Updating Municipal Street Standards for Stormwater Quality and Quantity Management: Examples from Four Central Coast Communities

Purpose

Green/Complete Street Standards (Standards) were created for the cities of Gonzales, King, Salinas, and Soledad, which are situated in California's Central Coast Region. Funded in part by a Proposition 84 Stormwater Grant, the work was a collaboration between the municipalities, the State Water Resources Control Board, the California Stormwater Quality Association (CASQA), and the Central Coast Low Impact Development Initiative (LIDI).

The Standards were created with the following objectives:

- Create Standards that support post-construction stormwater control requirements under the Stormwater National Pollutant Discharge Elimination System (NPDES) Permits (e.g., stormwater volume retention and water quality treatment using low impact development design).
- Create Standards that integrate transportation and other community objectives associated with Complete Streets (e.g., bike lanes, pedestrian access and transit).
- Focus on design strategies that provide a cost-effective approach to implement Green/Complete Streets.

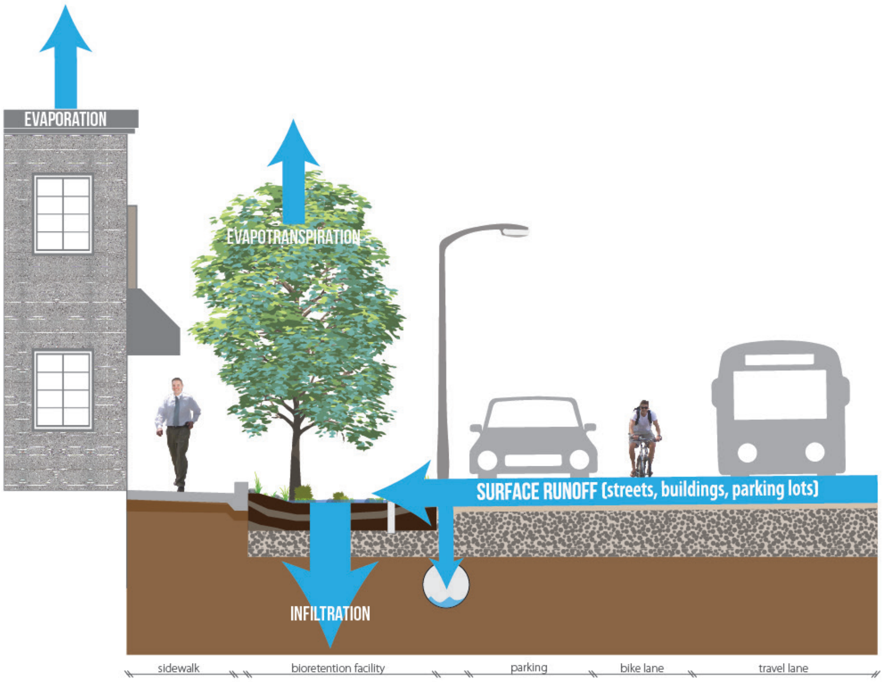
The resulting Standards showcase designs for a combination of different streets types (e.g., residential, arterial) and varying right-of-way widths. The Standards were created by AHBL, Inc. with input from project stakeholders and were evaluated for technical credibility and ability to meet project objectives before being finalized. The Green/Complete Street Standard drawings and the appurtenant specifications and details, including the native AutoCad files, can be found at the following sites:

- http://www.centralcoastlidi.org/applications-streets.php
- http://www.centralcoastlidi.org/bioretention-details-and-specs.php

This remainder of this document is intended to provide a brief introduction to Green Streets and further document project objectives and approach.

Introduction to Green Streets

Urban areas are filled with impervious surfaces. Roofs, roads, sidewalks and parking lots all contribute to stormwater runoff volumes, which are conveyed to downstream lakes, rivers and ocean along with urban pollutants such as metals, grease, bacteria, and pesticides/herbicides. Conventional street designs often dictate wide, paved streets, which generate high volumes of stormwater runoff and associated pollutants and require expensive drainage and treatment systems to protect downstream water quality and prevent flooding. Low Impact Development (LID),



Green/Complete Street design example showing the use of the vegetated planting strip to provide "at the source" stormwater management (capture, treatment, infiltration) as well as much-needed urban plants and trees. Pedestrian walkways, parking, transit and bike lanes provide Complete Street design elements.

sometimes referred to as green infrastructure, uses methods to capture, slow and treat stormwater at the source similar to a natural, pre-urban landscape. Integrating green infrastructure principles within the urban right-of-way helps to reduce flooding, protect natural waterbodies and provides a safer, healthier and more aesthetically pleasing environment for all users including drivers, pedestrians and bicyclists. For example, narrowing or reduction of vehicular travel lanes reduces impervious surfaces while providing space for cyclists and pedestrians without the need to widen the right-of-way. Pervious surfaces such as pervious asphalt, concrete and pavers can also be used selectively to facilitate stormwater infiltration while retaining a hard surface for defined uses (e.g., parking, walking, cycling).

Fundamental to Green Street design is optimizing the use of trees, plants and soil to provide stormwater management and other community benefits (aesthetics, habitat, air quality, shade). Bioswales, bioretention and drought-tolerant landscaping are examples of Green Street elements that mimic natural pre-urban hydrology to reduce stormwater runoff, treat pollutants and provide additional community and natural resource protection benefits. These features can be incorporated into many places within the right-of-way including traffic islands, planting strips, medians and curb extensions.

Barriers/Design Challenges

One of the challenges to Green Street implementation is that many communities have barriers within their own existing codes and ordinances that inhibit, discourage, or prohibit the use of green infrastructure practices. Increasingly, Stormwater NPDES Permits include requirements to update existing local codes and ordinances to remove barriers to Low Impact Development (LID) and green infrastructure.

Limited water resources within more arid regions have been considered barriers to the use of green infrastructure. However, communities can successfully incorporate green infrastructure appropriate to their climate by using native, drought-tolerant plants and trees and practicing good soil management to reduce or eliminate irrigation demands.

The long-term cost of maintaining stormwater infrastructure, included vegetation and trees associated with green infrastructure, is often a challenge for Green Street implementation. While costs associated with any new infrastructure cannot be avoided, maintenance costs can be minimized by using dual purpose landscape to meet stormwater and landscaping requirements and selection of low or no irrigation plant palettes to reduce water demand.

Benefits

Green Streets support post-construction stormwater control and Total Maximum Daily Load reduction compliance while providing additional natural resource and community benefits such as groundwater recharge, reduction of urban heat island effect, improved air quality, and overall community wellness.

Just a few of the many places throughout California where one can find excellent examples of green infrastructure within the street right-of-way include Santa Monica, Downey, Paso Robles, Los Angeles, and San Francisco.

While guidance exists to help designers integrate LID Best Management Practices (BMPs) to support Green Streets, there are very few examples of off-the-shelf standard drawings to support design of new streets. With the notable exception of Los Angeles' Green Streets & Green Alleys Design Guidelines Standards, most of the examples of green infrastructure within the street right-of-way were designed for retrofit situations. Green/Complete Street Standards for new streets provide a valuable local resource for municipalities and developers alike. Standard drawings illustrate the elements that the municipality expects within a street right-of-way so that developers and municipalities have congruent, predictable expectations of the design elements.

The additional vegetation and trees associated with the use of green infrastructure practices also provides passive recreation and green space within urban areas. These landscape elements can also reduce noise and air quality impacts from adjacent travel ways. The use of vegetation also helps to reduce the heat island effect within urban areas or areas that are highly covered by pavement, buildings and other surfaces. Trees and other green infrastructure can keep pedestrian areas cooler by shading buildings, deflecting sunlight, and evapotranspiring moisture into the air.

California Case Studies

There are a number of green street projects in California that illustrate the successful integration of green infrastructure and LID into local street designs.

Bicknell Avenue, Santa Monica
Source: LocalEcologist.org

Elmer Avenue, Los Angeles
Source: LACreekFreak.wordpress.com

CASQA

Elmer Avenue, Los Angeles

21st Street, Paso Robles
Source: CentralCoastLIDI.org

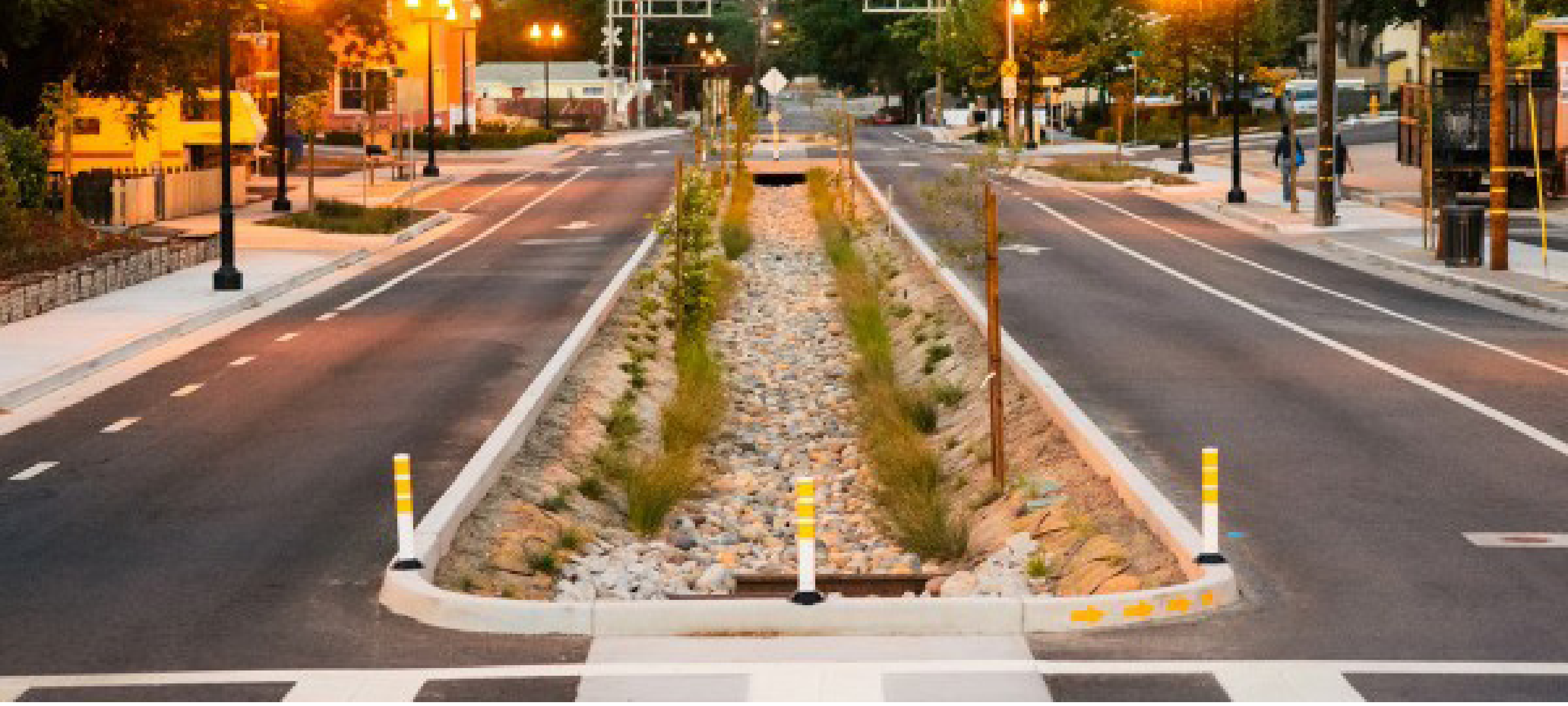
In Santa Monica, the Bicknell Avenue Green Street project has received acclaim for its use of innovative methods for treating and harvesting urban stormwater runoff. The street was designed to convey stormwater water runoff into bioretention facilities and underground infiltration basins. Permeable concrete was used for the parking lanes on the street and infiltration basins under the parking lanes store runoff during a storm event or other runoff. The street utilizes native plants that are able to thrive with little water or maintenance.

The project was intended to provide water quality improvements from stormwater discharges into Santa Monica Bay. Furthermore, the Bicknell project is a pilot to test the ability of Green Streets to help meet regulatory requirements imposed by the NPDES and TMDL mandates.

Elmer Avenue in Los Angeles is another example of how an existing neighborhood street can be retrofitted to accommodate green infrastructure elements to reduce flooding, increase groundwater recharge, prevent pollutants from entering waterways and water supply systems, and improve air quality. The street did not originally have a stormwater conveyance/management system and was retrofitted to capture, treat and infiltrate runoff using a comprehensive system comprised of an underground infiltration gallery; bioswales for treatment and conveyance; permeable surfaces for walkways; bioretention facilities for treatment and infiltration; rain barrels for capturing water; and, drought-tolerant landscaping.

The 21st Green/Complete Street project is located in Paso de Robles. The street includes commercial and residential frontage properties and was redesigned as a Green/Complete street corridor that meets sustainable infrastructure performance objectives while delivering multiple community benefits including three quarters of a mile of new bike lanes and ADA pathways; improved pedestrian safety at intersections and the railroad crossing; traffic calming; pedestrian amenities such as seating areas, interpretive signage, art, and bike racks; 81 new trees; and a low water-use, native-plant landscape. The project addresses stormwater quality control and flood reduction using only surface features to capture, treat and infiltrate stormwater and avoided the creation of subsurface stormwater conveyance such as pipes to reduce long-term operation and maintenance costs.

CASQA

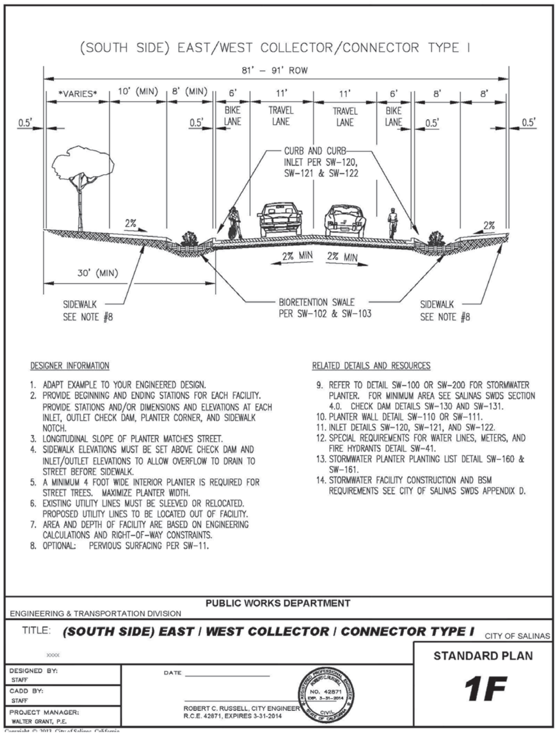


21st Street, Paso Robles
Source: CentralCoastLIDI.org and Cannon

Development of the Central Coast Green Complete Street Standard Drawings

Green/Complete Street Standards provide design guidance and specifications for implementing green infrastructure within the public right-of-way. **The Standards created for the four Central Coast municipalities were influenced by a number of factors, including:**

- Limitations on available right-of-way. Green/Complete Street design elements needed to fit within each cities' existing defined right-of-way widths for various street classifications. Local streets had the least amount of available right-of-way while arterial streets were the widest. Acquiring additional right-of-way through condemnation or developer dedication was not considered feasible by the municipal participants.
- Competition for space within available right-of-way. There is substantial competition for the scarce right-of-way area when designing Green/Complete Streets. Vehicular traffic, pedestrian and bicycle mobility, transit, parking, utilities, landscaping, and stormwater management all competing for space within the design. Local agreements to implement regional transit authority guidelines for Complete Streets also influenced designs.
- Costs associated with Green Streets. While the value of Green Streets to support stormwater regulatory compliance and provide community benefits was agreed upon, municipalities communicated the need to consider construction and long-term maintenance costs associated with Green/Complete Streets and requested that the Standards reflect cost-effective strategies to increase the likelihood of implementation.



Key Design Strategies in Response to Project Drivers:

- Reduction of on-street parking. The participant cities often chose to decrease on-street parking, where appropriate, to accommodate bike lanes and space for landscape/bioretention areas.
- Dual function areas. Conventional landscape strips, medians, and similar areas were identified as areas that could also provide stormwater management function.
- Focus on vegetated designs for stormwater management. The most cost-effective approach to meet stormwater quality objectives tends to focus on use of vegetated type designs (e.g., bioretention) located in the areas designated for landscape strips.
- Minimal use of permeable surfaces. Permeable surfacing can certainly be incorporated within Green/Complete Street designs. However, extensive use of permeable paving was not included in the Central Coast Green/Complete Street Standards due to construction, performance and long-term maintenance considerations.
- Use appropriate bioretention design details and specifications. Bioretention details were obtained from the Central Coast LID Initiative, which are consistent with the Phase II Small MS4 NPDES Permit.

Each Green/Complete Street design was modeled to evaluate the ability to retain/infiltrate the 85th percentile, 24-hour storm event runoff volume generated within the right-of-way (i.e., street, sidewalk, etc. only; no run-on from adjacent parcels). Conservative values were used for precipitation and native soil types and results from the modeling showed that the Green/Complete Street Standards provide sufficient capacity for all street types to manage the prescribed storm event. In some cases, results showed additional available stormwater management capacity within the residential streets right-of-way. One noteworthy residential street scenario situation was encountered for the City of Gonzales where their travel lane width requirements and required area behind the curb precluded the use of the side-sloped bioretention design, which requires a minimum width to achieve adequate ponding and infiltration. In this case, a more compact planter-box style bioretention design was incorporated into their residential Green/Complete Street Standard to meet the performance objective. However, planter-box style designs are not ideal for residential neighborhoods and in future revisions to Standards, the City of Gonzales may wish to adjust their residential right-of-way dimensions to accommodate a more appropriate design.

For all four cities, modeling showed that additional stormwater management capacity was generally not available for larger streets (e.g., minor and major arterials) due to the greater area of contributing impervious surfaces and inability, due to space constraints, to increase the bioretention footprint proportionally.

While the modeling exercise helped to establish that the Green/Complete Street Standards can generally support post-construction stormwater control requirements, designers must still conduct appropriate analyses to evaluate the influence of project-specific design parameters (e.g., native soils infiltrate rates) in establishing their Green/Complete Street design.

The standard details for Green/Complete Streets include the following general classifications:

- Low volume residential (Local street)
- Residential collector
- Minor arterial
- Major arterial

The Green/Complete Street Standard drawings were supported and supplemented by a series of standard details associated with the design and construction of bioretention facilities. The standard details are included as separate drawings and referenced accordingly within the street standard drawings. The standard details emphasized various edge conditions and configurations for bioretention that are commonly found within streets and other public rights-of-way. The green infrastructure details that were included within the package included:

Bioretention

- Curb Bulb Extensions
- Sloped Planting Strip
- Combination Curb Extension/Planting Strip
- Design for "Enhanced" Infiltration
- Infiltration/Flow-Through Planters

Edge Conditions and Other

- Curb Inlets
- Flat Curbs
- Energy Dissipation
- Weirs
- Beehive Structures

Planting Palettes

- Plant palettes to include trees, shrubs, and groundcover including options ranging from irrigated to xeriscaping

The intent for the four Central Coast communities is to adopt the Green/Complete Street Standards as their default requirements. Of course, as with most municipal codes and ordinances, each city retains the ability to modify how they implement these requirements based on their overall strategy to provide services, manage infrastructure, and protect natural resources.

Sources

City of Los Angeles Stormwater Program – Green Streets & Green Alleys Design Guidelines and Standards: http://www.lastormwater.org/wp-content/files_mf/greenstreetguidelines.pdf

City of Santa Monica – Bicknell Avenue Green Street: http://www.smgov.net/uploadedFiles/Departments/OSE/Categories/Urban_Runoff/CSM%20UR%20Bicknell_LID2.pdf

Council for Watershed Health – Elmer Avenue Neighborhood Retrofit Project: http://watershedhealth.org/Files/document/702_Elmer%20brochure_lores.pdf

Low Impact Development Center: http://www.lowimpactdevelopment.org/greenstreets/index.htm

Monterey Bay Area Complete Streets Guidebook: http://www.tamcmonterey.org/programs/completestreets/CS_Guidebook.html

San Mateo County- Sustainable Green Streets and Parking Lots Design Guidebook. http://www.flowstobay.org/greenstreets

Smart Growth America - Green Streets: http://www.smartgrowthamerica.org/complete-streets/implementation/factsheets/green-streets/

U.S. EPA - Green Infrastructure: http://water.epa.gov/infrastructure/greeninfrastructure/index.cfm#tabs-1