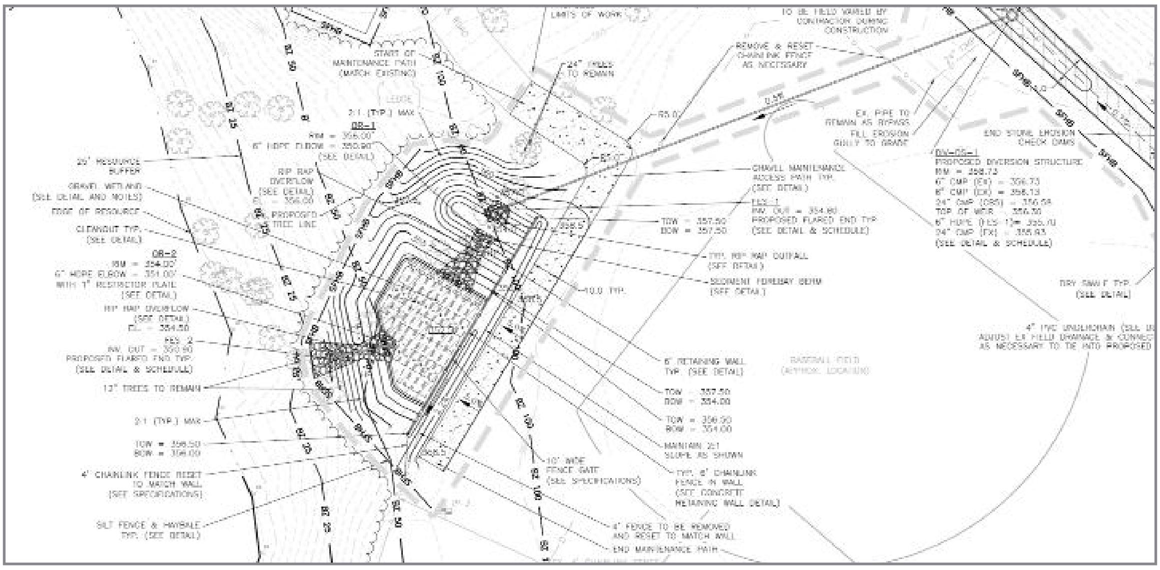

Figure 6-4: Retrofit Concept Sketch

5. Evaluate and rank retrofit concepts based on predetermined factors such as pollutant reduction requirements, BMP feasibility and performance, impervious cover disconnection, cost, visibility, property ownership, and community support. Structural control measures include practices that reduce or disconnect impervious cover, enhance infiltration, or otherwise treat stormwater. Non-structural measures include pollution prevention and source control activities (e.g., street sweeping). Retrofits should also be viewed as demonstration projects to highlight water quality management in your community.

6. Model watershed treatment benefits for various implementation scenarios to help determine the most cost-effective approaches to implementation to maximize pollution management per dollar spent. There are a number of existing public models that could be used to assist in the evaluation

of implementation scenarios including the design guidance found in Chapter 4 in this guidance manual. Other resources include the Harris County LID Manual, the San Antonio River Authority LID Manual, and the Aransas County Storm water Management Design Criteria. **At this point in time, it is appropriate to seek grant funding and/or public private partnerships to help fund the project.**

7. Take the top projects to final design and construction stages. Allow additional time to complete site surveys, necessary State and local permitting, contractor bidding and specifications, and, in some cases, generate public support. The time required to secure implementation funding will likely vary depending on the primary source of funds (i.e., stormwater utility, general or capital budgets, or grants.

8. Provide frequent and detailed construction inspection to ensure that the project is built per the design plans. Also, maintenance inspection services are necessary for the life of the retrofit to verify performance and identify maintenance issues as needed so that maintenance (mowing, sediment removal, trash collection, etc.) takes place to maximize function and appearance. The community should establish a BMP tracking system to ensure long-term maintenance of existing and retrofitted facilities.

CASE STUDY

TULE CREEK WEST: SEDIMENT TRAP POND, BANK STABILIZATION, AND HABITAT ENHANCEMENT

- Aransas County, 2015.
- Grant funded: 60% federal funds and 40% local match.
- Total Project Cost = $740,000

The Tule Creek watershed drains areas of the City of Rockport and the Town of Fulton. The area population and impervious cover are expected to increase in the next two decades, causing an associated increase in stormwater runoff. Scientists have identified polluted stormwater runoff as a principal cause of declining water quality and loss of wildlife habitat within Little Bay, which Tule Creek joins. Little Bay provides water-based recreational activities for local residents along with important habitat for local wildlife.

Aransas County, working with local communities, developed a stormwater management plan. A range of stormwater BMPs were identified for use in the area.

This project implemented several stormwater BMPs along West Tule Creek. The first project built a sediment trap pond below the confluence of the Upper Tule Creek West with North Tule Creek. Invasive vegetation was selectively removed from riparian areas to allow natural colonization of deep-rooted species for shoreline stabilization, improved wetland functions, reduced erosion, and improved water quality. Two additional projects widened a section of creek bank, stabilized it with riparian vegetation, and monitored water quality after the sediment trap was installed, as well as before and after the bank stabilization. Using this monitoring data to conduct continuous simulation modeling, they documented the effectiveness of the sediment trap and bank stabilization in reducing sediment loading to Little Bay.

6.2 RETROFITTING EXISTING DETENTION BASINS

Modifying existing detention basins may be one of the most cost-effective approaches to enhance water quality treatment. Detention is a common flood prevention requirement for new developments in many areas of the Texas coastal zone. One example is the subdivision in Chambers County, shown in Figure 6-5, which has three detention areas. By modifying the design of these detention basins to include wet pond or wetland characteristics, significant aesthetic and water quality improvements may be achieved.

Figure 6-5: Layout of a high-density single-family residential development. Includes three detention ponds.

Wet ponds can be designed as neighborhood amenities, attracting birds and allowing opportunities for fishing and canoeing. These visual elements and recreational opportunities, as shown in Figure 6 6 through Figure 6 8 enhance the value of the development. The first two figures illustrate detention incorporated in single family residential developments. In areas with dry detention basins, residents typically install privacy fences because stormwater basins are viewed as unsightly liabilities. On the other hand, residents that back up to a wet pond frequently chose fencing materials that provide a view of the facility, indicating that it is viewed positively, and increases the value of those lots. Figure 6 8 shows a wet pond located at an apartment complex. It is very clear that having an open water component makes the detention basin an asset to the development, allowing higher rents to be charged for those apartments with a view of the pond.

If the use of a wet pond for recreational activities is not desired, the developer may choose to install a wetland detention area instead. Wet ponds include open water in the middle and vegetation around the edges while wetlands detention areas are generally shallow enough to have vegetation throughout. Both of these enhanced detention options are well suited to locations with a high-water table and high average annual rainfall.

Figure 6-6: Enhanced detention wet pond is an amenity (in a subdivision in Chambers County, Texas).

Figure 6-7: Chambers County neighborhood uses wet pond with a fountain for water circulation as a prominent feature in the subdivision.

Figure 6-8: Constructed wet pond provides water quality benefits and an attractive place to recreate for nearby multi-family housing.

6.3 DOWNTOWN REDEVELOPMENT - RETROFITS

Grant funding is often available for projects that incorporate sustainable stormwater components as part of downtown renovation. High density and downtown areas frequently have space constraints that preclude the use of swales and filter strips. However, options such as bioretention and porous pavement are available, used either together or individually, to reduce the impacts of stormwater and improve the performance of the streetscape.

When designing a pedestrian walkway near a busy road, the use of swales or bioretention strips between the sidewalk and road can help the pedestrian feel insulated from nearby traffic and therefore more comfortable walking in groups or with children and pets. As shown in Figure 6-9 and Figure 6-10, the stormwater benefits of these structures are complimented by the use of porous pavement and can be, integrated with the social and aesthetic benefits afforded by the landscaping.

Figure 6-9: Bioretention serves as a buffer between the sidewalk and street. (Photo courtesy of State of Washington Transportation Improvement Board)

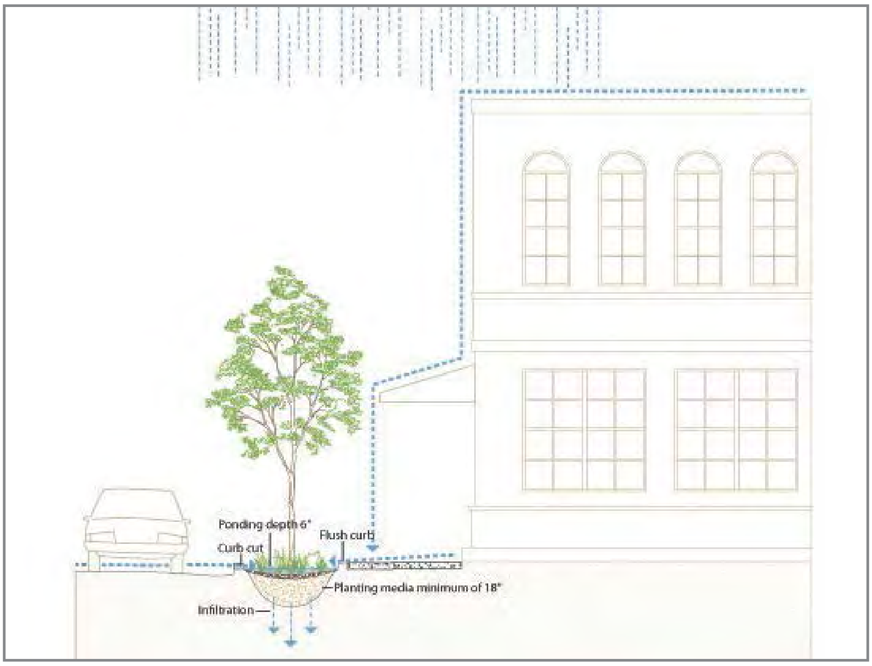

Figure 6-10: Schematic of a bioretention area with no underdrain creating a buffer between the pedestrian zone and the street; stormwater infiltrates into surrounding soils.

Medians and bike lanes afford additional opportunities for stormwater capture and filtration, as in Figure 6-11.

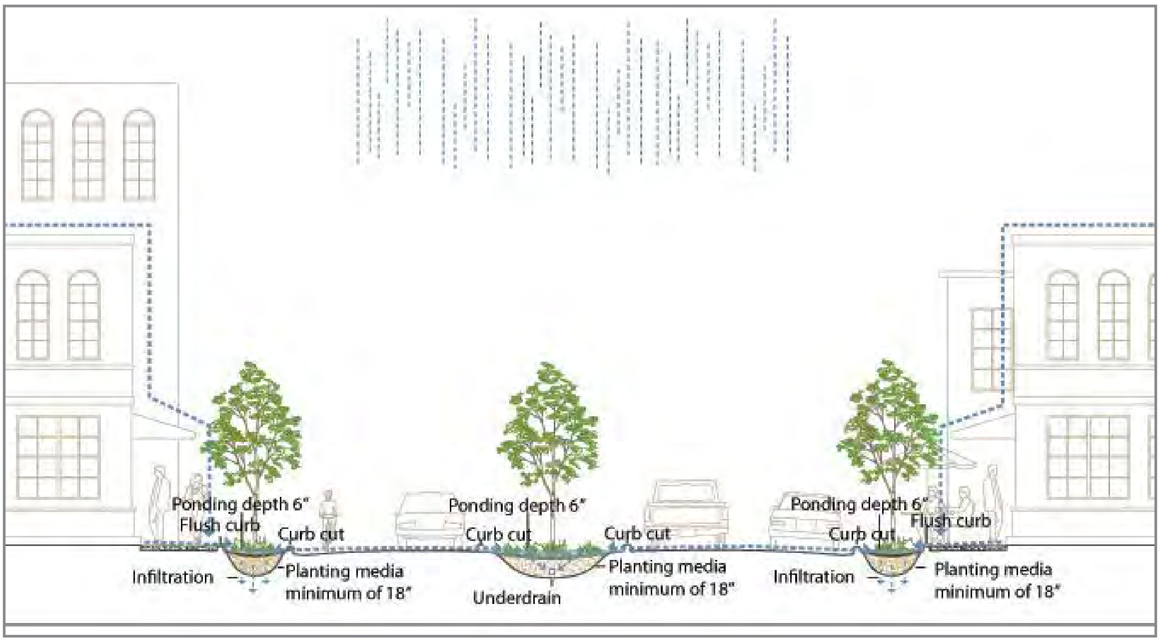

Figure 6-11: Bioretention along streets with a combination of infiltration and underdrain.

The use of alternate material for bike lanes and pedestrian crossings, such as that in Figure 6-12, can increase the safety of those biking or walking. Porous pavement can eliminate standing water on the surface of the area and reduce opportunities for slipping or skidding. Alternate materials also serve to delineate the space, reducing the possibility of a vehicle crossing into the bike lane or failing to stop for a pedestrian.

Figure 6-12: Pedestrian crossing constructed with pervious pavers.

The following renderings (Figure 6-13 through Figure 6-15) illustrate possibilities for downtown redevelopment that incorporates stormwater controls while maintaining the local character of the place and improving the user experience. The renderings are set in Port Isabel, Texas. Given that

tourism in Port Isabel is the primary economic driver, the visitor experience can have an appreciable impact on economic growth in the area. The "before" photograph is shown in Figure 6-13.

Figure 6-14 shows pervious pavers on the sidewalks and bioretention areas between the sidewalk and the street that can easily be incorporated into a redevelopment project. These features also provide more shade for pedestrians and parked cars and create a stronger buffer between people on the sidewalk and traffic on the street. Figure 6-15 demonstrates how these stormwater controls can be integrated seamlessly into the fabric of downtown life.

This type of redevelopment can be achieved with very little expense to the city. As redevelopment of private property occurs, stormwater controls can be incorporated into the new design with no cost to the city.

Figure 6-13: Downtown redevelopment. BEFORE stormwater controls.

Figure 6-14: Downtown redevelopment. Existing site WITH potential stormwater changes.

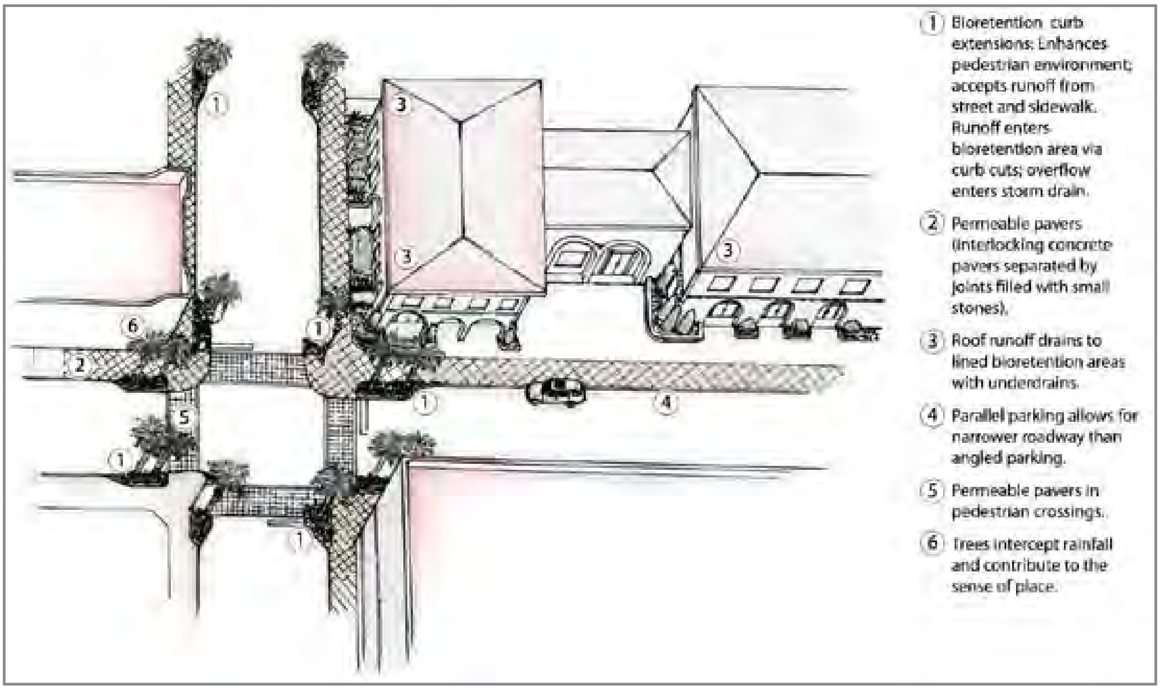

Figure 6-25: Downtown redevelopment. Birds-eye view of stormwater controls.