PROP. 84 REMOVING BARRIERS TO LID: MUNICIPAL CODE UPDATE ASSISTANCE

CASE STUDY: ADDRESSING BARRIERS TO LID IN BARSTOW

JUNE 27, 2017

CASE STUDY: ADDRESSING BARRIERS TO LID IN BARSTOW

Barstow is a high desert city in San Bernardino County that is located approximately 130 miles northeast of Los Angeles. Barstow is home to Marine Corps Logistics Base Barstow and is the closest city to the Fort Irwin National Training Center.

Barstow's growth has been tied to the mining history of the Mojave Desert following the discovery of gold and silver in the Owens Valley and in mountains to the east in the 1860s and 1870s. The influx of miners arriving in Calico and Daggett resulted in the construction of railroads. The Southern Pacific constructed a railway line from Barstow to Needles in 1883. Before the advent of the interstate highway system, Barstow was an important stop on both Routes 66 and 91. The two routes met in what is now Barstow's historic downtown and continued west together to Los Angeles.

Today, Barstow is a major transportation center for the Inland Empire. Several major highways including Interstate 15, Interstate 40, California State Route 58, and U.S. Route 66 converge in the city. It is the site of a large rail classification yard, belonging to the BNSF Railway.

Barstow's historic downtown aside, growth over the last thirty years has been primarily suburban in character. Residential growth has been steady and is primarily single-family in character. Auto-oriented commercial uses are characteristic of new development at the City's exits along Interstate 15 and Interstate 40. The City's population has grown by more than 13 percent since 2000, while 402 new dwelling units were constructed between 2000 and 2010. Growth and construction is anticipated to be strong as more families consider Barstow's affordable housing opportunities.

Barstow is situated in the Mojave Desert and experiences four seasons. Summer days are very hot with highs typically exceeding 100° F. Winter is characterized by cold mornings with lows near 30° F. Daily temperature ranges are large as a result of the low atmospheric moisture, typically between 30° and 35° F. There are an average of 140 days with highs of 90° F or higher, an average of 82 days with highs of 100° F degrees or higher, and an average of 25 days with lows of 32° F. The average annual precipitation is 4.12 inches, with nearly 70% of rain typically falling during the cooler months (Nov–Apr). There is an average of 24 days annually with measurable precipitation.

Another characteristic of Barstow's climate is strong winds, particularly from the west and south in spring. These winds can reach 60 mph or higher and can quickly dry out plants. Regular irrigation and protection from the wind are advised until plants are established. Additionally, with the wind sand and dust blown by the wind are a concern that needs to be considered for plant selection, system design, and maintenance protocols and frequencies.

Climatic conditions in the Barstow are harsher and more extreme than most of the other participants in CASQA's *Proposition 84 Removing Barriers to LID: Municipal Code Assistance* project. As a consequence, the project team developed a bioretention planting list unique to this environment.

CASQA's project team selected Barstow as a project participant because the City had local codes and standards that inhibited the use of LID practices and there was an unfilled opportunity to provide technical guidance for application throughout the high desert region of Southern California. Moreover, Barstow's continued growth means that the guidance prepared under this grant will be implemented in new development. As described more fully below, the CASQA project team performed the following tasks:

- Identified barriers to the use of LID practices within landscape-related codes and standards
- Prepared amended code language for City Council adoption
- Prepared Bioretention/Biofiltration Standard Details and Specifications
- Prepared High Desert Bioretention/Biofiltration Plant List

IDENTIFYING BARRIERS

The State of California's Phase II National Pollutant Discharge Elimination System (NPDES) Permit requires that permittees implement Low Impact Development standards (LID) to reduce runoff, treat storm water, and provide baseline hydromodification management to the extent feasible to meet sizing criteria for storm water retention and treatment.

The NPDES Permit acknowledges that many permittees may have codes and standards that place impediments to the use of LID practices. To that end, within the first year of the effective permit date, permittees must conduct a review of existing codes and standards, with a priority on landscape-related codes. The goal of this analysis is to correct gaps and impediments impacting effective implementation of post-construction requirements. Within the second year of the effective date of the permit, the permittee shall complete any changes to the landscape code to effectively administer post-construction requirements.

Barstow is a new Phase II permittee in San Bernardino County and in the Lahontan Regional Board (Region 6) jurisdiction. On March 6, 2017, the Barstow City Council adopted Ordinance 951-2017 which added a new chapter to its Municipal Code titled Stormwater and Urban Runoff Pollution Control (Chapter 15.14) which placed the numeric standards from the City's municipal stormwater permit into enforceable City code.

GAP ANALYSIS

The CASQA Proposition 84 Grant assisted the City of Barstow with AHBL staff conducting a gap analysis of the City's codes and standards. The grant project team utilized the Municipal Regulatory Update Assistance Program (MRUAP) gap analysis template developed by AHBL for the Central Coast Low Impact Development Initiative (LIDI) to identify barriers to the use of LID practices in the City's landscape-related codes. The project team also looked for opportunities to integrate LID practices into the City's street standards.

Upon review of the City's code, barriers to the use of LID practices were identified, and opportunities to improve suggested. In many ways, the City's code is aligned with the goals and objectives of LID. Stormwater retention areas are permitted within landscape areas. However, some barriers to the use of LID practices were identified.

Some of the barriers to the use of LID practices found are common impediments found in many local codes and ordinances. Street sections and stormwater details require the use of continuous curbs and closed conveyance stormwater collected in catch basins and conveyed via pipe into the storm drains. Another gap or opportunity involved the design of multi-family projects. The City has strong site design requirements that emphasize minimizing the removal of native vegetation in single-family development proposals, but similar standards did not extend to multi-family design. The following code sections were found to contain barriers to the use of LID practices within the City of Barstow:

- Sec. 19.06.050. - Off-street parking.
- Sec. 19.08.060. - Multifamily residential design guidelines

Figure 1: Excerpt from Gap Analysis Performed for Barstow

Objective	Code Reference and Summary of Existing Standards	Impediment / Opportunity to Improve
(1) PARKING LOT RUNOFF		
(a) Is a minimum percentage of a parking lot required to be landscaped? No. The City's code requires that parking areas providing more than two parking spaces are required to adhere to the City's landscape manual, however, no landscape requirements are listed within the City's landscape manual for parking lots. Planting lists are provided, but a minimum landscaped area is not listed.	19.06.050 Off-street Parking *(d) 2) The maximum a vehicle may overhang into a planter area shall be two feet, provided this does not damage the landscaping or interfere with the irrigation system. In such cases, the planter width shall be a minimum of seven feet (retaining a five-foot clear landscape area). Vehicles may also overhang onto an on-site sidewalk provided the sidewalk is a minimum of seven feet in width.* *(10) All parking areas providing more than two parking spaces shall be subject to the requirements as listed in the landscape manual.*	Consider adding minimum landscaping percentages for parking lots, and adding additional regulations for landscape design.

After completing the gap analysis, the project team held a meeting/training session with City staff to discuss gaps found and opportunities for incorporating LID into the City's codes and standards.

To review the gap analysis template that was used by the City of Barstow, please see the California LID Portal under the LID Code Updates tab or through the current link:

https://www.casqa.org/sites/default/files/downloads/20140328_gap_analysis_user_guide_%28final_draft%29.pdf

AMENDING THE CODES

The results of the gap analysis, aided by meetings over the course of the project, led to proposed amendments to the City's codes and standard drawings. The adoption of the proposed amendments will fulfill the City's requirement to amend landscape-related codes under the NPDES Permit. The amendments include updates to landscape-related codes and standards that remove barriers to the use of LID practices and remove ambiguity within the City's regulations as to the design of landscape-related BMPs such as bioretention.

Following the code updates, a meeting was held with Barstow staff to discuss the code amendments. The grant project team presented the draft code amendments to City staff for feedback. Final code amendments were then delivered to the City based on the input gathering during the code update meeting.

OFF-STREET PARKING

The City's code requires that parking areas providing more than two parking spaces shall adhere to the City's landscape manual; however, no landscape requirements are listed within the City's landscape manual for parking lots. Planting lists are provided, but a minimum percentage landscaping for the parking lot is not specified. To that end, the project team worked with City staff to establish a standard for a minimum amount of internal parking lot landscaping as a means of minimizing impervious surface coverage, reducing urban heat island effects, and providing landscape areas that can be used for stormwater management where feasible.

Figure 2: Amendments to Off-Street Parking Standards

Sec. 19.06.050 – Off-street parking.

[…]

(d) *Improvements and maintenance*. Every parcel of land hereafter used for parking, sales or display purposes for two or more automobiles or trailers shall be improved and maintained as follows:

[…]

(10) All parking areas providing more than two parking spaces shall be subject to the requirements as listed in the landscape manual. All parking areas providing more than eight parking spaces shall provide one interior parking lot landscape planter per eight parking spaces provided. The landscape planter shall measure a minimum of five feet in width as measured perpendicularly from the interior planter curb faces. This landscaping shall count towards the total lot area landscaping, as required, and may be used for on-site stormwater retention.

MULTI-FAMILY DESIGN STANDARDS

The City of Barstow has existing standards that emphasize the retention of native vegetation into the project design of single-family residential subdivisions [Sec. 19.08.050(a)(8) BMC] and commercial projects [Sec. 19.08.070(c)(2) BMC], but similar provisions were not included within the City's multi-family design standards [Sec. 19.08.060 BMC].

The provisions that are currently required for single-family residential subdivisions are that, "[N]ative vegetation shall be retained and incorporated into the project wherever possible. Grading for building pads shall be sensitively designed to reduce disturbance and visual impacts." The CASQA grant project team developed language for amendment to Barstow's multi-family design standards that would require native vegetation be retained and incorporated within a project's design where possible. The language for the amendment is identified in Figure 3.

Figure 3: Example of Amendment to Multi-family Residential Design Guidelines

Sec. 19.08.060. - Multifamily residential design guidelines

(a) *Site planning.* The following guidelines apply to the siting of multifamily residences:

(1) Multifamily residential developments shall be sited to respond to and respect property views, site features, existing topography, dwelling unit privacy and any adjacent existing development.

(2) Site grading shall recognize existing natural landforms and drainage patterns (where appropriate) by providing an appropriate transition of architectural elements to grade. Native vegetation shall be retained and incorporated into the project wherever possible. Grading for building pads shall be sensitively designed to reduce disturbance and visual impacts. Split pad grading shall be utilized in place of excessive soil export/import to create a building pad.

STORMWATER QUALITY MANAGEMENT AND DISCHARGE CONTROL

As a condition of the Phase II NPDES permit, the City of Barstow needed to incorporate post-construction requirements into its municipal code for new development and redevelopment projects that disturb one or more acres. The grant project team reviewed a stormwater ordinance prepared by City staff that included language for addressing post-construction runoff from applicable development projects and alternative compliance for sites that are unable to meet the post construction requirements.

Figure 4: Excerpt from Stormwater and Urban Runoff Pollution Control Ordinance

Sec.15.14.100 – Planning and land development program requirements for new development and redevelopment-low impact development

(a) Objective. The provisions of this section establish requirements for construction activities and facility operations of Development and Redevelopment projects to comply with the current Municipal NPDES Permit, to lessen the water quality impacts of development by using smart growth practices, and to integrate Low Impact Development (LID) practices and standards for storm water pollution mitigation through means of infiltration, evapotranspiration, biofiltration, and rainfall harvest and use. LID shall be inclusive of new development and/or redevelopment requirements.

(b) Scope. This section contains requirements for storm water pollution control measures in development and redevelopment projects and authorizes the city to further define and adopt storm water pollution control measures, and to develop LID principles and requirements, including but not limited to the objectives and specifications for integration of LID strategies, grant alternative compliance measures from the LID requirements for projects that demonstrate technical infeasibility to retain the Hydraulic Sizing Design Criteria on-site or where an opportunity exists for regional groundwater replenishment as defined in the Municipal NPDES Permit, and collect funds for projects that are granted alternative compliance measures. Except as otherwise provided herein, the city shall administer, implement and enforce the provisions of this section.

IMPLEMENTING STANDARDS

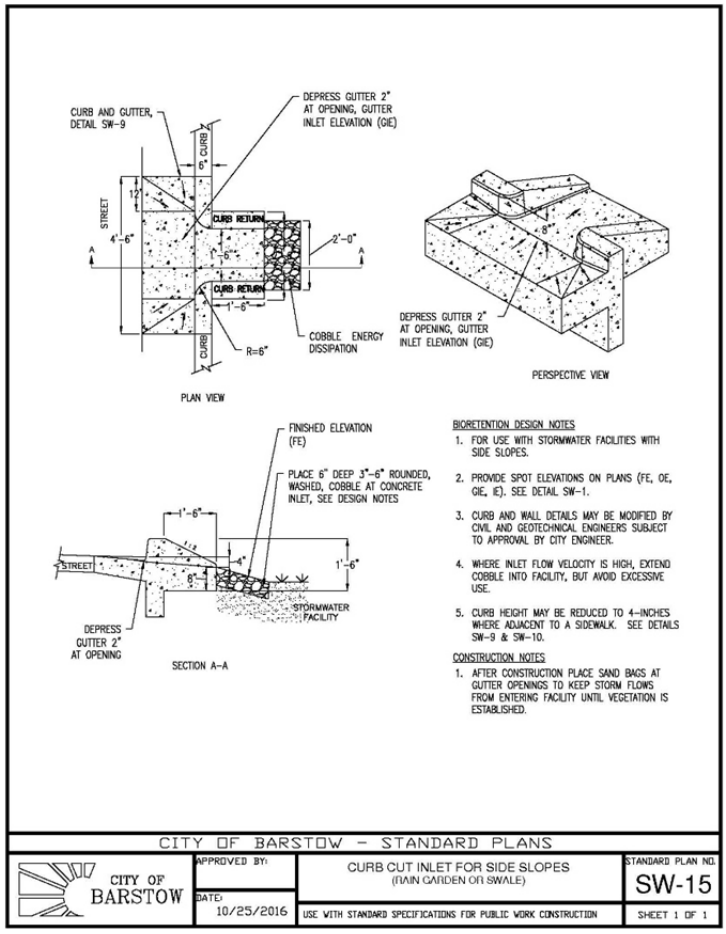
BIORETENTION/BIOFILTRATION STANDARD DRAWINGS AND SPECIFICATIONS

In order to implement the use of LID practices within the City, there is a need for design standards and details to ensure proper construction and installation. Standard drawings for bioretention facilities were prepared by the grant project team for the City based standards originating from LIDI to maintain consistency with Statewide NPDES requirements. The standard drawings and specifications originated out of work that was performed by the Central Coast Low Impact Development Initiative (LIDI).

The LIDI details were then modified through this grant based on extensive input from the participating municipalities, stormwater design professionals, and peer review by a design team not associated with the initial development of the details. The refinements to the bioretention and biofiltration standard drawings addressed various edge conditions (with variations for facilities within the landscape strip adjacent to travel lanes or on-street parking and within a parking lot), pervious pavements, edge conditions such as curb inlets and flat curbs, overflow structures and planting palates for landscaping frequently inundated areas of the facilities.

After modifications to the drawings were completed to address local comments, the numbering for the drawings was updated to reflect the adopted numbering conventions for the City of Monterey, and the drawings were placed within the City's standard title block.

Figure 5: Bioretention Standard Drawings



To review the bioretention standard plans prepared for the City of Barstow, please see the California LID Portal under the Standard Details & Specifications tab or through the current link:

https://www.casqa.org/resources/california-lid-portal

PROP. 84 REMOVING BARRIERS TO LID: MUNICIPAL CODE UPDATE ASSISTANCE

CASE STUDY: ADDRESSING ALTERNATIVE COMPLIANCE IN MONTEREY

JUNE 27, 2017

CASE STUDY: ADDRESSING ALTERNATIVE COMPLIANCE IN MONTEREY

Monterey is a city in Monterey County that is situated on the southern edge of Monterey Bay, in the northern portion of California's Central Coast. The City has a total area of approximately 12.09 square miles, of which 8.62 square miles is land and 3.47 square miles is water. Elevation ranges from 0 to 683 feet sea level.

Local soil is Quaternary Alluvium. Common soil series include the Baywood fine sand on the east side, Narlon loamy sand on the west side, Sheridan coarse sandy loam on hilly terrain, and the pale Tangair sand on hills supporting closed-cone pine habitat. Monterey is in a moderate to high seismic risk zone, the principal threat being the active San Andreas Fault situated approximately 26 miles to the east.

The climate of Monterey is moderated by its proximity to the Pacific Ocean resulting in a cool-summer Mediterranean climate. Monterey's average high temperatures range from around 57° F in winter to 70° F during the summer months. Average annual precipitation is around 19.5 inches, with most rainfall occurring between October and April. There is an average of 70 days with measurable precipitation annually.

Monterey is an essentially built-out city with typical urban land uses (e.g., residential, commercial, industrial). New development is primarily infill and redevelopment. The development sites tend to be urban in character, with frontage on existing streets. Between 2000 and 2010, Monterey's population has declined by approximately 6.3 percent; however, 202 new dwelling units were created over the period as well as considerable new non-residential development.

Stormwater runoff is routed to a variety of receiving waters including small lakes, streams and the Monterey Bay. This geologic, urban development and receiving water characteristics of Monterey greatly influence the type and feasibility of stormwater quality management actions, including those that comply with the Central Coast Regional Water Board's post-construction stormwater quality control requirements (i.e., PCRs).

In addition to project tasks consistent with other grant participants, the CASQA project team selected Monterey as a project participant because the City was interested in cost-effectively integrating bioretention/biofiltration into street designs and exploring alternative compliance strategies for projects that could not meet the City's post-construction stormwater controls on-site. Monterey was also selected because the redevelopment character of the City's new construction would provide useful lessons on the use of green infrastructure to other municipalities that are essentially built out. The technical framework for alternative compliance is often lacking within a municipal LID strategy and can be a barrier to LID implementation. As described more fully below, the CASQA grant project team performed the following tasks in coordination with the City of Monterey:

- Green Complete Street Sections
- LID street retrofit framework to support Alternative Compliance (drawings, calculations, memorandum)
- Bioretention/Biofiltration Standard Details and Specifications

GREEN COMPLETE STREET STANDARDS

The City of Monterey is in the process of widespread infrastructure improvements to improve accessibility of its streets consistent with the Americans with Disabilities Act (ADA) of 1990. ADA-related improvements include the design and construction of ramps and other features at street intersections. The ongoing construction of these improvements offers the City and opportunity to integrate other stormwater infrastructure into the redesign of the intersections.

Monterey requested that the CASQA grant project team explore the integration of bioretention into street and intersection design. Where feasible and consistent with a Water Board-approved Watershed Plan, the City of Monterey was also interested in building capacity within its rights-of-way for development that could not meet its NPDES stormwater quality post-construction requirements (PCRs) on site.

GREEN/COMPLETE STREET STANDARDS

Green/complete street standards were prepared for multiple street classifications within the City of Monterey. 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.

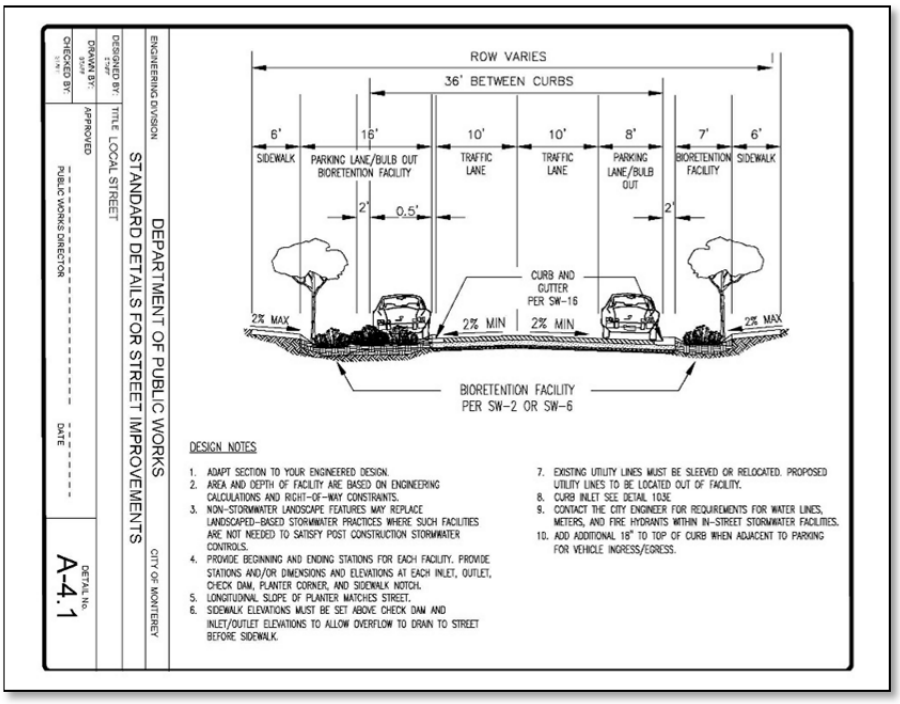
Conventional street designs often dictate wide, paved streets, which generate high volumes of stormwater runoff and associated pollutants and require expensive drainage and treatment systems to protect downstream water quality and prevent flooding. Low Impact Development (LID), sometimes referred to as green infrastructure, uses methods to capture, slow and treat or infiltrate 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.

Fundamental to green street design is optimizing the use of trees, plants, and soil to provide stormwater management and other community and multiple benefits (e.g., aesthetics, habitat, air quality, and shade). Bioswales, biofiltration, 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; but 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.

In order to implement the use of LID practices within City rights-of-way, the CASQA grant project team prepared sections for various street classifications. Figure 1 depicts a section for a local street classification that was prepared for Monterey.

Figure 1: Section for a Monterey Local Street



To review the street sections that were prepared for the City of Monterey, please visit the California LID Portal under the Standard Details & Specifications tab or through the current link:

https://www.casqa.org/resources/california-lid-portal

ALTERNATIVE COMPLIANCE

Monterey, like many municipalities, has objectives to improve urban greening to support environmental, social and economic goals. Additionally, NPDES stormwater quality post-construction requirements (PCRs), which are generally implemented on a parcel-by-parcel basis, are intended to mitigate new and/or address existing urban impacts to watershed processes and associated receiving waters. In some instances, an Alternative Compliance approach is used to comply with the PCRs when compliance cannot be achieved on-site or in cases where the municipality can show that a different approach can meet or exceed the water quality benefits of implementing PCR requirements onsite and perhaps provide ancillary benefits for the community. Street retrofits are

increasingly viewed as an attractive approach to address stormwater quality compliance and urban greening objectives.

ALTERNATIVE COMPLIANCE

A concept design for retrofit of a collector street was prepared to provide Monterey with a promising design option that would provide stormwater management and water quality benefits within the context of a collector street right-of-way. The Stormwater Control Measures (SCMs) (i.e., bioretention or biofiltration facilities) can be integrated into street retrofits based on actual site-specific opportunities and objectives. The concept design is a thoughtful integration of bioretention infrastructure into a collector street classification at mid-block and intersection locations.

Figure 2: Alternative Compliance Concept Design

Facility	Total Footprint Square Feet	Functional Footprint Square Feet	A/B Soils Retain/Treat (ft²)	C/D Soils Retain/Treat (ft²)
1	229	112	168	105
2	229	112	168	105
3	179	96	126	84
4	179	96	126	84
5	229	112	168	105
6	229	112	168	105
7	229	112	168	105
8	229	112	168	105

Four assumptions were undergirded the development of the concept design:

1. The concept design was created for a collector street classification with a curb-to-curb width of 40 feet and parking on both sides of the street. The City identified that opportunities within this street classification likely provide a cost-effective and technically feasible approach versus less cost-effective efforts on local or arterial streets.
2. The concept design focused on an LID or Green Street "lite" approach meaning, the concept design integrated elements of LID that are realistic related to cost, technical feasibility, parking constraints,

etc. This design approach avoids the cost and impact of a full street retrofit, which typically is economically infeasible.

3. Permeable paving was not evaluated as a design option as the associated operations and maintenance requirements were not considered an attractive option for Monterey at this time. Moreover, the Regional Water Board has expressed a preference for vegetated SCMs for NPDES compliance thereby guiding the CASQA team's development of a concept design emphasizing the use of bioretention/biofiltration SCMs.
4. The quantitative stormwater runoff volume and quality performance of the LID SCMs are based on assumed depths of bioretention soil, aggregate, etc. that were considered reasonable from an engineering retrofit perspective. Adjustments to these variables would vary performance.

The County of Santa Barbara's Stormwater Control Measure Sizing Calculator (Calculator) (http://www.sbprojectcleanwater.org/development.aspx?id=76) was used to estimate stormwater volume and treatment performance for the SCMs. The Calculator is consistent with the Region 3 Water Board approved sizing calculations and provides the user the ability to iteratively work with the SCM area footprint and depth to arrive at a design appropriate for the specific street right-of-way.

The PCRs for the City may include biofiltration (treatment only) or bioretention (treatment and retention) performance requirements, so the concept design reflects either approach. The Calculator was manipulated so that the assumed depth of bioretention soil media and aggregate was applied for either a bioretention or biofiltration system.

The Calculator was used to back-calculate the volume of stormwater that would be retained and/or treated. One can iteratively adjust the SCM depth, area footprint and volume routed to the SCM. By setting the SCM depth and footprint, the volume that can be managed by the facility is also set. This performance quantification via volume allows the City to create a stormwater "bank" that can be used for Alternative Compliance.

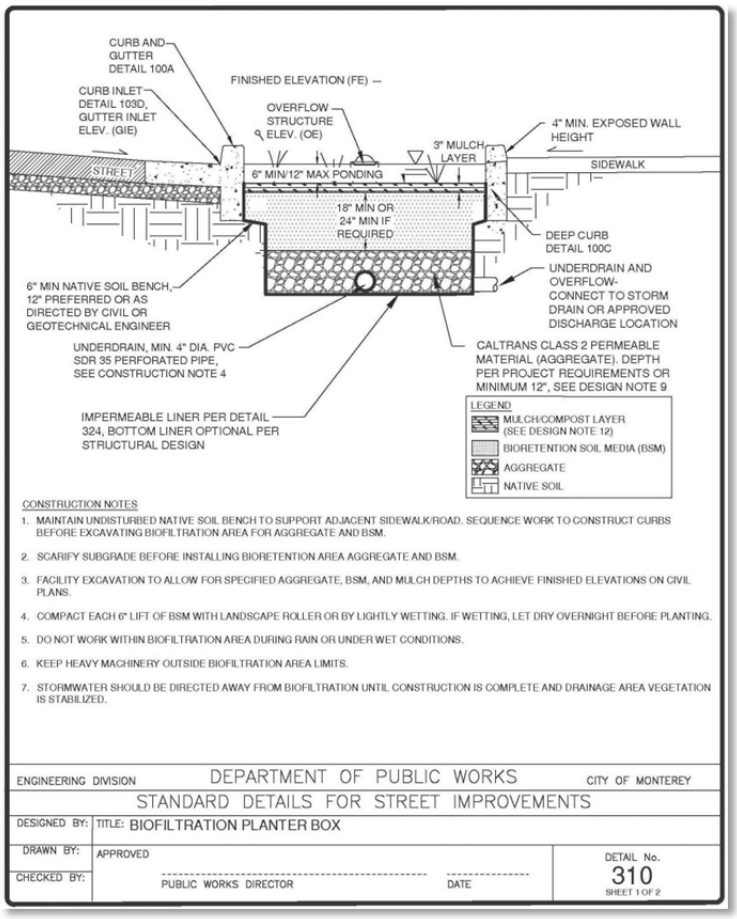
IMPLEMENTING STANDARDS

BIORETENTION/BIOFILTRATION STANDARD DRAWINGS AND SPECIFICATIONS

In order to implement the use of LID practices within the City, there is a need for design standards and details to ensure proper construction and installation. Standard drawings for bioretention facilities were assembled by the grant project team for the City based standards originating from LIDI to maintain consistency with Statewide NPDES and Region 3 PCR requirements. The standard drawings and specifications originated out of work that was performed by the Central Coast Low Impact Development Initiative (LIDI). The LIDI details were then modified through this grant based on extensive input from the participating municipalities, stormwater design professionals, and peer review by a design team not associated with the initial development of the details.

The refinements to the bioretention and biofiltration standard drawings addressed various edge conditions (with variations for facilities within the landscape strip adjacent to travel lanes or on-street parking and within a parking lot), pervious pavements, edge conditions such as curb inlets and flat curbs, overflow structures and planting palates for landscaping frequently inundated areas of the facilities. After the drawings were completed, the numbering for the drawings was changed to reflect the adopted numbering conventions for the City of Monterey, and the drawings were placed within the City's standard title block.

Figure 5: Bioretention Standard Drawings



To review the bioretention standard plans prepared for the City of Monterey, please see the California LID Portal under the Standard Details & Specifications tab or through the current link:

https://www.casqa.org/resources/california-lid-portal

PROP. 84 REMOVING BARRIERS TO LID: MUNICIPAL CODE UPDATE ASSISTANCE

CASE STUDY: INTEGRATING LID INTO MORRO BAY'S STREETS

JUNE 27, 2017

CASE STUDY: INTEGRATING LID INTO MORRO BAY'S STREETS

Morro Bay is a city in San Luis Obispo County that is situated approximately 12 miles north of San Luis Obispo at the crossroads of Highway 1 and Highway 41 on California's Central Coast. Morro Bay sits along a natural estuary characterized by Morro Rock, an extinct volcano extending 500 feet in elevation amid water protected by a natural sand spit. According to the United States Census Bureau, the Morro Bay has a total area of 10.3 square miles, of which, 5.3 square miles of it is land and 5.0 square miles of it is water.

The climate of Morro Bay is moderated by its proximity to the Pacific Ocean resulting in a cool-summer Mediterranean climate. Morro Bay's average high temperatures range from around 65° F in December to 71° F during September and October. Average annual precipitation is around 17.5 inches, with most rainfall occurring between November and April. There is an average of 50 days with measurable precipitation annually.

Morro Bay is primarily a residential community and a vacation destination, especially during the summer months. Between 2000 and 2010, Morro Bay's population fell by 116 (-1.1%); however, the number of new dwelling units rose by 69 dwelling units (1.1%). The number of occasional, or seasonal, dwelling units rose from 980 dwelling units to 1,125 dwelling units. The 14.8 percent growth in seasonal dwelling unit occupancy explains how construction grew during the period while population diminished.

The City's topography includes very hilly areas with low-infiltrating native soils, which presents a challenge for stormwater management. Additionally, many streets in the City are unimproved (e.g., no curb/gutter/sidewalk) such as the north end neighborhoods and objectives to implement urban greening, improve pedestrian mobility, and use low impact development strategies can be especially challenging in these areas of the City.

CASQA's project team selected Morro Bay as a project participant because the City is a good example of a small community with geologic characteristics that make LID challenging. Although Morro Bay has experienced little growth in the last 15 years, the City is exploring additional sources of potable water that may result in both growth and redevelopment.

Because of the geological challenges faced throughout the City, the work included a concept design for a residential street located in the northern portion of the City (i.e., Greenwood Avenue) to illustrate how LID measures could be integrated the City approach to manage its street network. As described more fully below, the CASQA project team performed the following tasks:

- Green Complete Street for Local Streets
- Greenwood Avenue Retrofit Concept Design
- Bioretention Standard Details and Specifications

GREEN COMPLETE STREET STANDARDS

The City of Morro Bay has identified opportunities to integrate green stormwater infrastructure into its street prisms. City staff noted that the opportunities are primarily related to retrofits along local street classifications. The CASQA grant project team prepared concepts to integrate of bioretention into its local street classification.

GREEN/COMPLETE STREET STANDARDS

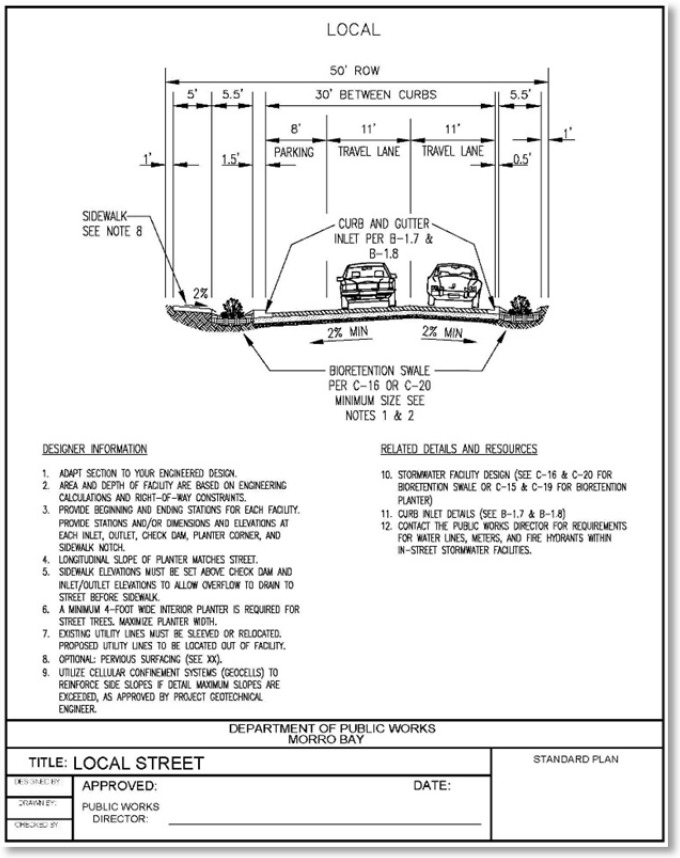
Green/complete street standards were prepared for the local street classification within the City of Morro Bay. The street section was created with the following objectives:

- 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 a local street standard that would have a curb face to curb face width of 30 feet and contain two 11-foot travel lanes and an 8-foot parking lane, with bioretention facilities situated between the back of curb and the sidewalk on both sides of the street.
- Focus on design strategies that provide a cost-effective approach to implement Green/Complete Streets.

Morro Bay's existing street designs include wide, paved streets, which generate high volumes of stormwater runoff and associated pollutants. There is very little stormwater infrastructure in the City's existing network of streets. City staff concluded that integrating green infrastructure principles within its rights-of-way would help to reduce flooding and improve water quality.

In order to implement the use of LID practices within City rights-of-way, the CASQA grant project team prepared a section for integrating bioretention into the City's local street classification. Figure 1 depicts a street section that was prepared for Morro Bay.

Figure 1: Section for a Morro Bay Local Street



To review the street section that was prepared for the City of Morro Bay, please visit the California LID Portal under the Standard Details & Specifications tab or through the current link:

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GREENWOOD AVENUE RETROFIT

Morro Bay has goals to improve its streets to achieve multiple objectives and provide multiple benefits. Green/complete street principles were applied to the retrofit design for Greenwood Avenue, where the following objectives guided the design:

- Prepare a design that would 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).
- Prepare a design that integrates other modes of travel (e.g., bike lanes, pedestrian access, and transit).

- Focus on design strategies that provide a cost-effective approach to implement Green/Complete Streets.

GREENWOOD AVENUE RETROFIT

A concept design for retrofit of Greenwood Avenue was prepared to provide Morro Bay with a design that would provide stormwater management and water quality benefits within the context of a collector street right-of-way.

On May 25, 2016, Kevin Perry of Urban Rain|Design and Darla Inglis met with City of Morro Bay staff to kick off the project. City staff discussed the constraints of the project site, and opportunities to accommodate both green infrastructure and pedestrian/bike improvements along the Greenwood Avenue project corridor. Kevin Perry walked the project site and recorded existing conditions.

On June 16, 2016, Kevin Perry submitted a preliminary corridor-wide concept plan for City staff to share with the public at an annual event. The public noted its desire to keep the potential improvements along Greenwood Avenue semi-rural in nature. In July, Darla Inglis met with City staff to further define what "semi-rural character" meant within the context of street design. She discussed alternatives that would balance green infrastructure, bicycle/pedestrian use, and rural character.

On September 26, 2016, Kevin Perry and Darla Inglis met with City staff to discuss the three design options for Greenwood Avenue depending on the amount of green infrastructure desired and different bike and pedestrian configurations. City staff recommended looking at a forth option that maximized bike and pedestrian improvements.

On February 22, 2017, Urban Rain|Design provided the City of Morro Bay an updated design that included a forth option for Greenwood Avenue. After review and consideration by City staff and decision makers, on June 14, 2017, Morro Bay staff directed Kevin Perry on the preferred approach for the Greenwood Avenue retrofit. The typical plan views and perspective sketches for the preferred design are depicted in Figures 2-6, below.

Figure 2: Greenwood Avenue Retrofit (North)

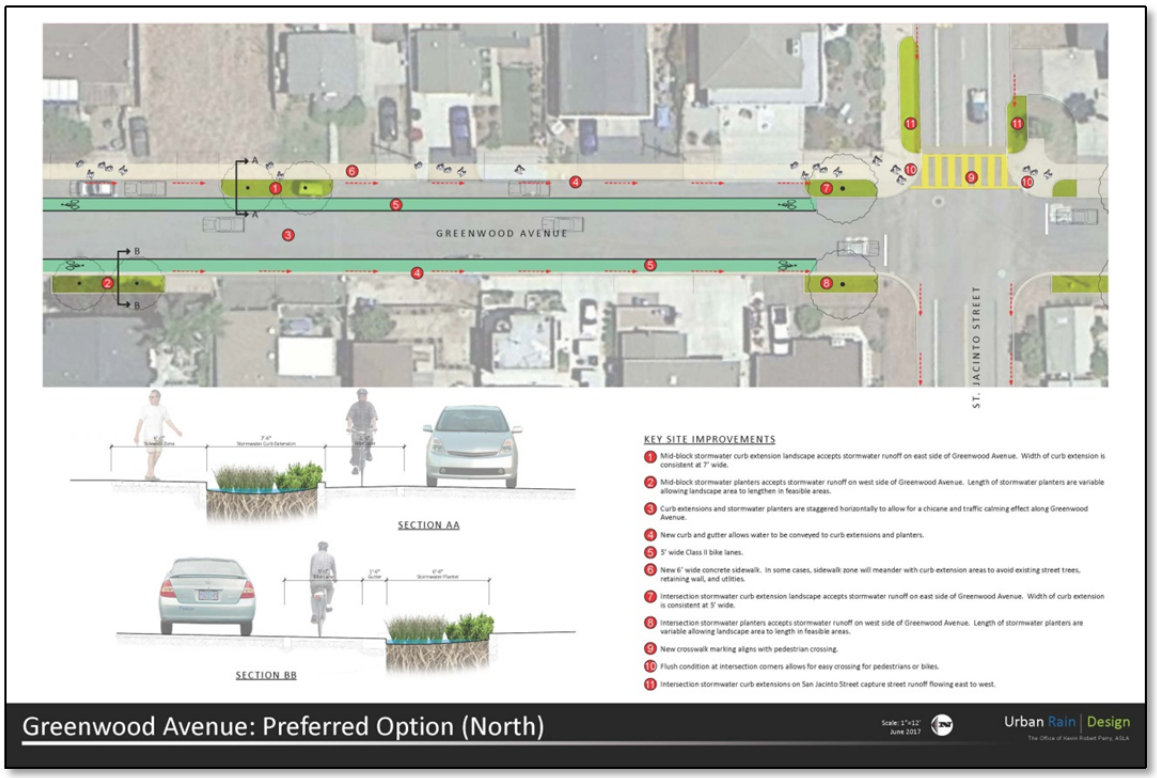


Figure 3: Greenwood Avenue Retrofit (South)

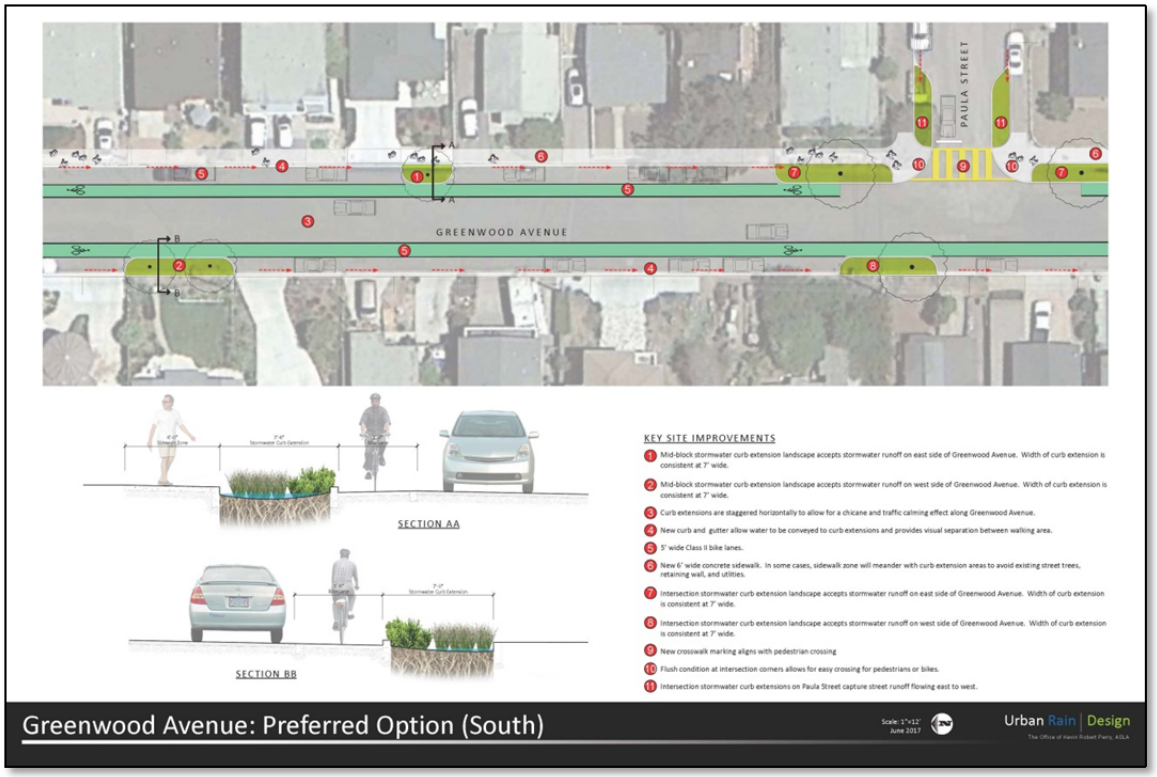


Figure 4: Greenwood Avenue Perspective Sketches

Figure 5: Greenwood Avenue (Sequoia Street to Elena Street)

Figure 6: Greenwood Avenue (Elena Street to Avalon Street)

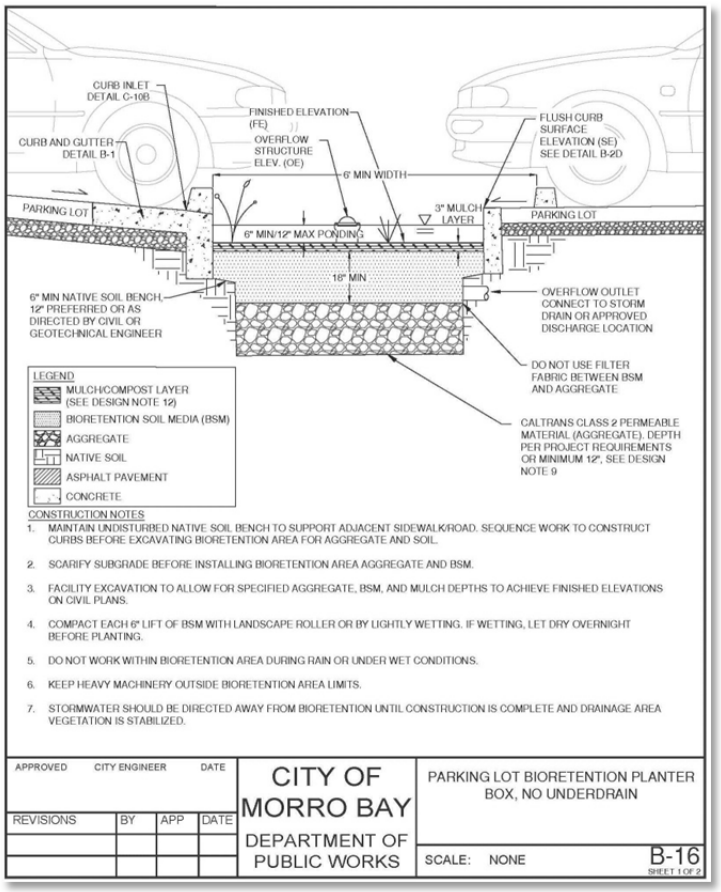
The following assumptions were undergirded the development of the preferred concept design:

1. The concept design focused on an LID or Green Street "lite" approach meaning, the concept design integrated elements of LID that are realistic related to cost, technical feasibility, parking constraints, etc. This design approach avoids the cost and impact of a full street retrofit, which typically is economically infeasible.
2. The preferred concept design maximized bicycle lanes and provided pedestrian facilities on one side of the street.
3. Green stormwater infrastructure was emphasized at intersections.

BIORETENTION/BIOFILTRATION STANDARD DRAWINGS AND SPECIFICATIONS

In order to implement the use of LID practices within the City, there is a need for design standards and details to ensure proper construction and installation. Standard drawings for bioretention facilities were assembled by the grant project team for the City based standards originating from LIDI to maintain consistency with Statewide NPDES and Region 3 PCR requirements. The standard drawings and specifications originated out of work that was performed by the Central Coast Low Impact Development Initiative (LIDI). The LIDI details were then modified through this grant based on extensive input from the participating municipalities, stormwater design professionals, and peer review by a design team not associated with the initial development of the details.

Figure 5: Bioretention Standard Drawings



The refinements to the bioretention and biofiltration standard drawings addressed various edge conditions (with variations for facilities within the landscape strip adjacent to travel lanes or on-street parking and within a parking lot), pervious pavements, edge conditions such as curb inlets and flat curbs, overflow structures and planting palates for landscaping frequently inundated areas of the facilities. After the drawings were completed, the numbering for the drawings was changed to reflect the adopted numbering conventions for the City of Monterey, and the drawings were placed within the City's standard title block.

To review the bioretention standard plans prepared for the City of Morro Bay, please see the California LID Portal under the Standard Details & Specifications tab or through the current link:

https://www.casqa.org/resources/california-lid-portal