CITY OF PACIFIC GROVE

URBAN GREENING PLAN

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DECEMBER 31, 2016

Prepared by

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PROJECT INTRODUCTION

This Urban Greening Plan identifies projects, plans, policies, and programs the City of Pacific Grove (City) can implement to achieve numerous environmental and community benefits. For example, green spaces can help to reduce flooding and improve stomwater quality, provide wildlife habitat, help maintain air quality, reduce urban heat islands, and provide gathering spaces for neighborhood socializing and community building.

To achieve four identified Urban Greening Plan Goals the City should seek projects, plans, policies, and programs that fulfill multiple objectives. The goals and objectives the City has committed to support:

Goal 1 Objectives: Stewardship of Environmental Resources

- Prioritize work, reduce hazards, and increase the health of the urban forest.
- Increase public awareness and participation in creating a healthy urban forest.
- Identify and implement projects that support climate change resiliency and reduce stormwater flows and pollutants

Goal 2 Objectives: Maintaining and Enhancing City Identity

- Strengthen economic vitality consistent with the City's historic character and scenic resources.
- Evaluate opportunities to construct Green Gateways into the City's economic corridor while adding to the urban forest, reducing stormwater runoff, and creating safe pedestrian and bicycle routes.

Goal 3 Objectives: Promoting Alternative Transportation

- Identify opportunities for and construct safe bicycling and pedestrian pathways in a Complete Streets design approach.

Goal 4 Objectives: Implementing Sustainable (Re)Development

- Conserve water and promote healthy soils through sustainable landscaping and plant selection.
- Develop resources for homeowners and construction professionals on landscape design and planting practices to create healthy and environmentally friendly landscapes that fit with the natural conditions of Pacific Grove.

Five (5) individual Urban Greening Plan components have been developed consistent with these goals and objectives:

1. Public Tree Inventory
2. Landscape Trees for Pacific Grove
3. Landscaping Guidelines and Policies
4. Stormwater Low Impact Development (LID) Assessment
5. Watershed Modeling

Through development of the five Urban Greening Plan components, review of existing City plans, policies and programs, and with input from the community, specific recommendations and "action steps" were identified. These action steps provide specific short and long term strategies to incrementally achieve the Urban Greening Plan goals and objectives and are presented in this Plan along with the complete reports for each of the Urban Greening Plan components. The City will review and update these action steps as needed and as implementation occurs. The Plan components and associated documents are subject to review, allowing updates and revisions for future changes and City adaptations.

WHAT IS URBAN GREENING?

Urban greening programs usually include creation and maintenance of green space, such as parks; planting and care of trees; and the creation of green infrastructure.

Green spaces and plants in urban areas provide numerous environmental and community benefits. They can help to reduce flooding and sewer overflow by absorbing large amounts of stormwater, provide wildlife habitat, help to maintain air quality, reduce urban heat islands and provide green space for neighborhood socializing and community building. This Urban Greening Plan is intended to serve as a guiding document to coordinate greening projects in the City of Pacific Grove.

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URBAN GREENING GRANT

The City of Pacific Grove applied for and was awarded a Proposition 84 Grant to develop an Urban Greening Plan. Proposition 84—the Safe Drinking Water, Water Quality and Supply, Flood Control, River and Coastal Protection Bond Act of 2006—authorized funding for the purpose of creating urban greening plans to guide and coordinate urban greening projects in local jurisdictions across the state. Development and implementation of urban greening plans support the State's environmental goals and planning policies; promote infill development and equity; protect the environment; and encourage efficient development patterns.

Below are the five (5) elements that make up the Urban Greening Plan for the City of Pacific Grove.:

- Public Tree Inventory
- Landscape Trees for Pacific Grove
- Landscaping Guidelines and Policies
- Stormwater Low Impact Development (LID) Assessment
- Watershed Modeling

"The City of Pacific Grove is located on the northwestern tip of the Monterey Peninsula approximately 100 miles south of San Francisco. It covers an area of approximately 2.87 square miles with a population of over 15,000."

- City of Pacific Grove Urban Diversion Preliminary Design Report

URBAN GREENING PRACTICES

Low Impact Development (LID)

Low Impact Development (LID) or "green infrastructure" refers to practices that mimic or restore natural hydrologic process within the built environment . The benefits of LID implementation include reducing stormwater and pollutant loading to receiving waters, conserving water, and creating resilient infrastructure. Resiliency is achieved through decentralized LID implementation to reduce exposure during natural disasters while providing redundancy to the conventional stormwater conveyance system.

Complete Streets

Complete Streets is a transportation design concept that equally prioritizes the safety and convenience of all roadway users: bicyclists, pedestrians, automobiles, and public transit users. The integrated approach is considered to improve safety for all users regardless of age and ability, while providing positive economic and environmental outcomes.

Green Streets

In the context of this Urban Greening Plan, Green Streets incorporate the Complete Streets design concept and LID practices to maximize benefits to the community and the environment.

"Street greening strengthens communities, improves public health, enhances our environment and increases the City's economic resilience and vitality."

- SF Better Streets

URBAN GREENING PLAN GOALS & OBJECTIVES

The Urban Greening Plan goals and objectives synthesize goals from the General Plan, Local Coastal Program (comprised of the Pacific Grove Land Use Plan and Implementation Plan), and other planning efforts and were developed with input from the Community and City staff.

GOALS

Goal 1: Stewardship of Environmental Resources

Enhance, restore, or maintain the City's water and marine, parks, urban forest, and biological resources.

Goal 2: Maintaining and Enhancing City Identity

Design project to catalyze economic activity while protecting the City's unique scenic and historical resources.

Goal 3: Promoting Alternative Transportation

Develop bike and pedestrian pathways while preventing coastal erosion.

Goal 4: Implementing Sustainable (Re) Development

Support environmentally sustainable projects with native landscapes and runoff reduction strategies.

The City was established in the mid-1880s with the arrival of the Southern Pacific Railroad. Houses for year-round occupancy were built and a summer religious retreat was developed. Many distinct neighborhoods formed as population growth continued and preserving the architectural character of the neighborhoods has been important for the local community. For additional information reference the City's Historic Context Statement; a tool to better understand and evaluate the City's historic resources. (Pacific Grove Landscape Guidelines & Plant Palette, 2016)

OBJECTIVES

To achieve the identified goals the City should seek projects, plans, policies, and programs that fulfill multiple objectives and benefits. The individual Urban Greening Plan components have been developed consistent with these goals and the following objectives.

Goal 1 Objectives: Stewardship of Environmental Resources

- Prioritize work, reduce hazards, and increase the health of the urban forest.
- Increase public awareness and participation in creating a healthy urban forest.
- Identify and implement projects that support climate change resiliency and reduce stormwater flows and pollutants

Goal 2 Objectives: Maintaining and Enhancing City Identity

- Strengthen economic vitality consistent with the City's historic character and scenic resources.
- Evaluate opportunities to construct Green Gateways into the City's economic corridor while adding to the urban forest, reducing stormwater runoff, and creating safe pedestrian and bicycle routes.

Goal 3 Objectives: Promoting Alternative Transportation

- Identify opportunities for and construct safe bicycling and pedestrian pathways in a Complete Streets design approach.

Goal 4 Objectives: Implementing Sustainable (Re)Development

- Conserve water and promote healthy soils through sustainable landscaping and plant selection.
- Develop resources for homeowners and construction professionals on landscape design and planting practices to create healthy and environmentally friendly landscapes that fit with the natural conditions of Pacific Grove.

SUMMARY OF RECOMMENDED ACTION STEPS

The following recommendations and "action steps" are long term strategies to incrementally achieve the Urban Greening Plan goals and objectives. The City will review and update these action steps as needed and as implementation occurs.

- *City adoption of this Urban Greening Plan (Plan) with commitment to consider implementation of proposed projects, plans, policies and programs consistent with the Plan Goals and Objectives.*

Plans, Policies, and Programs

- *Prepare and adopt a comprehensive Citywide Urban Forest Management Plan.*
- *Establish an Integrated Pest Management Policy and Program.*
- *Review and update recommendations from the 2008 Pedestrian Safety Assessment.*
- *Consider adoption of the Draft Urban Runoff and Artificial Turf Ordinance.*
- *Continue to discourage the installation of Copper Roofing Materials in the City.*
- *Identify primary fecal contamination sources in stormwater runoff and implement reduction and control strategies.*
- *Initiate community dog park planning process.*
- *Develop a City Complete Streets Vision and Policy*

Coordination and Outreach

- *Promote interdepartmental coordination to implement Urban Greening Plan projects and policies.*
- *Actively promote citizen tree planting, native landscapes, and implementation of LID BMP's on private property.*
- *Build community awareness about practices to fertilize and suppress pest problems.*
- *Continue school and community outreach about LID strategies and opportunities.*

Projects

- *Enhance City pedestrian and bikeways with Green Street pilot projects.*
- *Identify opportunities to incorporate educational signage while keeping with the character and aesthetics of the City.*
- *Consider further design and implementation of concept designs developed through the Stormwater LID assessment.*
- *Leverage available public grant funding opportunities for projects reducing urban runoff impacts, specifically community-supported LID projects in the ASBS watershed.*
- *Integrate LID and Tree Planting Opportunities into future capital improvement projects.*
- *Continue to identify potential LID projects with high percolation rates, on public land, and with high retention volumes relative to contributing watershed areas, such as along Pine Avenue.*
- *Identify community supported opportunities to remove coastal invasive species and replant with appropriate native species.*

Urban trees promote retail shopping by stimulating more frequent visits and a willingness to pay more for goods and services (Wolf 1999) (Urban Forest Resource Analysis, Pacific Grove, California, 2015).

PREVIOUS AND CURRENT CITY PLANNING EFFORTS

The City has a strong foundation of existing long range planning efforts codified within plans and policies. Many of those planning efforts establish the City's commitment to Urban Greening.

GENERAL PLAN (1994)

The 1994 General Plan is the principal policy document for guiding future conservation and development of the City, with the exception of the Local Coastal Program Land Use Plan which governs the coastal zone. The General Plan represents an agreement among the citizens of Pacific Grove on basic community values, ideals, and aspirations to govern a shared environment. Zoning, subdivision, and public facilities ordinances, decisions, and projects must be consistent with the General Plan.

The Forest Hill Specific Plan, adopted in 1998, supplements the General Plan and provides additional policy direction for development in this 15.6 acre commercial area. The area represents about one quarter of the commercial land area available in Pacific Grove and is one of two entrances to the City.

The Lovers Point Draft Master Plan was never adopted, but provides useful information about this key City park.

"Pacific Grove's water and marine resources include the rocky intertidal and subtidal areas of the coastline interspersed with sandy beaches and coastal bluffs."

- City of Pacific Grove Land Use Plan (2016)

DRAFT LOCAL COASTAL PROGRAM (LCP) (IN PROCESS, 2016)

Pacific Grove's Local Coastal Program, comprised of the Pacific Grove Land Use Plan and a separately published Implementation Plan, is in the process of being updated. The City's Coastal Zone covers approximately 458 acres, and with minor exceptions, development within that zone requires issuance of a Coastal Development Permit. Development includes such activities as the construction of buildings, divisions of land, and activities that change the intensity of land use or public access to coastal waters.

The LCP includes policies for Natural Systems and Resource Management and the Built Environment. Of specific relevance to Urban Greening are water and marine resource policies, scenic resource policies, biological resource and environmentally sensitive habitat area policies, public infrastructure policies, and parks, recreation and public access policies.

NATIONAL POLLUTION DISCHARGE ELIMINATION SYSTEM (NPDES) REGULATIONS

The work the City does to prevent stormwater pollution is regulated under the jurisdiction of the Central Coast Regional Water Quality Control Board, Region 3 (Regional Board), the enforcement arm of the State Water Resources Control Board (SWRCB). The SWRCB adopted a General Permit for the Discharge of Storm Water from Small MS4s (WQ Order No. 2013-0001-DWQ) to provide permit coverage for smaller municipalities, including non-traditional Small MS4s, which are governmental facilities such as military bases, public campuses, prison and hospital complexes.

MS4 permits require the discharger to develop and implement a Stormwater Management

Plan/ Program with the goal of reducing the discharge of pollutants to the maximum extent practicable (MEP). MEP is the performance standard specified in Section 402(p) of the Clean Water Act.

The management programs specify what best management practices (BMPs) will be used to address certain program areas. The program areas include public education and outreach; illicit discharge detection and elimination; construction and post-construction; and good housekeeping for municipal operations. Landscape based BMPs that provide stormwater treatment are also an opportunity to green the City.

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ASILOMAR GENERAL PLAN

"The Asilomar State Beach and Conference Grounds is covered by the Asilomar State Beach and Conference Grounds General Plan (Asilomar General Plan), approved by the California State Park and Recreation Commission in 2004 under Resolution 19-2004. The Asilomar General Plan contains a detailed evaluation of biotic resources, including: vegetation community types, special status plant species, wildlife species by vegetation community types, special status animal species, and wildlife management issues. The Asilomar General Plan includes goals and guidelines to manage these resources" (Local Coastal Program Land Use Plan, 2016).

CLIMATE CHANGE VULNERABILITY ASSESSMENT (2015)

The City of Pacific Grove Climate Change Vulnerability Assessment was prepared to support the City's development of its Local Coastal Program (LCP) and provides an evaluation of potential significant impacts of climate change to the City's coastal zone.

One component of the Vulnerability Analysis was to evaluate the City's capacity to adapt to the affects of climate change. The report determines that incorporating watershed wide LID techniques will "not only protect the marine sanctuary, but it will also encourage the alleviation of flood hazards, sea level rise potential, and stormwater runoff issues.

AREA OF SPECIAL BIOLOGICAL SIGNIFICANCE (ASBS) COMPLIANCE PLAN (IN DEVELOPMENT 2016)

Portions of the City of Pacific Grove drain to an area of the Monterey Bay identified as an Area of Special Biological Significance (ASBS). The Pacific Grove ASBS is one of 34 similarly designated near shore waters along the California coast and extends 3.2 miles along the Pacific Grove shoreline west from the Monterey Bay Aquarium to Asilomar Boulevard just before Point Pinos. The Pacific Grove ASBS receives runoff from approximately 822 acres in Pacific Grove and 100 acres in Monterey including a small portion from the federal U. S. Army Presidio of Monterey.

Protection of ASBS are governed by the State Water Resources Control Board (SWRCB) through the California Ocean Plan. The Ocean Plan prohibits the discharge of waste to designated ASBS. On March 20, 2012 the SWRCB adopted a General Exception which governs point and non-point waste discharges to California's ASBS, which includes municipal stormwater discharges (SWRCB Resolution No. 2012-0012, amended by Resolution No. 2012-0031). The General Exception includes "Special Protections" for Beneficial Uses of ASBS and requires development of ASBS Compliance Plans to demonstrate local compliance by permitted point source discharges to the ASBS. The City is currently drafting an Updated ASBS Compliance Plan that outlines structural and non-structural best management practices that will be implemented to reduce pollutant loads to the ASBS.

The Pacific Grove ASBS receives runoff from approximately 822 acres in Pacific Grove and 100 acres in Monterey including a small portion from the federal U. S. Army Presidio of Monterey.

PACIFIC GROVE ASBS SPOTLIGHT

The Central Coast ASBS Regional Monitoring Program (CCRMP) was a three year collaboration of various agencies and entities, covering an area from Big Sur, in Monterey County, to Pt. Reyes, in Marin County. As of August 2016, the monitoring program was completed. Six samples were collected at each of three locations within the Pacific Grove ASBS over the course of three years, starting in February 2014 through March 2016.

The monitoring results identified trace metals, Urea, polynuclear aromatic hydrocarbons (PAHs), an organophosphate insecticide (Malathion), chronic toxicity (urchin fertilization), and fecal indicator bacteria (FIB) concentrations in exceedance of the natural ocean water quality from stormwater discharges into the ASBS.

Below is a description of each of the constituents identified as exceeding natural ocean water quality in the Pacific Grove ASBS and a description of their potential sources:

- Trace Metals, sometimes called heavy metals, can be toxic at elevated concentrations. They are found naturally in rocks and soils and also can be elevated in association with anthropogenic sources such as architectural, construction, automotive, and other non-point source pollution.
- Polynuclear aromatic hydrocarbons, or PAHs, are compounds found in petroleum and combustion products and can be toxic at elevated concentrations. PAHs can originate from petroleum spills, natural seeps, vehicle leakage, and various combustion sources.
- Pyrethroid and organophosphate pesticides are known to cause toxicity to aquatic organisms in urban streams. Pyrethroid pesticides were primarily developed to replace organophosphate pesticides, which are noted for causing significant toxicity in ambient waters.
- Toxicity measured in receiving water samples suggest that marine biological resources could be affected by ASBS discharges (AMS, 2016).
- Three fecal indicator bacteria (FIB) were measured, including Fecal Coliforms, Enterococcus, and E. coli. They are used as indicators of fecal contamination. FIBs can be elevated due to sewage leakage and domestic animal and wildlife feces.

The Cities of Pacific Grove and Monterey have been implementing non-structural and structural BMPs consistently since adoption of the ASBS General Exception in March 2012.

The Cities have proposed a three phased implementation approach to achieve compliance with the Special Protections. The phased approach includes a combination of strategies: LID green infrastructure projects, extension of the existing wet/dry weather diversion system, and continued education and outreach to tourists and community members.

MONTEREY REGIONAL STORMWATER MANAGEMENT PROGRAM (MRSWMP)

The Cities of Monterey, Carmel-by-the-Sea, Del Rey Oaks, Sand City, Seaside, Pacific Grove and the County of Monterey are seven local agencies that have joined to develop and implement a regional storm water program for the Monterey Peninsula and surrounding areas. This group meets monthly to discuss urban runoff issues and implement components of the Monterey Regional Storm Water Management Program (MRSWMP).

The Monterey Regional Water Pollution Control Agency (MRWPCA) acts as the group's administrative agent, holding meetings and working with the group to develop this regional program.

DRAFT URBAN FOREST MANAGEMENT PLAN (2012)

The Draft Urban Forest Management Plan (UFMP) is a 25-year plan that recommends steps to protect city trees and the coastal environment. "Pacific Grove's urban forest touches the lives of its citizens every day. It consists of all trees in the City on both public and private property, including street trees, park trees, forested parklands, trees at schools, trees on the Pacific Grove Golf Links, and trees in many private ownership settings."

The Draft UFMP identifies city-wide and neighborhood strategies to meet the city's tree canopy target. City wide strategies include (1) Greening Pacific Grove - Establishing an Urban Forest Restoration Program, (2) Green Streets - Promoting Sustainable Management and Mobility, and (3) Memorable Gateways - Using trees to Create Distinctive Entries into Pacific Grove.

The Draft UFMP is included in the Urban Greening Plan as Appendix A, as a means to compile City Planning documents relevant to Urban Greening. The Draft UFMP was never finalized or adopted.

ACTION STEP: Prepare and adopt a comprehensive Citywide Urban Forest Management Plan.

COASTAL PARKS PLAN (1998)

The Pacific Grove Coastal Parks Plan (Coastal Parks Plan) was adopted as an element of the Local Coastal Program Land Use Plan in 1998. Its purpose is to guide the design,management, restoration, and enhancement of the coastal parks planning area consistent with state and community objectives. As an element of the Local Coastal Program Land Use Plan, the Coastal Parks Plan is also required to be consistent with the Coastal Act. The Coastal Parks Plan is applicable to an area of about 248 acres, and addresses trails, bikeways, parking and circulation, coastal resources, and visual quality and appearance. Development within this defined area must be consistent with not only the Coastal Parks Plan, but also the Land Use Plan, and the Implementation Plan. There are currently no funds to update the Coastal Parks Plan, but the City plans to seek funds for an update after the Local Coastal Program is adopted.

"Pacific Grove strives to maintain and re-establish the urban forest as a thriving mix of tree species and ages that... will be ... an essential environmental, economic and community asset.

- Draft Urban Forestry Management Plan (2012)

PACIFIC GROVE PEDESTRIAN SAFETY ASSESSMENT (2008)

The Pacific Grove Pedestrian Safety Assessment was conducted with the objectives of improving pedestrian safety and enhancing walkability and accessibility for all pedestrians. A 2006 California Office of Traffic Safety ranking identified older pedestrians (ages 65+) of the highest concern in Pacific Grove. In 2007 the City ranked 46 out of 101 California cities in the same population group for the number of pedestrian collisions. From January 1997 to December 2007, 60 pedestrian collisions occurred, three of which resulted in pedestrian fatalities. In 2007 older pedestrians (ages +65) and bicyclists were determined the highest traffic safety concern. High collision corridors include Forest, Pine, Lighthouse and Central Avenues and Sunset Drive.

The assessment recommendations include identification of (1) programs, policies, and practices that "could be better" or "deserve attention" and (2) physical improvements such as road diets, bulb outs, and median refuge islands, that are based on field observations and best practices in pedestrian design and safety. Many of the report recommendations are predicted to also improve bicycle safety in the City.

Top Ten Pedestrian Vehicle Collision Locations in Pacific Grove

Intersection	# of Collisions	
	1997-2007	2014-2016
Forest Avenue & Pine Avenue	5	1
Forest Avenue & Sinex Avenue	3	1
Congress Avenue & Lighthouse Avenue	3	0
Central Avenue & Dewey Avenue	3	0
Forest Avenue (Rt. 68) & Sunset Drive	2	0
Sunset Drive (Rt. 68) & Congress Avenue	2	0
Congress Avenue & Laurel Avenue	2	0
Central Avenue & Eardley Avenue	2	0
Sunset Drive (Rt. 68) & 19th Street	2	0
Prescott Lane & Forest Avenue (Rt. 68)	2	0
Central Avenue & 8th Street	2	0
Forest Avenue & Laurel Avenue	2	0

Source: 1997-2007 Data from Pacific Grove Pedestrian Safety Assessment, Pacific Grove Police Department and Fehr & Peers. 2014-2016 Data from Pacific Grove Police Department.
Notes: This list is based on number of collisions and does not adjust for vehicle or pedestrian volumes (exposure). Midblock collisions were mapped to the nearest intersection.

ACTION STEP: Review and update recommendations from the 2008 Pedestrian Safety Assessment to prioritize implementation of the "could be better" or "deserve attention" program areas. Evaluate and prioritize implementation of proposed physical improvements for incorporation into capital improvement and Urban Greening Projects.

PROPOSED PLANS, POLICIES, & PROGRAMS

INTEGRATED PEST MANAGEMENT

Build community awareness about practices to prevent or suppress pest problems with minimum impact on human health, the environment, and non-target species. Preferred pest management techniques include:

- Encouraging naturally occurring biological control;
- Using alternate plant species or varieties that resist pests; and
- Adopting cultivating, pruning, fertilizing, or irrigation practices that reduce pest problems.

ACTION STEP: Establish an Integrated Pest Management Policy and Program with the goal of eliminating or reducing pesticide application on City property to the maximum extent feasible.

REDUCING COPPER RUNOFF

The City should continue to discourage the installation of copper roofing materials. Information should be provided to property owners on how to limit copper runoff to the Pacific Ocean and Monterey Bay, and provide comparable alternatives to the use of copper for use as chimney trim, gutters, and details.

To protect water quality during installation, cleaning, treating, and washing of architectural copper, develop information to provide to all project applicants proposing the use of architectural copper in new or redevelopment projects.

STRATEGY TO REDUCE FECAL CONTAMINATION

Pathogens, in the form of fecal indicator bacteria, have been detected in elevated concentrations within the ASBS. A basic flow fingerprinting process and Microbial Source Tracking (MST) would provide information about the primary fecal contamination sources. An MST study can identify the primary sources of fecal contamination and recommend practices, projects, and/or policies to address the specific contamination sources. Additional strategies to reduce fecal contamination include:

- Include information in community articles and bulletins to remind pet owners to clean-up the pet waste in their yard, especially prior to rain events, and to generally ensure no pollutants reside outside that may come into contact with rainfall.
- As public works projects or trail/park improvements occur, identify opportunities to provide additional signage about pet-waste pick-up along with pet waste collection bags.

ACTION STEP: Continue to discourage the use of copper roofing materials in new or redevelopment projects.

ACTION STEP: Identify primary fecal contamination sources and implement reduction and control strategies.

The Bruce King Memorial Dog Park in El Cerrito covers a quarter acre and is 35 feet wide and 280 feet long. Amenities include two fenced areas - one for dogs 20-inches or shorter and an entryway with drinking fountains (for humans and dogs) and waste receptacles. (City of El Cerrito)

EDUCATIONAL SIGNAGE

Identify opportunities to incorporate educational signage while keeping with the City's character and aesthetic considerations, specifically:

- Develop a program to mark (stencil or emblem) 100% of storm drains in the ASBS watershed (where feasible);
- Encouraging pet-waste pick-up at parks and at public trails;
- Identifying the limits of the ASBS watershed (e.g. "Now entering the ASBS Drainage Area").

ACTION STEP: Identify opportunities to incorporate educational signage while keeping with the City's character and aesthetics.

COMMUNITY DOG PARK PLAN

Contained dog parks can include fenced areas for large and small dogs, drinking fountains, and waste receptacles. The benefit of a contained dog park in the City of Pacific Grove, would be to reduce the disturbance of natural areas, that is currently occurring within the informal off-leash Rip Van Winkle dog park for example, and maximize the collection of pet waste.

Initiation of a process to gauge community interest, potential locations, and design for a City dedicated Dog Park to be used as a contained off-leash area for people and their pets is recommended.

ACTION STEP: Initiate community dog park planning process.

(RE)DEVELOPMENT URBAN GREENING POLICY

Through adoption of this Plan the City demonstrates its commitment to Urban Greening programs, policies, and projects. Implementation can be achieved through promotion of interdepartmental coordination and a City (re)development urban greening policy. For example, if a developer wants to develop or redevelop a site, they would need to implement appropriate strategies or policies consistent with this plan or pay to have them implemented elsewhere in the City as a way of funding the projects.

ACTION STEP: Adoption of this Urban Greening Plan with commitment to consider implementation of proposed projects, plans, policies and programs.

ACTION STEP: Promote interdepartmental coordination to implement Urban Greening Plan projects and policies.

COMPLETE STREETS POLICY & PILOT PROJECT IMPLEMENTATION

To build upon the City's General Plan goal of creating and maintaining a safe and convenient system of pedestrian and bicycle pathways, the development of a Complete Streets Policy and Vision is proposed, with the near term implementation of three pilot projects focused on linking LID and tree planting opportunities with parks, trails, parking, tourism, pedestrian and bicycle routes in a Complete Streets approach. The three pilot projects are:

1. Pine Avenue Green Street
2. Forest Avenue Pedestrian link between Lovers Point and Lighthouse Avenue
3. Lighthouse Avenue Green Street Retrofit

These "Green Gateways" are ideally located to address high risk pedestrian safety intersections (as identified through the 2008 Pedestrian Safety Assessment) and positively impact economic vitality with the City's commercial corridor. The master plan could integrate a historical and architectural walking tour, to highlight these unique City features. Reducing the number of cars on City roadways will decrease car related contaminants, specifically PAHs and trace metals from entering the Bay and ASBS.

☑ *ACTION STEP: Enhance City pedestrian amenities and bikeways with Green Street Pilot projects on Forest, Lighthouse and Pine Avenues.*

☑ *ACTION STEP: Develop a City Complete Streets Vision and Policy.*

The Multiple Shades of Green Streets

Level 1	Maximize landscaped areas along the street and minimize overall impervious area. Some runoff from adjacent sidewalks may be managed in landscaped areas.	
Level 2	Significant tree canopy is added to the urban streetscape.	
Level 3	Stormwater runoff is fully managed from the street, sidewalk, and driveway areas within a landscaped system. Design solutions are cost effective, provide direct environmental benefits, and are aesthetically pleasing.	
Level 4	Green street provides a direct focus on alternative modes of transportation including mass transit, biking, and walking.	
Level 5	The building, site, and street frontage become one integrated space for stormwater management. The entire green street "envelope" manages both public and private runoff.	

Source: San Mateo County, Sustainable Green Streets and Parking Lots Design Guidebook, 1st Edition, January 2009

INTEGRATION WITH EXISTING PLANS, POLICIES, & PROGRAMS

The previously described Recommended Action Steps and Proposed Plans, Policies, and Programs have been selected for consistency with the City's existing guiding plans, policies and programs. This section describes how the proposed Urban Greening Plan elements integrate into the City's existing long range planning efforts.

GENERAL PLAN

Below is a list of the General Plan Goals, Policies, and Programs that the proposed Urban Greening Plan elements would directly work to achieve. A more complete list is included in Appendix B.

Transportation Section (chapter 4):

Transportation Goal 7. Promote pedestrian and bicycle travel as alternatives to automobile use.

Transportation Policy 10: Encourage design for new and expanded development that facilitates access by transit, walking, bicycles, and carpools.

Transportation Policy 25: Create and maintain a safe and convenient system of pedestrian and bicycle pathways throughout the city.

Parks and Recreation Section (chapter 5):

Parks and Recreation Policy 5: Where practical, foster the use of drought-tolerant and drought resistant landscaping in City parks.

Natural Resources Section (chapter 6):

Natural Resources Goal 1. Comprehensively manage Pacific Grove's vegetation and wildlife habitat.

Natural Resources Goal 2. Protect Pacific Grove's coastal resources.

Natural Resources Goal 4. Protect Pacific Grove's water and marine resources.

Natural Resources Policy 3: Actively promote tree planting to maintain and renew the urban forest.

Natural Resources Program B: Prepare and adopt a comprehensive and citywide urban forest management plan.

Natural Resources Program C: Work with citizens to encourage tree planting on private property.

Natural Resources Program D: Encourage the restoration and maintenance of native plants.

Natural Resources Policy 7: Develop procedures to more effectively focus the abundance of environmental and other volunteerism available to the City.

Natural Resources Policy 8: When reimbursement is available, cooperate with State and Federal agencies in reducing impacts from urban runoff.

Natural Resources Policy 9: Prohibit the unsafe use of chemical pesticides and herbicides.

DRAFT LOCAL COASTAL PROGRAM

The proposed Urban Greening Plan elements would directly work to achieve the DRAFT Local Coastal Program Goals, Policies, and Programs.

ASBS

The identified LID projects, Green Streets, and Plans, Policies, and Programs targeting the improvement of stormwater runoff quality will all work in concert to achieve compliance with the ASBS Special Protections. Education and Outreach is critical to reducing stormwater flow and improving water quality. One element of this program will be updating the ASBS website to serve as a portal for on-going activities and programs, such as:

- Access to a summary of findings from regional and local water quality data;
- Maintain community access to LID techniques web page;
- Create interface for visitors to enter contact information to receive email alerts regarding ASBS specific topics (e.g. pre-rain pet waste pick-up reminders);
- Materials for upcoming workshops and events such as for the LID Infrastructure and Urban Greening Plan development;
- Information and sign-up for Urban Watch monitoring program;
- Integrated Pest Management educational flyers;
- Links to/from the ASBS website from MRWSMP and other City websites relevant to stormwater management; and
- ASBS specific information for roofing supply and roofing contractors servicing the Pacific Grove area about the use of architectural copper and its associated water quality risks.

"Since its founding in 1875 as a seaside resort, Pacific Grove has been a city with... volunteers who are dedicated to protection and maintenance of the unique... resources in the Coastal Zone."

- City of Pacific Grove Land Use Plan (2016)

CONTINUED SUPPORT OF PARTNERSHIPS AND VOLUNTEERISM

The Cities support an annual Coastal Cleanup Day through MRSWMP; however the sponsored beaches rotate each year and may not always be in the ASBS. Coordinate with MRSWMP to:

- Ensure Annual Coastal Cleanup Day always includes a beach within the ASBS .
- Incorporate ASBS specific information into the existing educational programs to school groups.

ACTION STEP: Through coordination with the Beautification and Natural Resources committee create a volunteer based tree planting program.

Draft Highway 68 Improvement Concepts - under revision (June 2016, provided by Ariana Green, Transportation Agency of Monterey County). Image at right, 17-mile Drive swale concept plan. (Mark Thomas & Company)

TRANSPORTATION AGENCY OF MONTEREY COUNTY (TAMC) HIGHWAY 68 IMPROVEMENTS

"The Pacific Grove Highway 68 Study evaluated ways to improve two streets in Pacific Grove: Forest Avenue and Sunset Drive. The goal is to create a more "complete" corridor—one that works better for different forms of transportation and for people of all ages and abilities. In particular, the study is exploring ways to improve walking and biking on those streets. The study corridor encompasses Forest Avenue from the city limit to Sunset Drive; and Sunset Drive from Forest Avenue to Asilomar Avenue." (www.PGHwy68.org)

Complete Streets concept options were proposed for the Highway 68 Improvements, consistent with the Urban Greening Plan recommendations. To maximize reducing stormwater flows and improving water quality, the designs should maximize opportunities to incorporate Green Street design elements. Specific examples include incorporating the use of permeable pavers and bioretention bulbs, median, and roundabouts where feasible.

PROJECT TEAM AND RESOURCES

The five (5) plan components that make up the Urban Greening Plan for the City of Pacific Grove include:

- Public Tree Inventory
- Landscape Trees for Pacific Grove
- Landscaping Guidelines and Policies
- Stormwater Low Impact Development (LID) Assessment
- Watershed Modeling

Each plan component was completed by a separate contributor, and in some instances include numerous final products or documents. The Plan components and associated documents are subject to review, updates and revisions to allow for future changes and City adaptations.

The Landscape Guidelines and Plant Palette (2016) was written and produced by Oona Johnsen Landscape Architecture, Inc., a local landscape architect in conjunction with the City of Pacific Grove Public Works Department, with community input.

Stormflow Monitoring and Modeling at Pacific Grove, California (2016) was completed by staff and students at the Watershed Institute at California State University Monterey Bay (CSUMB) under the direction of Associate Professor Dr. Fred Watson.

Davey Group Resources Group prepared the City wide Public Tree Inventory (2015), the Urban Forest Resource Analysis (2015), and the Urban Tree Canopy Assessment (2015).

The Stormwater Low Impact Development (LID) Assessment was prepared by Fall Creek Engineering, Inc. and landscape archictect Joni L. Janecki Associates of Santa Cruz, California.

CALIFORNIA STRATEGIC GROWTH COUNCIL

Funding for all the individual plan components that are summarized in this Urban Greening Plan was provided by Proposition 84 to Improve the Sustainability and Livability of California's Communities through the Strategic Growth Council's Urban Greening for Sustainable Communities grant program. Grant funding authority is through The Safe Drinking Water, Water Quality and Supply, Flood Control, River and Coastal Protection Bond Act of 2006.

PUBLIC TREE INVENTORY

The following documents were completed as part of the Citywide Public Tree Inventory.

PUBLIC TREE INVENTORY (2015)

An inventory of individual trees on public property was conducted in 2015 in Pacific Grove in order to provide information for forest managers to better prioritize work, reduce hazards, and increase the health of the urban forest. The inventory included 7,394 trees and 623 vacant sites and stumps, for a stocking rate of 92.2%.

The three most common species made up 76% of the tree population and the report suggested planting a greater diversity of tree species in order to create a more resilient forest. Other recommendations included removing and pruning 530 priority trees, providing clearance pruning for 128 trees, developing a 3-5 year pruning cycle, repairing hardscape at 395 sites, developing a planting plan, and addressing issues with tree stakes.

URBAN FOREST RESOURCE ANALYSIS (2015)

The Urban Forest Resource Analysis is an analysis of public trees within the city right-of-way on streets and in parks. A GIS layer was created to analyze trends and performance measures over the entire urban forest and for each of the major species.

Pacific Grove's urban forest has a nearly ideal age distribution and has a healthy diversity with over 136 species, although the top three species represent 75% of the total population. The study found that the City's 7,394 trees are providing over $1.2 million in annual gross benefits for an average of $166.32 per tree. The net annual benefit from the urban forest is $930,232, and Pacific Grove is receiving $4.11 in benefits for every $1 invested in community trees.

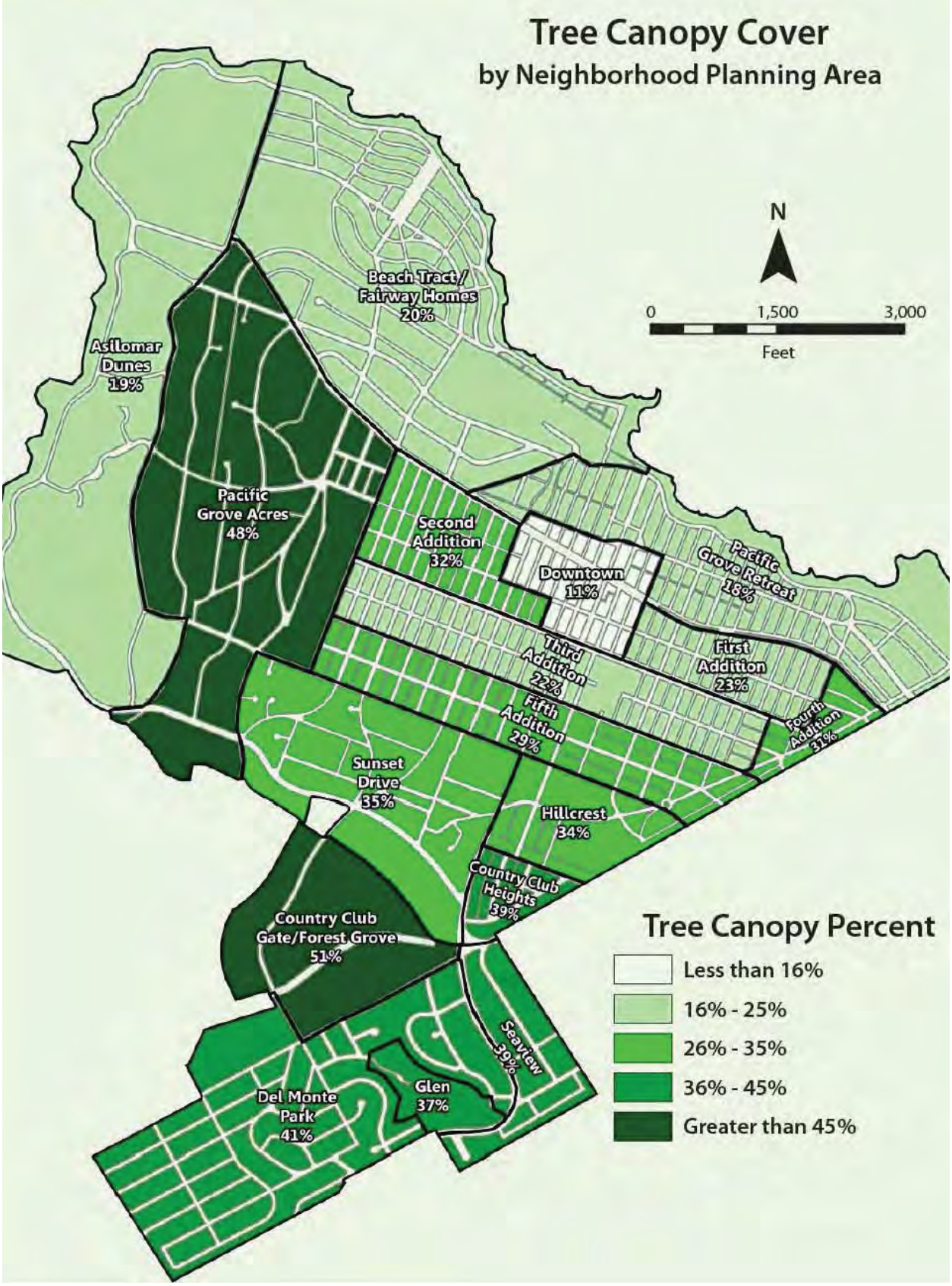
Recommendations include increasing species diversity, increasing stocking level, pruning all trees, inspecting regularly, updating the inventory database, and planting trees that emit fewer biogenic organic compounds.

> ***"The City's 7,394 trees are providing over $1.2 million in annual gross benefits for an average of $166.32 per tree. Pacific Grove is receiving $4.11 in benefits for every $1 invested in community trees."***
>
> ***- Citywide Public Tree Inventory***

URBAN TREE CANOPY ASSESSMENT (2015)

The Urban Tree Canopy Assessment is a comprehensive evaluation of Pacific Grove's urban tree canopy. It uses remote image sensing and GIS analysis to develop a birds-eye view of the entire urban forest, both public and private. Canopy cover in the City increased from 25.8% in 2005 to 28.6% in 2014. The City contains 523 acres of pervious land (57% of its total area) with the potential to support tree canopy. Land change modeling software projects that tree canopy will reach 31% cover in 2024. Based on historic and projected growth, the community is on track to reach its goal of an overall tree canopy of 33% by 2037. Prioritized maps, such as the Stormwater Priority Planting Map, provide a basis for strategically focused planting plans that will increase canopy cover, support stormwater management, and preserve soil. GIS data on canopy cover supports additional analysis and will remain an important tool for urban forest managers and others.

ACTION STEP: Integrate LID and Tree Planting Opportunities into future capital improvement projects.



Tree Canopy by Neighborhood in Pacific Grove (Urban Tree Canopy Assessment 2015)

LANDSCAPE TREES FOR PACIFIC GROVE

The recommended landscape tree list for Pacific Grove was updated in April 2015 by the Beautification and Natural Resources Commission and included the development of an informational handout, brochure, and a Guide to Selection, Planting, and Care of Landscape Trees.

"More than a century ago, the City of Pacific Grove was founded in a forest. Trees grew in profusion... Since then, we have lost much of that forest. ...we must do all we can to ensure that trees will always flourish in Pacific Grove."

- Carmelita Garcia, Former Mayor. Landscape Trees for Pacific Grove: a Guide to Selection, Planting & Care

American Sweetgum (*Liquidambar styraciflua)*

London Plane Tree (*Platanus racemosa)*

New Zealand Christmas Tree (*Metrosideros excelsa)*

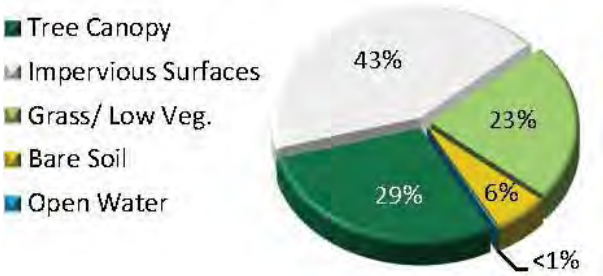
ACTION STEP: Prepare and adopt a comprehensive and citywide Urban Forest Management Plan to address aesthetics, forest renewal, maintenance, and safety. The Plan should include a plan for species diversification, initiate a pruning cycle, provide a maintenance schedule, and require a regular inventory of the urban forest.

Monarch Grove Sanctuary, with conifer and eucalyptus species that provide crucial habitat for Monarch Butterfly

Based on historic and projected growth, the community is on track to reach its goal of an overall tree canopy of 33% by 2037.

- Urban Tree Canopy Assessment

Land Cover in Pacific Grove



Condition of Pacific Grove's Urban Community Forest

Source: Urban Tree Canopy Assessment, 2015

LANDSCAPING GUIDELINES AND POLICIES

The Pacific Grove Landscape Guidelines and Plant Palette document is a guiding document with recommendations for landscape design, planting practices, and maintenance for the homeowner and to assist landscape and construction professionals. It provides an integrated approach to creating healthy, environmentally friendly landscapes for the Pacific Grove environment.

The final Landscape Guidelines and Plant Palette document was accepted in February 2016 by the Beautification and Natural Resources Commission.

Figure 1: Plants in the marine community are threatened by non-native invasive species. Removing coastal invasive species, such as ice plant, and replanting with appropriate native species will help the native marine species establish and thrive. A good example of such efforts can be found along the Asilomar Dunes Natural Preserve across from Asilomar State Beach. (Pacific Grove Landscape Guidelines & Plant Palette, 2016)

LANDSCAPE GUIDELINES AND PLANT PALETTE (2016)

The Pacific Grove Landscape Guidelines provide recommendations for landscape design, planting practices, and maintenance for homeowners and landscape and construction professionals.

This document lists native shrubs, perennials, groundcovers, grasses, succulents, vines, and lawn alternatives but not trees (information about trees is available on the City website). This document provides information about the geology, hydrology, topography, impervious surfaces, native plant communities, irrigation, and soils of Pacific Grove. It walks the reader through plant choice, planting design, planting techniques, and maintenance.

"Interspersed among the streets of historic homes are several small parks... The scale, vegetation, and physical features of the parks make a distinctive contribution to the... Pacific Grove Retreat."

- City of Pacific Grove Land Use Plan (2016)

ACTION STEP: Identify feasible opportunities to remove coastal invasive species and replant with appropriate native species to help the native marine species establish and thrive.

ACTION STEP: Build community awareness about practices to fertilize and suppress pest problems with minimum impact on human health, the environment, and non-target species.

URBAN RUNOFF AND ARTIFICIAL TURF ORDINANCE (2016) - UNADOPTED

The Draft Urban Runoff Ordinance would regulate public and private projects that either consist of new construction or result in an increase of 1,000 square feet of new impervious surface. All commercial projects that require Use Permits, and all parking lot resurfacing projects are also regulated.

ACTION STEP: Consider adoption of the Draft Urban Runoff and Artificial Turf Ordinance.

The Draft ordinance would require new construction to use at least two LID practices such as rainwater harvesting, permeable paving, and/or bioretention. Parking lots would require a minimum number of trees based on the number of parking spaces, a minimum 10% landscaped area, and bioswales.

Artificial turf would be allowed on residential and mixed use sites for up to 20% of the total yard area of the project site and regulations must be followed. Artificial turf could be installed in playgrounds, recreation, education, and public assembly land by permit.

COMMUNITY STORMWATER TREATMENT RESOURCE

City of Pacific Grove LID Techniques website resources:

http://www.cityofpacificgrove.org/living/community-economic-development/planning/stormwater

This website covers six techniques for enhancing stormwater quality and reducing flows, including roof downspout redirection, rain gardens, rainwater harvesting, replacing impervious surfaces with pervious, tree planting, and gull deterrents. Design guidelines are provided for all six techniques, which include information on planning, sizing, checklists, plant selection, prerequisites, installation, example photos, and irrigation. The website is geared toward homeowners and doesn't cover other methods including green roofs, bioswales, or other infiltration techniques.

Currently this website remains from an expired rebate program but the information will be reused in a city-wide program to support community led activities to clean and reduce stormwater runoff with a focus on the ASBS.

ACTION STEP: Actively promote citizen tree planting, native landscapes, and implementation of LID stormwater BMPs on private property through promotion and maintenance of previously developed web portal.

STORMWATER LOW IMPACT DEVELOPMENT (LID) ASSESSMENT

This element includes initial planning and conceptual design of priority areas for green infrastructure and the urban forest to implement stormwater treatment measures. The Assessment considers the outcomes of all previous elements developed for the Urban Greening Plan and public input with the purpose of:

- Identifying a suite of potential urban greening projects that meet the urban greening plan goals and objectives; and
- Developing concept designs, at a level sufficient to seek funding, for projects that provide multiple community benefits.

LID PRACTICES

Employing green infrastructure techniques to meet stormwater regulations versus a combination of detention pipes and cartridge filters ("gray infrastructure") allows stormwater managers to meet multiple objectives in a way that mimics a site's natural function and maximizes overall water quality and quantity improvements. Often green infrastructure alternatives can be more cost effective than traditional gray infrastructure .

LID site design principles:

- Improve water quality
- Limit disturbance of natural drainage features;
- Limit clearing, grading and soil compaction;
- Minimize impervious surfaces; and
- Minimize runoff by dispersing runoff to landscape or using permeable pavements.

The following is a general brief description of each of the LID practice proposed for incorporation into the Plan.

Bioretention. Bioretention features can be used to capture stormwater runoff from impervious surfaces in commercial, residential, and industrial areas. Use of bioretention for stormwater management is ideal for median strips, parking lot islands, and swales. Using native and/or climate adapted plant species in the bioretention cells reduces fertilizer, pesticide, irrigation demands, and overall maintenance requirements. An inlet pipe or sheet flow over impervious area conveys water into the basin, where it is stored until it infiltrates into the ground or is conveyed back into the storm drain system. Basins often provide complete on-site infiltration for small storm events.

Bioretention areas can be designed to be landscaped features and be manicured or "natural" in character depending upon the vegetation selected, hardscape elements, and maintenance schedule. During design of stormwater management facilities, mosquito abatement measures need to be considered to prevent nuisance conditions from arising.

Permeable Pavement. Permeable pavement allows for stormwater infiltration while providing a stable load-bearing surface that does not contribute to a project's impervious area. There are two main categories of pervious pavements: pervious concrete and pervious asphalt, which are poured in place, and permeable pavers, which are discrete units set in place. Pervious asphalt, pervious concrete, and permeable pavers can be used in practically all pedestrian areas as well as driveways and commercial parking lots. Pervious asphalt and concrete on private streets and public roadways should be evaluated on a case-by-case basis.

Rain Gardens. A rain garden is a landscape area designed to receive rainfall and/or stormwater runoff. It is usually small and simple in construction as compared to bioretention facilities, though through processes of infiltration and filtration the water quality treatment and volume reduction benefits are similar. Rain gardens are typically located in close proximity to the runoff source, for example at the end of a disconnected downspout. The subsurface soils in a rain garden are engineered to support infiltration, and the plants are selected to thrive with periodically saturated soils and inundation. A rain garden can provide habitat for birds, butterflies, and bees and can be incorporated into a larger landscaped garden or stand alone. Below the surface of the garden, a number of processes are occurring which mimic the hydrologic action of a healthy forest, and multiple rain gardens over an area will have a positive cumulative effect on both the volume and quality of stormwater runoff."

Bioretention soil media is designed for quick infiltration. Overflow or underdrain pipes can be used to prevent water from ponding for more than 24 hours.

Dry Swales. Dry swales are a permutation of bioretention systems constructed in a linear fashion. Dry swales typically contain a shallow depth of engineered soil and are configured as channels, with interconnected treatment cells. The surface can be covered with native grasses, cobble, or turf in a manner that integrates the swale into the adjacent landscape. Similar to bioretention features, dry swales can include a perforated underdrain beneath the soil media to convey runoff that percolates through the system back to the storm drain system. In this way, water quality treatment is provided via filtration through the engineered soil media.

LID DESKTOP EVALUATION

FCE completed a GIS based Desktop Evaluation to identify priority parcels for a site visit and evaluation of LID retrofit opportunities. In addition to soil type and slope, FCE coordinated with the City to select additional factors to consider in the evaluation of parcels for LID retrofit suitability. Points were assigned to each of the selected factors and a single prioritization shapefile was created based on a union of the overlapping factors. The total points were tallied to indicate a relative high, medium, or low opportunity for LID implementation.

LID RETROFIT INVENTORY

Over the course of four (4) field days in May and June 2016, FCE visited the top 40 sites identified in the Desktop Evaluation. Each site was evaluated for potential LID strategies and designs using a common field evaluation worksheet. Emphasis was placed on project concepts with high public visibility, existing grading that could support an LID retrofit with relatively low complexity, and the opportunity to provide water quality treatment to support ASBS compliance. A scoring template and a prioritization matrix were used to compare all the parcels and identify 15 sites to recommend for development into LID Concept Plans.

LID CONCEPT PLANS

Below is a list of the 15 sites recommended for LID concept design development. A more complete description and graphic illustration of the proposed LID concept at each site is include within the Full Plans & Documents section of the Urban Greening Plan. Site numbering is based on location (south to north) not on priority.

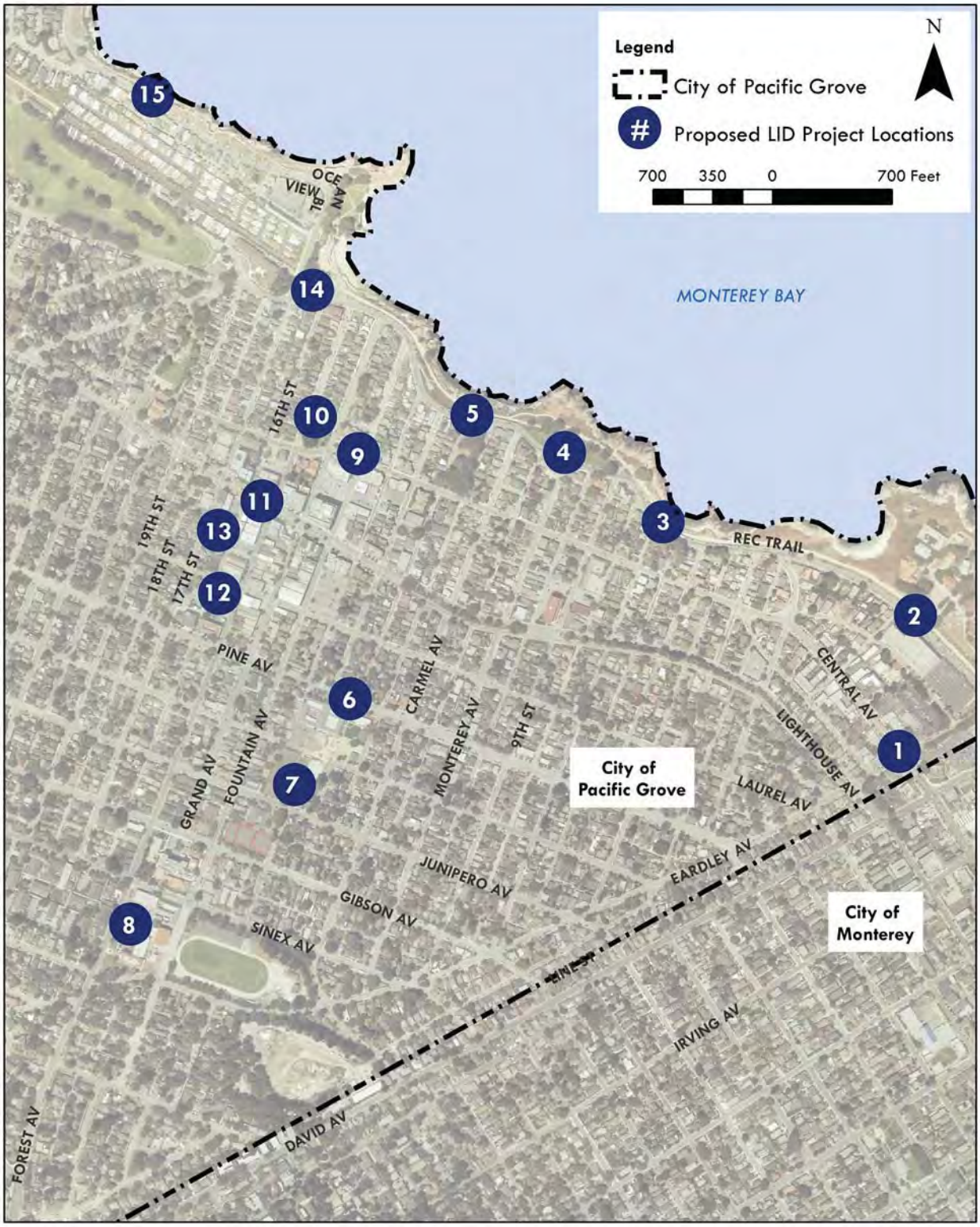
1. **Central Avenue - Landscape Bulbs**
2. **Dewey Avenue to Eardley Avenue - Dry Swale**
3. **7th Street - Bioretention**
4. **Berwick Park - Bioretention**
5. **12th to 13th Street - Bioretention**
6. **Pine Avenue - Green Street**
7. **Robert Down Elementary School – Rainwater Collection**
8. **Pacific Grove Middle School - Downspout Disconnect**
9. **Library Rain Garden & Bioretention Islands**
10. **Jewell Park - Bioretention**
11. **Lighthouse Avenue - Green Street**
12. **City Hall - Courtyard Plaza Retrofit**
13. **Fandango Parking Lot - Retrofit**
14. **Lovers Point Parking Lot - Retrofit**
15. **Ocean View Curb Cuts to Rain Gardens**

ACTION STEP: Consider further design and implementation of concept designs developed through the Stormwater LID assessment.

ACTION STEP: Leverage available public grant funding opportunities for projects reducing urban runoff impacts, specifically community-supported LID projects in the ASBS watershed.

ACTION STEP: Integrate LID planning into future capital improvement projects.

ACTION STEP: Continue school and community outreach about LID strategies and opportunities.



Pacific Grove Proposed LID Project Locations
Urban Greening Plan

FALL CREEK ENGINEERING
Date: 9/8/2016

PROJECT COMPARISON CHART

	Healthy Urban Forest	Climate Change Resiliency	Clean Stormwater	Economic Vitality	Preserves City Character & Scenic Resources	Complete Street	Green Gateway	Pedestrian & Bicycle Safety	Sustainable Landscaping
Central Avenue - Landscape Bulbs	✓	✓	✓	✓	✓		✓		✓
Dewey Avenue to Eardley Avenue - Dry Swale		✓	✓	✓	✓		✓		✓
7th Street - Bioretention		✓	✓	✓	✓				✓
Berwick Park - Bioretention		✓	✓	✓	✓				✓
12th to 13th Street - Bioretention		✓	✓	✓	✓				✓
Pine Avenue - Green Street	✓	✓	✓	✓	✓	✓	✓	✓	✓
Robert Down Elementary School – Rainwater Collection		✓			✓				✓
Pacific Grove Middle School - Downspout Disconnect		✓			✓				✓
Library Rain Garden and Bioretention Islands	✓	✓	✓	✓	✓		✓		✓
Jewell Park - Bioretention	✓	✓	✓	✓	✓		✓		✓
Lighthouse Avenue - Green Street	✓	✓	✓	✓	✓	✓	✓	✓	✓
City Hall - Courtyard Plaza Retrofit	✓	✓	✓	✓	✓				✓
Fandango Parking Lot - Retrofit	✓	✓	✓	✓	✓				✓
Lovers Point Parking Lot - Retrofit	✓	✓	✓	✓	✓		✓		✓
Ocean View Curb Cuts to Rain Gardens		✓	✓		✓				✓

WATERSHED MODELING

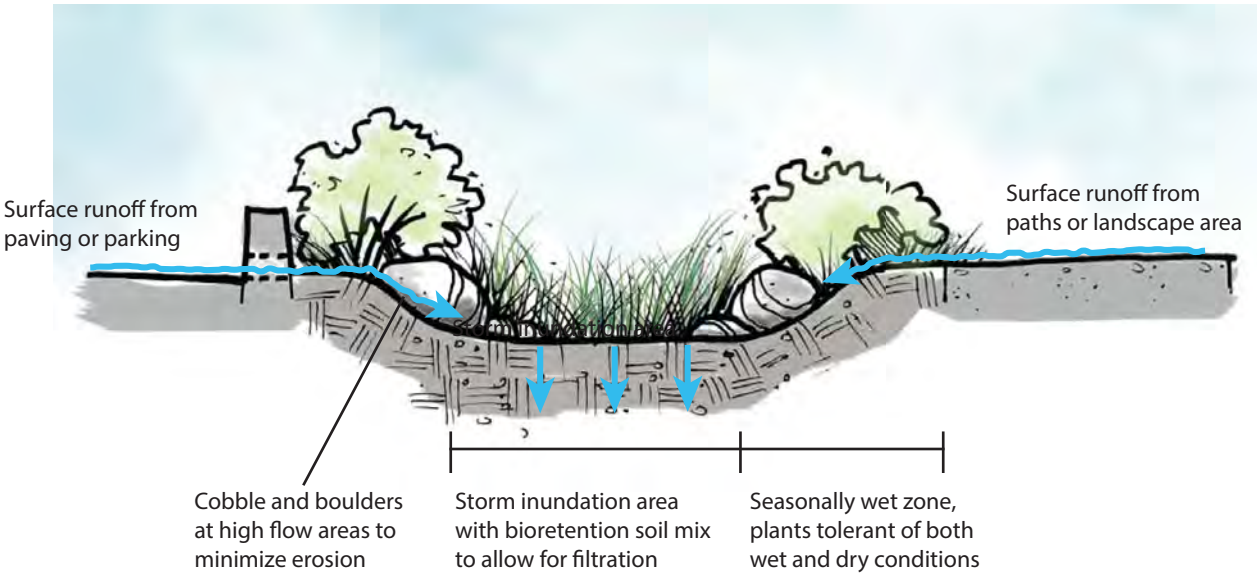
Stormflow Monitoring and Modeling at Pacific Grove, California (2016) was completed by staff and students at the Watershed Institute at California State University Monterey Bay (CSUMB) under the direction of Associate Professor Dr. Fred Watson. The purpose of the report was to measure stormflow within diverse watersheds, specifically within Greenwood Park and at 8th Street and Pico Avenue, and to use a data-driven modeling approach to make stormwater flow predictions about proposed stormwater control measures. A potential bioretention project along Pine Avenue was modeled to predict its storm flow reduction effectiveness and was determined to substantially reduce runoff from an 85th percentile design storm event.

The CSUMB team also developed a dye-dilution storm flow measurement technique applicable to coastal outfalls. The measured flow values were used to calibrate runoff coefficients applied in the watershed models.

ACTION STEP: Continue to identify potential LID projects with high percolation rates, on public land, and with high retention volumes relative to contributing watershed areas, such as along Pine Avenue.

"The City can implement and has implemented a variety of watershed management strategies to reduce runoff...One such strategy is to intercept and detain stormflow once it has entered the street system but before it has entered the subsurface storm drain system.

- CSUMB Stormflow Monitoring and Modeling



Typical Bioretention Area Retrofit

OVERVIEW OF PLANNING PROCESS

Input from the community, City Committees, and City Staff were incorporated throughout the development of the Urban Greening Plan and its individual elements. Feedback on the proposed plan goals, objectives, and "action steps" were solicited at the following venues.

PUBLIC WORKSHOP

A facilitated public workshop was held on September 16, 2016 for community members to provide valuable input on the LID and Urban Greening Plan development. The workshop provided an overview of the DRAFT Urban Greening Plan, including the approach, possible LID retrofit locations, and timeline.

The public workshop was divided into three parts: (1) a power point presentation and introduction to key Urban Greening Plan and LID concepts, (2) an opportunity for facilitated feedback on concepts, criteria, and projects, and (3) individual review and "voting" on priority projects. The top five community and City selected projects were developed into schematic level design concepts.

Appendix C includes a copy of the complete workshop presentation and notes from the workshop which include community questions and responses.

"The Pacific Grove General Plan designates most shorefront lands for open space... [and] relies on more detailed policy in the Local Coastal Program to protect and preserve coastal open space lands and public viewsheds."

- City of Pacific Grove DRAFT Local Coastal Program Land Use Plan (2016)

PUBLIC INVOLVEMENT METHODS

CITY COUNCIL, COMMISSION & COMMITTEES

The recommended landscape tree list for Pacific Grove was updated in April 2015 by the Beautification and Natural Resources Commission and included the development of an informational handout, brochure, and a Guide to Selection, Planting, and Care of Landscape Trees.

The final Landscape Guidelines and Plant Palette document was accepted in February 2016 by the Beautification and Natural Resources Commission.

PROJECT WEBSITE

The Pacific Grove Urban Greening Website was launched in 2015 and included: an introduction to Urban Greening, a summary of the five Plan components funded through the Urban Greening Grant, and links to meeting materials and announcements. For each Urban Greening Plan component, the final reports and fliers were posted to the website as they became available. Information about ways to participate in the plan development was provided along with contact information for City Staff; allowing the community to provide feedback and comments throughout the Plan development process.

http://www.cityofpacificgrove.org/living/green-pg/environmental-programs-grants/urban-greening

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STORMWATER LOW IMPACT DEVELOPMENT (LID) ASSESSMENT

This plan component includes initial planning and conceptual design of priority areas for green infrastructure and the urban forest to implement stormwater treatment measures. The Assessment considers the outcomes of all previous elements developed for the Urban Greening Plan and public input with the purpose of:

- Identifying a suite of potential urban greening projects that meet the urban greening plan goals and objectives; and
- Developing concept designs, at a level sufficient to seek funding for projects that provide multiple community benefits.

The Stormwater LID Assessment is presented in three parts:

Part 1: Identification of Potential LID Retrofit Locations

Part 2: LID Concept Plans

Part 3: LID Schematic Design Development

PART 1: IDENTIFICATION OF POTENTIAL LID RETROFIT LOCATIONS

Fall Creek Engineering Inc. (FCE) is pleased to present to you this summary of our evaluation of potential LID retrofit locations in the City of Pacific Grove (City) in support of the City's Stormwater LID Infrastructure and Urban Greening Plan (Plan). FCE's approach to screening and selecting site-specific LID opportunities is based on our recent experience with similar efforts in Monterey and Santa Cruz Counties and at the Presidio of Monterey. The process began with a desktop evaluation using spatial data to identify priority parcels for on-site review. For priority parcels a site check-list with scoring criteria was used to support concept development and objectively select projects for concept design development. The purpose of this section is to present the methodology and preliminary recommendations for projects to develop into concept designs.

METHODOLOGY

Desktop Evaluation of LID Retrofit Locations. FCE completed a GIS based Desktop Evaluation to identify priority parcels for a site visit and evaluation of LID retrofit opportunities. Characteristics commonly used in the evaluation of LID suitability include soil type as it relates to infiltration capacity and percent slope. In addition to soil type and slope, FCE coordinated with the City to select additional factors to consider in the evaluation of parcels for LID retrofit suitability. Points were assigned to each of the selected factors and a single prioritization shapefile was created based on a union of the overlapping factors. The total points were tallied to indicate a relative high, medium, or low opportunity for LID implementation.

Table 1 summarizes parcel characteristics identified for incorporation into the Desktop Evaluation, along with the associated point assignments. Figure 1 depicts the City wide identification of high, medium, or low priority areas for evaluation of LID practices. Figure 2 depicts the parcels selected for a site visit relative to the high and medium priority watersheds for compliance with the Area of Special Biological Significance (ASBS) protections.

LID Retrofit Inventory. Over the course of four (4) field days in March and June 2016 FCE visited each of the sites identified in the Desktop Evaluation. Each site was evaluated for potential LID implementation strategies and designs using a common field evaluation worksheet and scoring template.

LID practices cover a broad range of design elements that can be applied in almost all settings, even in areas with clay soils, high slopes and/or space constraints. Emphasis was placed on project concepts with high public visibility, existing grading that could support an LID retrofit with relatively low complexity, and the potential for LID features to provide water quality treatment for a high percentage of the sites' impervious area. Additional points were assigned to LID retrofit concepts with the opportunity to provide water quality treatment to support ASBS Compliance. The scoring template was used to compare all the parcels and identify 15 sites to recommend for development into LID Concept Plans.

Parcel Prioritization Factors			
Charecteristics	**Point**	**Charecteristics**	**Point**
Soil		**Located in a priority sub-watersheds**	
Hyd Group A	10	Draining to High Priority ASBS Outfall	10
Hyd Group B	7.5	Draining to Medium Priority ASBS Outfall	7.5
Hyd Group C	5	Draining to ASBS	5
Hyd Group D	2.5	**Urban Tree Canopy Stormwater Planting Priority**	
Slope		Very High	10
<5%	10	High	8
5%-10%	5	Moderate	6
>10%	1	Low	4
Land Ownership		Very Low	2
Publicly owned parcels or Roadway	10	**Proximity to a Stormwater Inlet, Catch Basin, or Conveyance Structure**	
Other ownership designation	1	Within 200 feet	10
Percent impervious surface		Not within 200 feet	0
75-100%	10		
50-75%	7.5		
25-50%	5		
0-25%	2.5		
Parcel size			
1.0 - 58 acres	10		
0.5 - 1.0 acres	7.5		
0.25 - 0.5 acres	5		
0.005 - 0.25 acres	2.5		

Table 1. Factors and Point Assignments for GIS Based Desktop Evaluation

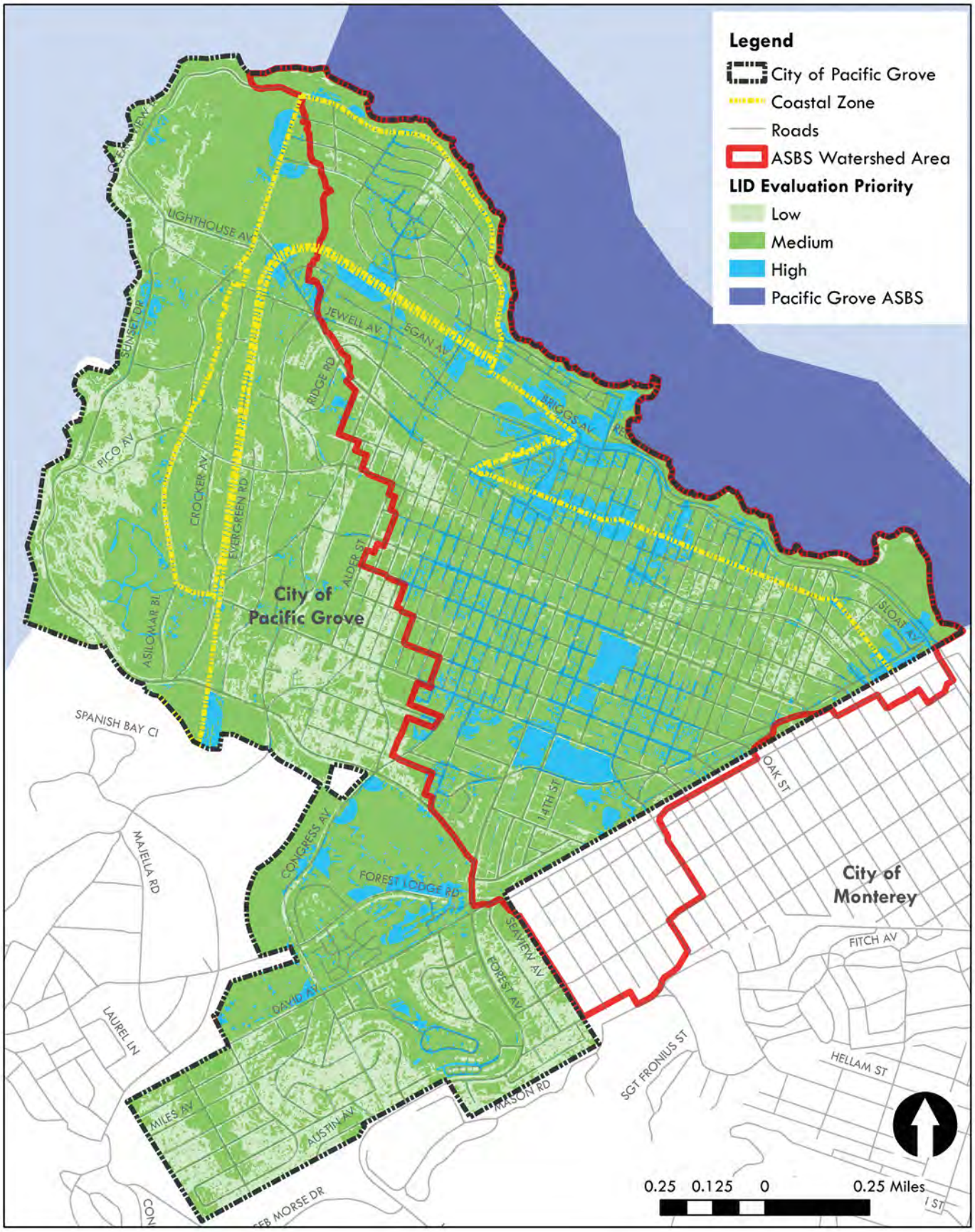

Figure1. Pacific Grove LID Evaluation Priority

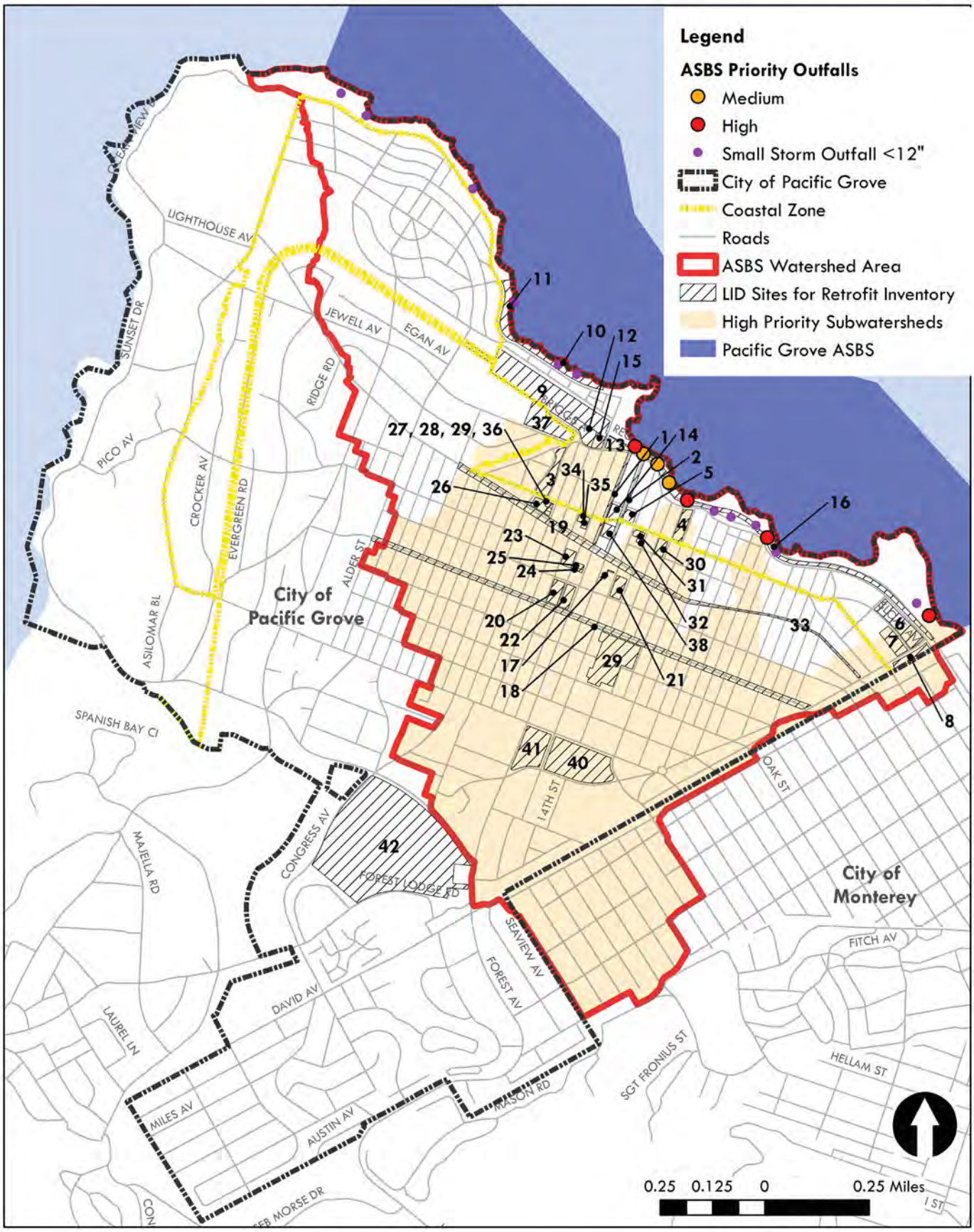

Figure 2. Selected Sites for LID Evaluation

RESULTS

Thirty-seven (37) high scoring parcels and five (5) right of way (ROW) alignments were selected through the Desktop Evaluation for a subsequent site visit and LID retrofit evaluation. Table 2 summarizes each of the sites' Assessor's Parcel Number (APN) (if a parcel), zoning, land use, area and address (as listed in GIS database). Also included in Table 2 are two columns indicating if the site is located in the Coastal Zone or in a high priority subwatershed for ASBS Compliance. Attachment A includes each sites' field evaluation and scoring worksheet. Below is a summary of the 15 sites recommended for LID concept design development with a brief description of the proposed LID retrofit concept for consideration.

Pine Avenue ROW (Site #18). The existing width and drainage patterns on Pine Avenue are suitable for implementation of new LID landscape bulbs on both the north and south sides of the roadway corridor by reducing the number of traffic lanes from four (4) to two (2). Adequate space for east and west bound bike lanes would likely be available while maintaining residential street parking. The combined width of the remaining two driving lanes and bike lanes would continue to be available for special events and parades that occur along the ROW. Additional benefits of this project concept is that it can provide water quality treatment of runoff from this well used roadway in a high priority ASBS watershed and it can slow traffic to support safe routes to the Robert Down Elementary School.

Lighthouse Avenue ROW (Site #19). The center and side parking aisles and crosswalks in this downtown corridor could be converted into permeable pavement strips. Many of the existing and newly installed landscape bulbs could be converted to LID features by using curb cuts to divert and treat roadway runoff. A preliminary concept plan for the portion of Lighthouse Avenue between 16th Street and Forest Avenue could be modified to locate the proposed planters to become LID stormwater planters, providing water quality treatment of the roadway and parking stormwater runoff.

Robert Down Elementary School (Site #39). The downspouts from the school building could be disconnected and directed to the front irrigated turf area which has the potential for conversion into a series of rain gardens with an educational emphasis. A portion of the school property along Spruce and 13th Avenue could be used to treat roadway runoff. Implementation of the buried cistern (proposed in the 2013 ASBS Stormwater Management Plan) for beneath the school ballfield has the potential to provide stormwater treatment and offset irrigation demand of the turf.

Recreation Trail West from Lovers Point to Siren Street (Site #10/#11). Curb cuts from Ocean View Boulevard could be used to direct runoff into the landscape area between the roadway and coastline. The landscape area could be converted into rain gardens with the potential to maintain the current ice plantings that are highly valued by the community. Existing curb cuts should be maintained to allow the continued diversion of roadway runoff into the landscape area. Roadway parking could also be converted to permeable pavement to provide water quality treatment of the stormwater runoff before entering the ASBS.

Recreation Trail East from Lovers Point to City of Monterey (Site #16). Numerous opportunities are available along the trail alignment to provide water quality treatment of runoff from the trail and Oceanview Boulevard. Proposed methods involve retrofit of existing drain inlets to allow for conversion to bioretention facilities and conversion of portions of the trail to permeable pavement. Specific locations include: (1) conversion of landscape area into a dry swale extending from Dewey Avenue to City of Monterey, (2) retrofit of inlets and trail underdrain to bioretention at 7th Avenue, (3) incorporation of bioretention into turf/landscape areas to treat roadway runoff

along trail park extending from 9th Avenue to Carmel Avenue , and (4) retrofit of the landscape area downslope of the mural to treat roadway and trail runoff while preserving the character and historical significance of the mural.

Grand Avenue ROW (Site #2). Extending from Park Place to Ocean View Boulevard, the roadway width could be narrowed to allow for bioretention facilities, located between driveways and adjacent to the sidewalk to treat runoff from the crowned roadway. Extending from the Natural History Museum to Park Place on Grand Avenue and from Forest Avenue to Fountain Avenue a zone of permeable pavement could be installed within the Farmers Market area to create a designated "Farmers Market Plaza" while providing water quality treatment for runoff from portions of Central and Grand Avenues.

Commercial Complex at Central and Fountain (Site #31/#32). Runoff could be diverted from 15th and Fountain Avenue to a new LID feature/ landscape bulb in the ROW. Similarly, a new LID planter could be installed parallel to 15th Street, in a no parking zone, to treat runoff up to Lighthouse Avenue. The parking lot area could retrofit to include LID features between parking stalls and/or retrofit of parking stalls to permeable pavers.

Parking Lot at the Fandango Restaurant (Site #23). The proposed treatment approach could convert the center parking aisles to bioretention planters and/or convert the parking stalls into permeable pavement. The current dumpster and grease collection barrel location and condition should be evaluated for consistency with best practices to manage runoff into the ASBS.

Lovers Point Parking Lot (Site #13). A Recreation Trail Accessibility Improvements site plan for the Lovers Point Parking Lot was reviewed and evaluated for incorporation of additional LID measures to provide water quality treatment of runoff from the parking lot and adjacent portions of Ocean View Boulevard. The current plan already includes the use of pervious pavers for the pedestrian trail access point at Forest Avenue and in all the crosswalks. Potential measures for incorporation include using landscape bulbs as bioretention features with curb cuts, installing pervious pavers along the parking aisles, and converting the landscape area at the intersection of 17th and Ocean View to a bioretention facility to treat runoff from this busy intersection.

Jewell Park (Site #14). Underutilized portions of the park area, though few, represent opportunities to convert into stormwater LID treatment features with an educational emphasis in this well used community park. It appears one such area is near the intersection of Forest Avenue and Park Place, where runoff from Forest Avenue could strategically be diverted to a new bioretention feature with an overflow onto Park Place. New LID landscape bulbs could be installed adjacent to the park at the corner of Grand and Park Place to treat runoff from both roadways.

Mayflower Presbyterian Church and Preschool (Site #30). Parallel to 14th Avenue, roadway runoff could be diverted into new LID landscape bulbs in this one-way street. A similar approach could be applied parallel to Doc Ricketts Row, with conversion of a narrow landscape strip into an LID stormwater planter. Existing turf near the church entrance could be converted to rain gardens (with underdrains to minimize nuisance groundwater) to receive runoff from disconnected downspouts. Permeable pavers could be installed within a narrow walkway between buildings to reduce and desynchronize runoff from the site.

Pacific Grove Post Office (#26). Proposed LID elements for incorporation at this site include the diversion of roadway runoff from Congress Avenue to landscape areas converted to bioretention facilities and disconnected downspouts to new rain gardens or dry swales within the existing non-functional turf areas. Stormwater tree wells could also be installed

along Lighthouse Avenue to treat roadway runoff. The high visibility of this site provides an excellent opportunity for an emphasis on educational elements related to LID, stormwater runoff, and the ASBS.

Fire Department, Heritage Society, and Youth Center (Site #20). Permeable pavers (suitable to withstand fire truck loading) could be installed at the fire truck driveway to receive roof and roadway runoff. A buried cistern beneath the driveway could provide a water supply for firefighting training exercises. Downspouts from the Fire Department building along Pine Avenue could be disconnected and routed to a cistern or cobble swale in the landscape area. Behind the Fire Department, permeable pavers could be located within the parking stalls and existing landscape bulbs converted to LID bioretention to treat parking lot runoff. At the Heritage Society, the courtyard in front of the barn represents a unique opportunity to develop into an LID demonstration courtyard; highlighting how LID can be accomplished in a manner consistent with the character, architecture, and historical resources in the City. Specifically highlighting permeable pavement pathways and diversion of roadway runoff from 17th Avenue into landscape areas retrofitted to rain gardens.

Pacific Grove Middle School & School District Offices (Site #40/#41). At the school entrance on Forest Avenue opportunity(ies) exist to divert roadway runoff into non-functional turf areas converted into bioretention LID features. Downspouts could be disconnected and collected in above ground cistern(s) to support irrigation of the school garden and provide an educational emphasis on stormwater management and reuse. Parking lot and walkway areas could be converted to permeable pavers. At the School District offices the opportunity to retrofit the parking lot to include bioretention and/or permeable pavers could be considered. Near the school district office entrance, space is available to create an LID landscape bulb at the intersection of Hillcrest and Carmel to treat nuisance flows.

City Hall & Police Station (Site #22). In the City Hall Courtyard the building downspouts could be disconnected via stormwater art into the existing landscape planters, slightly modified to accommodate the diverted flows. The Courtyard pavement could be replaced with permeable pavers with a stormwater art element that exhibits an educational and/or playful focus. New stormwater landscape tree wells could be installed along Laurel to treat roadway runoff. The existing landscape bulbs parallel to 16th Street could be retrofitted to LID features (double celled to accommodate the slope).

Sites for LID Retrofit Inventory										
Number	APN	ZONING	LAND USE	Area (ac)	ADDRESS	Description	In Coastal Zone	In High Priority ASBS Subwatershed	Score	RANK
1				1.10		Forest Ave ROW	X	X	90	16
2				1.39		Grand Ave ROW	X		123	6
3	6147001000	O	Open Space	1.51	667 CENTRAL AVENUE	Caledonia Park	X	X	86	20
4	6189001000	O	Open Space	1.08	550 CENTRAL AVENUE	Greenwood Park	X	X	72	28
5	6171098000	U	Public	0.46	550 CENTRAL AVENUE	Library	X		60	30
6	6231001000	V-C	Commercial	2.91	125 OCEAN VIEW BOULEVARD	Cannery Outlets	X	X	55	31
7	6234005000	C-2	Commercial	1.28	1 EARDLEY AVENUE	Parking Behind Outlets	X	X	90	16
8	6233002000	V-C	Commercial	1.03	1 EARDLEY AVENUE	Nob Hill Foods and Parking Lot	X	X	63	29
9	6087001000	M-H	MHR	11.16	700 BRIGGS AVENUE	Mobile Home Park	X		75	27
10	6071099000	O	Open Space	2.89	700 BRIGGS AVENUE	Rec Trail	X		126	4
11	6061099000	O	Open Space	2.05	700 BRIGGS AVENUE	Rec Trail	X			
12	6086001000	C-2	Commercial	1.25	700 BRIGGS AVENUE	Appartments at Briggs and 19th	X	X	86	20
13	6155001000	O	Open Space	0.66	560 FOREST AVENUE	Lover's Point Parking	X	X	111	9
14	6171099000	O	Open Space	0.60	560 FOREST AVENUE	Jewell Park	X		111	9
15	6086002000	O	Open Space	0.52	560 FOREST AVENUE	Appartments at Briggs and 19th - Parking	X	X	See 12	
16	GOVT LAND	O	Open Space	5.84	109 OCEAN VIEW BOULEVARD	Rec Trail	X	X	124	5
17				0.06		Garderner's Ally		X	84	22
18				9.51		Pine Ave ROW		X	144	1
19				5.58		Lighthouse Ave ROW		X	137	2
20	6295012000	U,O	Public	0.97		Parking Lot - Fire Department		X	101	13
21	6284015000	C-1	Commercial	0.86		Parking Lot - Theatre		X	77	25
22	6289012000	U	Public	0.82		Parking Lot - City Hall		X	98	15
23	6294017000	C-1	Commercial	0.68		Parking Lot - Fandango Restaurant		X	115	8
24	6281014000	C-1	Commercial	0.11		Parking Lot - Grove market		X	83	23
25	6281006000	C-1	Commercial	0.16		Parking Lot - Grove market		X		
26	6169006000	C-1	Public	0.55	680 LIGHTHOUSE AVENUE	Pacific Grove Post Office		X	104	12
27	6169002000	C-1	Public	0.06	156 19TH STREET	Residential		X	PRIVATE	
28	6169001000	C-1	Public	0.08	667 CENTRAL AVENUE	Residential		X	PRIVATE	
29	6169003000	C-1	Public	0.07	160 19TH STREET	Residential		X	PRIVATE	
30	6191003000	R-3-PGR	High Dens 29.0 DU/ac	0.57	550 CENTRAL AVENUE	Mayflower Presbytyrian Preschool		X	106	10
31	6174009000	C-1	Commercial	0.26	550 CENTRAL AVENUE	Commercial Area at Central and Fountain		X	123	6
32	6174008000	C-1	Commercial	0.10	550 CENTRAL AVENUE	Parking Area at Central and Fountain		X		
33	GOVT LAND	O	Open Space	1.18	1 EARDLEY AVENUE	Lighthouse Ave Median		X	See 19	
34	6166001000	C-1	Public	0.29	170 16TH STREET	Chatanuga Hall		X	77	25
35	6166002000	O	Open Space	0.10	170 16TH STREET	Chatanuga Hall Gardens		X		
36	6169004000	C-1	Public	0.07	662 LIGHTHOUSE AVENUE	Red House Café - Commercial		X	PRIVATE	
37	6087002000	O	Open Space	3.12	700 BRIGGS AVENUE	Senior Center (at Caledonia and Jewell)		X	89	18
38	6172001000	C-1	Public	0.55	560 FOREST AVENUE	Museum			88	19
39	6484001000	U	Public	5.88	485 PINE AVENUE	Robert Down Elementary School		X	130	3
40	6672001000	U	Public	7.47	381 FOREST AVENUE	Pacific Grove Middle School - Track		X	100	14
41	6671001000	U	Public	3.68	381 FOREST AVENUE	Pacific Grove Middle School		X		
42	7101009000	U	Public	44.30	615 SUNSET DRIVE	Pacific Grove High School			79	24

Table 2. Summary of Sites Selected through Desktop Evaluation and LID Retrofit Inventory Site Scores and Relative Ranks

PROJECT PRIORITIZATION AND SELECTION

Of the 15 sites recommended for design development consideration, many contain numerous potential LID retrofit opportunities of varying scales and types. Based on comments from reviewers, FCE developed a prioritization approach to evaluate and compare the initially identified 15 projects. This prioritization approach provided a structured and objective method to separate high and low priority projects using a prioritization matrix.

A prioritization matrix organizes a diverse set of items into an order of importance by assigning a numerical value to the priority of each item. The resulting matrix ranks projects based on criteria considered important by stakeholders. The benefit of this prioritization approach is its flexibility to add projects in the future and (re) evaluate/compare using the same criteria. The spreadsheet approach is easy to update when additional site information becomes available, for example, about biotic, cultural or geologic constraints.

A group of seven (7) criteria were selected to assess the importance of each LID project and a rating scale between 1 to 9 established to assess how well a particular project satisfies that criteria. Below is a description of what each criterion considers and the associated rating scale. Each of the criteria also was assigned a weight based on its relative importance.

Criteria #1. Sites owned and controlled by the City (versus School District) should receive preference. (Weight = 5)

9 = City Ownership/Control,

5 = Public Ownership (e.g. PGUSD),

1 = Private

Criteria #2. LID activities that do not require a modification to traffic circulation should receive preference. In other words, projects like Pine Avenue and new bump-out locations should not receive high priority as circulation should be studied much further. (Weight = 3)

9 = No modification (temporary or permanent) to traffic circuclation,

1 = Project requires further study to understand traffic impact

Criteria #3. Parks should receive high priority as we control them and the design does not alter circulation or parking patterns. (Weight = 5)

9 = Project completely contained within an existing City Park,

1 = Project not within a City Park

Criteria #4. Street modifications (i.e. permeable pavers) should receive medium priority. (Weight = 3)

9 = No permeable pavers included,

1 = Project mostly relies on permeable pavers

Criteria #5. Educational demonstration projects should receive priority (Weight = 4)

9 = Project has high visibility and includes a variety of LID/environmental education elements,

1 = Low visibility or educational interest

Criteria #6. Potential to coordinate implementation with other planned or proposed CIP projects (Weight = 4)

9 = CIP project planned in immediate vicinity within next 5 years,

1 = No future CIP project planned in immediate vicinity

Criteria #7. Provide water quality treatment to support ASBS compliance (Weight = 5)

9 = Would treat constituents in exceedance of natural ocean water quality, in high priority subwatersheds were no other structural BMPs are proposed ,

5 = Would treat constituents in exceedance of natural ocean water quality,

1 = Outside of ASBS

The numeric rating a project is given for a particular criterion is multiplied by the criteria's weight to create a priority score. A project matrix was created and each project was rated on each of the criteria. The sum of all the weighted values was used to determine a project's total score. Table 3 summarizes each of the projects' evaluation and rank through the prioritization process.

15 Sites Recommended for Concept Design Development				Criteria	#1	#2	#3	#4	#5	#6	#7	Score	Rank
Number	Description	Score	RANK		Ownership	Traffic	Parks	Permeable Pavers	Education	Coordination	ASBS		
				Weight	5	3	5	3	4	4	5		
18	**Pine Ave ROW**	144	1	Rating Scale (1-9)	9	1	1	9	9	1	9	165	16
19	**Lighthouse Ave ROW**	137	2		9	1	1	5	9	1	9	153	23
	Forest to Grand Pilot Concept (vs. 16th and Forest)				9	5	1	5	9	9	9	197	8
39	**Robert Down Elementary School**	130	3										
	Downspout Disconnection to Rain Garden or Dry Swale				5	9	1	9	9	1	6	154	22
	Spruce & 13th Diversion				5	6	1	9	3	1	7	126	36
	Ballfield Storage (EPIC System? - Refusal at 13')				5	9	1	9	9	1	9	169	14
10	**Rec Trail (East)**	126	4										
	Curb Cuts to Rain Gardens				9	5	9	9	9	9	5	229	2
	Permeable Pavement on Oceanview Parking				9	5	9	1	9	9	5	205	7
16	**Rec Trail (West)**	124	5										
	Dewey Ave to City of Monterey Dry Swale				9	5	9	9	9	1	9	217	5
	7th Ave Bioretention				9	5	9	9	9	1	5	197	8
	Diverison of Oceanview Runoff b/w 9th & Carmel (Andy Jacobsen Park)				9	5	9	9	9	9	5	229	2
	Bioretention @ Mural b/w 12th &13th				9	5	9	9	9	1	9	217	5
2	**Grand Ave ROW**	123	6										
	Park Place to Oceanview Green Street				9	1	1	9	5	1	5	129	33
	Farmers Market Plaza with Permeable Pavement				9	5	1	1	9	1	5	133	30
31	**Commercial Area at Central and Fountain**	123	6										
	15th and Fountain Landscape Bulbs				9	1	1	9	5	9	9	181	11
	Parking Lot Retrofits				1	9	1	5	1	9	9	137	29
23	**Parking Lot - Fandango Restaurant**	115	8		9	9	1	9	5	5	1	149	25
13	**Lover's Point Parking**	111	9		9	5	9	5	9	9	9	237	1
14	**Jewell Park**	111	9										
	Forest Ave & Park Place Bioretention				9	9	9	9	9	1	9	229	2
	Grand & Park Place Landscape Bulbs				9	1	1	9	9	1	9	165	16
30	**Mayflower Presbytyrian Church/Preschool**	106	11										
	14th Ave Landscape Bulbs				1	1	1	9	5	9	9	141	27
	Doc Ricketts Row Stormwater Planter				1	9	1	9	3	9	9	157	19
	Downspout Disconnection to Cistern, Rain Garden or Dry Swale				1	9	1	9	5	1	9	133	30
	Permeable Pavement Walkway				1	9	1	1	3	1	9	101	41
26	**Pacific Grove Post Office**	104	12										
	Congress Ave Diversion to Bioretention				5	5	1	9	9	1	1	117	38
	Downspout Disconnection to Cistern, Rain Garden or Dry Swale				5	9	1	9	9	1	1	129	33
	Stormwater Tree Wells on Lighthouse Ave				5	5	1	9	9	1	1	117	38
20	**Fire Department, Heritage Society, Youth Center**	101	13										
	Permeable Pavers with Buried Cistern				9	9	1	1	5	1	1	109	40
	Downspout Disconnection to Cistern, Rain Garden or Dry Swale				9	9	1	9	9	1	1	149	25
	Parking Lot Retrofit w/ Bioretention Landscape Bulbs				9	5	1	9	5	1	1	121	37
	LID Demonstration Courtyard @ Heritage Society Barn				9	9	5	5	9	1	1	157	19
40	**Pacific Grove Middle School & School District Office**	100	14										
	Forest Ave Runoff Diversion to Bioretention				5	5	1	9	9	1	9	157	19
	Downspout Disconnection to Cistern, Rain Garden or Dry Swale				5	9	1	9	9	1	9	169	14
	Permeable Pavement in Select Parking Areas and Walkways				5	9	1	1	5	1	9	129	33
	School District Parking Lot Retrofit				5	9	1	5	3	1	9	133	30
	Hillcrest & Carmel Landscape Bulb				9	1	1	9	3	1	9	141	27
22	**City Hall, Police Station**	98	15										
	City Hall Downspout Disconnection to Retrofited Planters				9	9	5	9	9	5	1	185	10
	Permeable Pavement in City Hall Courtyard				9	9	5	1	9	5	1	161	18
	Stormwater Tree Wells on Laurel				9	5	5	9	9	5	1	173	13
	16th Ave Landscape Bulb Retrofit				9	5	1	9	9	5	1	153	23
New	**Retrofit of Landscape Bulbs on Central Ave**				9	5	1	9	5	5	9	177	12

Note: Sites highlighted in Blue are outside the Coastal Zone and orange highlighted cells represent projects with potential to provide water quality treatment to a high or medium priority ASBS watershed.

Table 3. Project Evaluation and Rank through the Prioritization Process

SUMMARY OF IDENTIFICATION OF POTENTIAL LID LOCATIONS

FCE applied a detailed and objective approach to identify potential LID sites which provided information about City-wide LID opportunities and a clear methodology to convey to the public about the project development and selection process.

The 15 sites selected for concept design development were:

1. Central Avenue - Landscape Bulbs
2. Dewey Avenue to Eardley Avenue - Dry Swale
3. 7th Street - Bioretention
4. Berwick Park - Bioretention
5. 12th to 13th Street - Bioretention
6. Pine Avenue - Green Street
7. Robert Down Elementary School – Rainwater Collection
8. Pacific Grove Middle School - Downspout Disconnect
9. Library Rain Garden and Bioretention Islands
10. Jewell Park - Bioretention
11. Lighthouse Avenue - Green Street
12. City Hall - Courtyard Retrofit
13. Fandango Parking Lot - Retrofit
14. Lovers Point Parking Lot - Retrofit
15. Ocean View Curb Cuts to Rain Gardens

For the 15 selected project concepts FCE will continue to link LID and tree planting opportunities with parks, trails, parking, tourism, pedestrian and bicycle routes in a Complete Streets approach. Throughout, FCE will identify opportunities for locations to integrate educational opportunities for the community. These design concepts and linkages will be included in the Urban Greening Plan.

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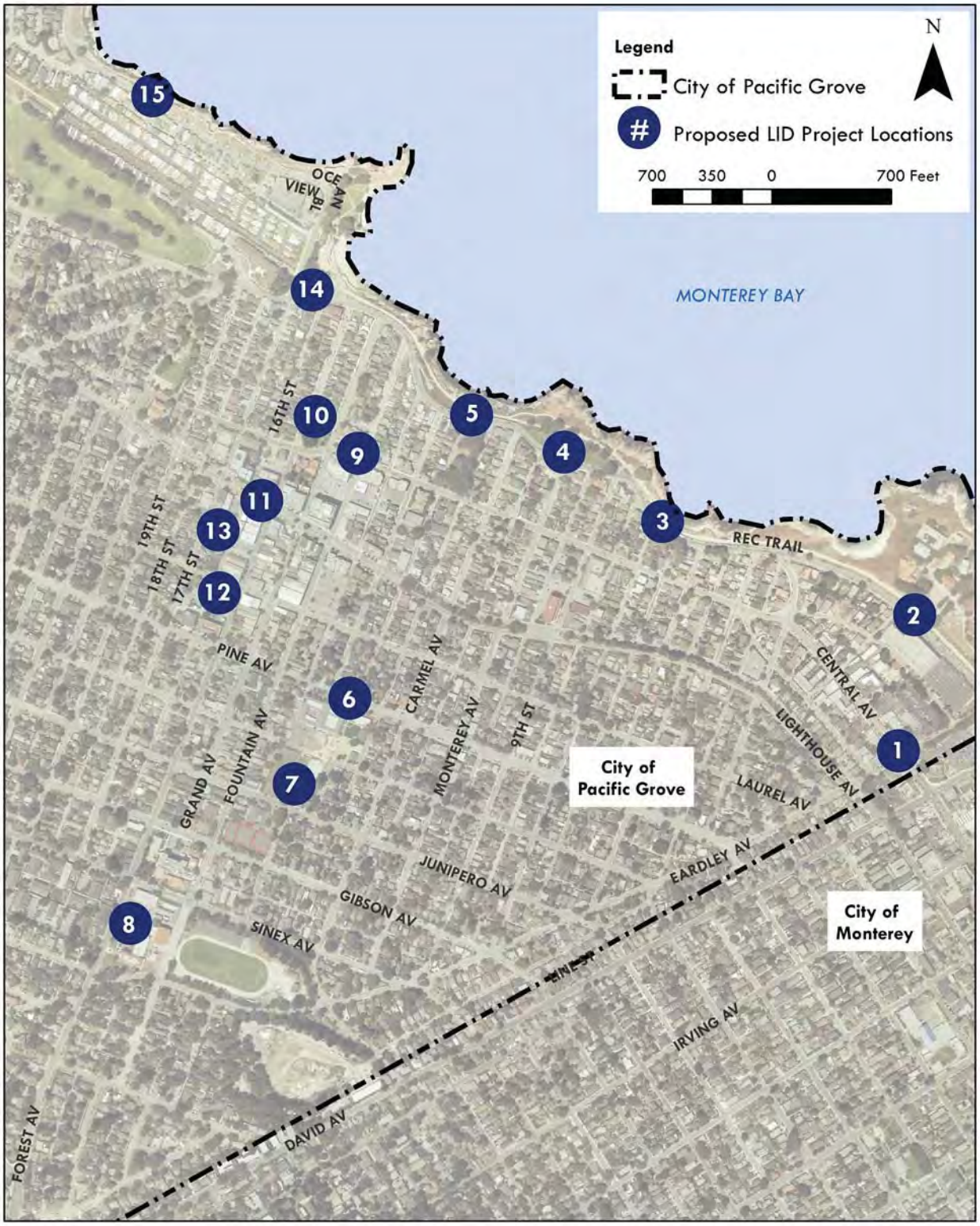
PART 2: LID CONCEPT PLANS

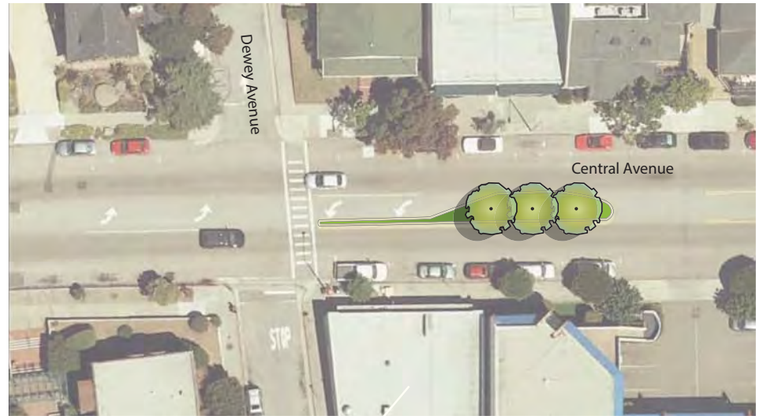
Below is a list of the 15 sites recommended for LID concept design development. Site numbering is based on location (south to north) not on priority. The following 11x17 concept plans for each site illustrate the general design ideas. Based on City and Community feedback five (5) of these 15 sites were selected for schematic design development in Part 3 of the LID Assessment.

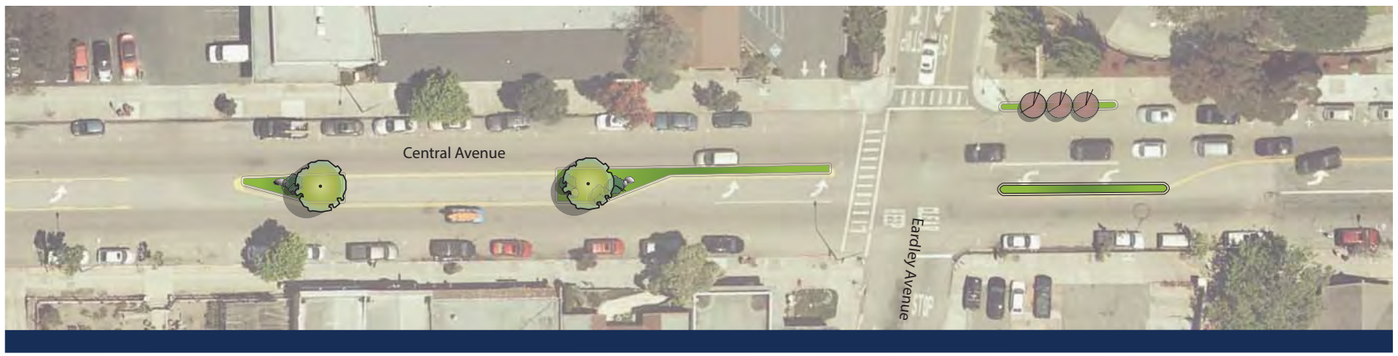
1. **Central Avenue - Landscape Bulbs**
2. **Dewey Avenue to Eardley Avenue - Dry Swale**
3. **7th Street - Bioretention**
4. **Berwick Park - Bioretention**
5. **12th to 13th Street - Bioretention**
6. **Pine Avenue - Green Street**
7. **Robert Down Elementary School – Rainwater Collection**
8. **Pacific Grove Middle School - Downspout Disconnect**
9. **Library Rain Garden and Bioretention Islands**
10. **Jewell Park - Bioretention**
11. **Lighthouse Avenue - Green Street**
12. **City Hall - Courtyard Plaza Retrofit**
13. **Fandango Parking Lot - Retrofit**
14. **Lovers Point Parking Lot - Retrofit**
15. **Ocean View Curb Cuts to Rain Gardens**

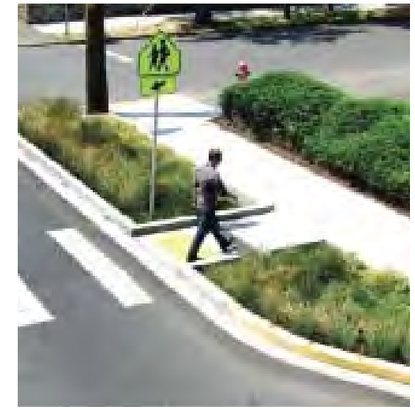


Pacific Grove Proposed LID Project Locations
Urban Greening Plan

FALL CREEK ENGINEERING
Date: 9/8/2016







LEGEND

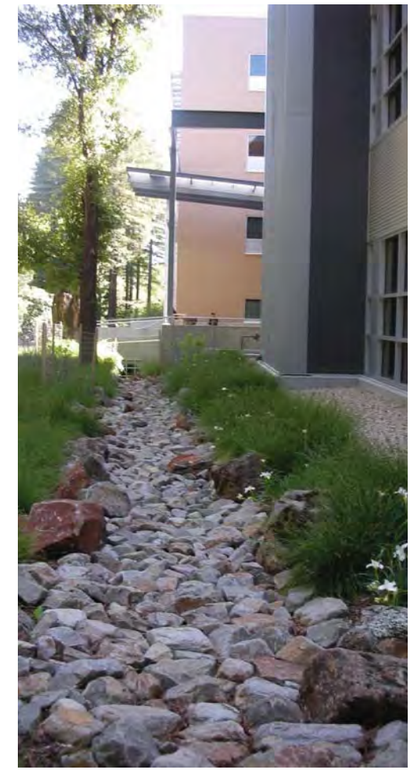
BIORETENTION PLANTERS WITH BOULDERS AND MIXED PLANTINGS

PROPOSED NEW TREE AND SHRUB PLANTING

CENTRAL AVENUE - LANDSCAPE BULBS

PROPOSED L.I.D. IMPROVEMENTS

In 2015/2016 twelve (12) new traffic bulb-outs and medians were installed on Central Avenue beginning at Eardley Avenue at the border with Monterey, extending northwest to 1st Street. It is proposed to retrofit these landscape traffic bulbs into bioretention features with curb cuts to allow stormwater runoff to be diverted from the roadway into the bioretention bulbs. The bulbs would be retrofitted with a planting medium composed of a structural soil to support plant growth and maximize pollutant removal capacity. One example is a structural soil developed by University of California Davis that contains 75% lava rock (0.75 inches) and 25% loam (by volume). The lava rock in the soil stores more stormwater than other structural soils and has a very high surface area to facilitate pollutant trapping.



LEGEND

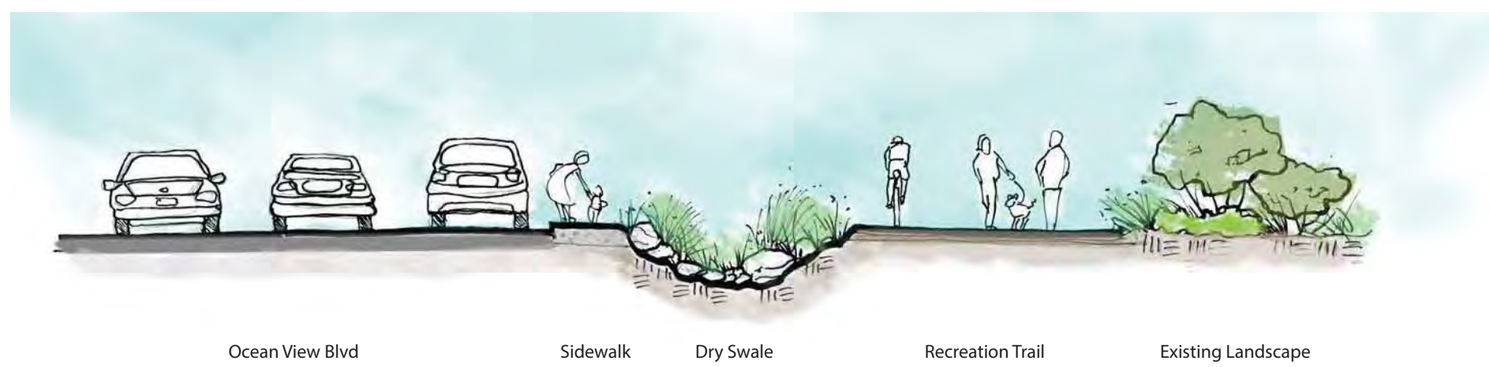
BIORETENTION WITH NATIVE GRASSES

BOULDERS

DEWEY AVENUE TO EARDLEY AVENUE - DRY SWALE

PROPOSED L.I.D. IMPROVEMENTS

This project proposes to convert a landscape strip between Ocean View Boulevard and the Recreation Trail extending from Dewey Avenue to the City of Monterey, into a dry swale to treat runoff diverted to the swale from the trail and the right-of-way. Runoff would be diverted into the dry swale via new curb cuts along Ocean View Boulevard that would direct runoff into the dry swale along numerous points along the length of the feature.



FULL PLANS & DOCUMENTS

LEGEND

BIORETENTION WITH
NATIVE GRASSES AND BOULDERS

7TH STREET - BIORETENTION

PROPOSED L.I.D. IMPROVEMENTS

Numerous opportunities are available along the Recreational Trail alignment to provide water quality treatment of runoff from the trail and Ocean View Boulevard. Proposed methods involve retrofit of existing drain inlets to allow for conversion of existing landscape areas to bioretention facilities. One such landscape area is located between Ocean View Boulevard and the Recreation Trail at the outlet of a storm drain from 7th Street. This landscape strip could be retrofitted to receive runoff diverted from the 7th Street drain and the drain located between 7th and 8th Streets.

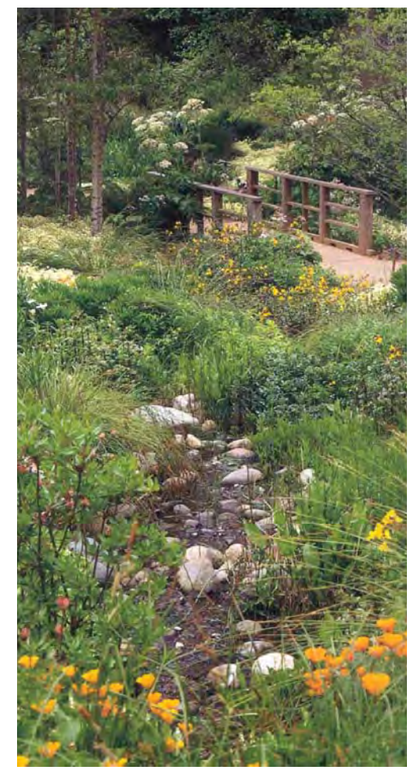
LEGEND

BIORETENTION WITH NATIVE GRASSES AND SHRUBS

BOULDERS

PATH BETWEEN BIORETENTION PLANTING AREAS

BERWICK PARK - BIORETENTION



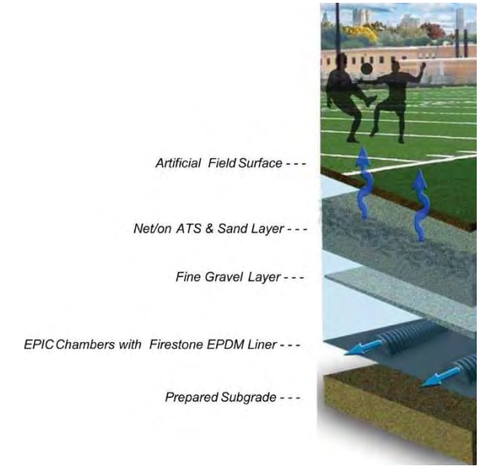
PROPOSED L.I.D. IMPROVEMENTS

Extending from 9th Avenue to Carmel Avenue, Berwick Park represents an opportunity to provide water quality treatment of runoff from Ocean View Boulevard and a portion of the residential neighborhood in the vicinity. A portion of the turf area at Berwick Park would be retrofitted to incorporate bioretention features to treat the diverted runoff. It is assumed that a portion of the runoff from storm drains extending beneath the park from Carmel Avenue and Monterey Avenue could be redirected into the new bioretention features along with roadway runoff, via new curb cuts along Ocean View Boulevard.

LEGEND

TURF WITH STORMWATER STORAGE (EPIC SYSTEM)

ROBERT DOWN ELEMENTARY RAINWATER COLLECTION

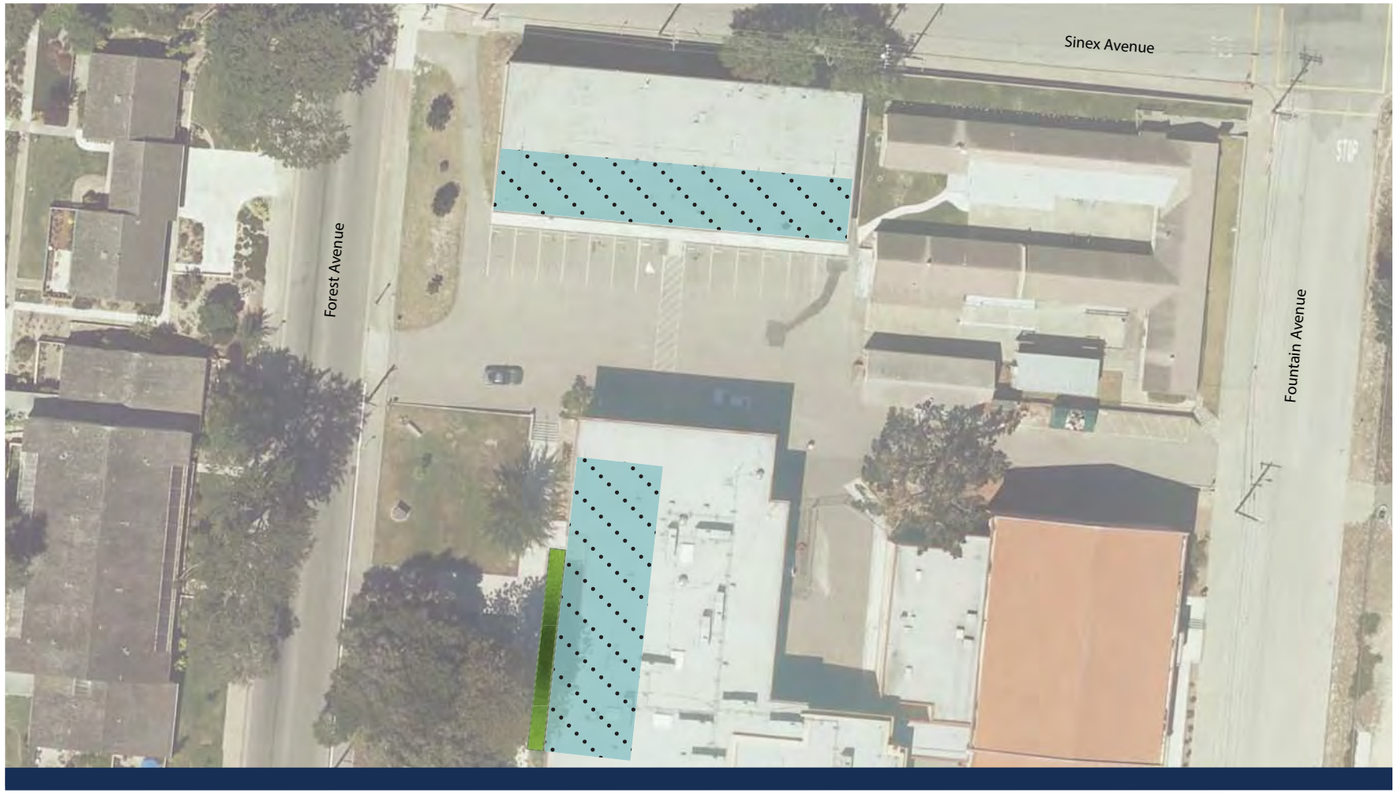


PROPOSED L.I.D. IMPROVEMENTS

The Robert Down Elementary School Field includes approximately 61,000 square feet of irrigated turf area and represents an annual irrigation demand that can potentially be offset with non-potable supply. An EPIC (Environmental Passive Irrigation Chamber) system installed beneath the turf area, is one option for diverting stormwater runoff from approximately 98 acres in the upper Greenwood Park sub-basin and 102 acres in the New Monterey area to reduce runoff rates to the Pacific Grove ASBS, while providing non-potable irrigation to the Field. EPIC systems typically include a sand and gravel layer beneath the turf with integrated storage chambers below that capture and release stormwater, to supply the needs of the grass through capillary action.

In 2015, the Presidio of Monterey installed a pilot EPIC system at its Fort Ord Department of Defense (DOD) Center to provide non-potable irrigation to an approximately 70,000 sf landscape area. The system receives stormwater runoff and will likely be connected to receive treated graywater in the future. The DOD EPIC system is using 2.83 gallons/sf since October 1, 2015 compared to an average of 4.86 gallons/sf for POM's other fields (Hilltop and Soldier Fields); this represents a 42% reduction in water use.

It is anticipated that overflow from an EPIC system beneath the Field would continue into the downstream storm drain system, specifically to the stormwater conveyance pipelines flowing north toward Pine Avenue.

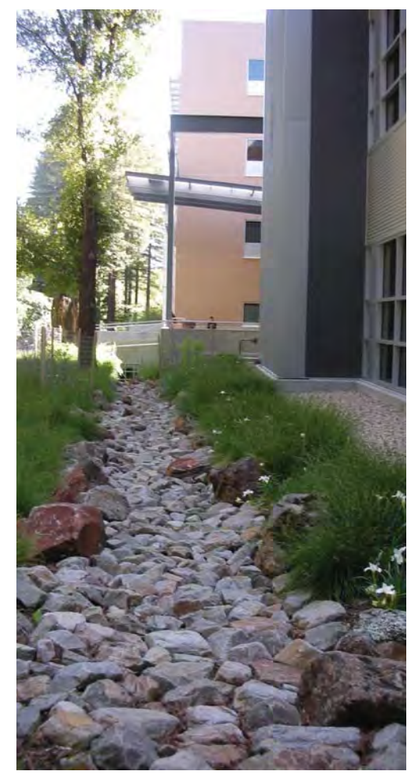


LEGEND

BIORETENTION WITH NATIVE GRASSES AND BOULDERS

DOWNSPOUT DISCONNECTION

PACIFIC GROVE MIDDLE SCHOOL DOWNSPOUT DISCONNECT



PROPOSED L.I.D. IMPROVEMENTS

Downspouts could be disconnected and collected in above ground cistern(s) to support irrigation of the school garden and provide an educational emphasis on stormwater management and reuse. Similarly, near the school building entrance, downspouts could be disconnected and routed to a retrofitted rain garden landscape area.

LEGEND

BIORETENTION LANDSCAPE
BULBS WITH TREE PLANTING

PACIFIC GROVE PUBLIC LIBRARY LANDSCAPE BULBS

PROPOSED L.I.D. IMPROVEMENTS

New LID landscape bulbs could be installed adjacent to the Pacific Grove Public Library at the corner of Central and Fountain Avenue to treat runoff from both roadways. The bioretention bulbs would be similar in style and structure as the traffic bulb proposed for retrofit on Central Avenue; curb cuts would allow stormwater runoff to be diverted from the roadway and a planting medium composed of a structural soil would be used to support plant growth and maximize pollutant removal capacity. The overflow from the new bioretention bulbs would be directed into the existing gutter on Fountain Avenue.

LEGEND

BIORETENTION WITH MIXED NATIVE SHRUBS, GRASSES AND BOULDERS

TREE PLANTING

PATHWAY THROUGH PLANTING AREA WITH EDUCATIONAL SIGNAGE

JEWELL PARK - BIORETENTION

PROPOSED L.I.D. IMPROVEMENTS

Under utilized portions of the Jewell Park turf area, though few, represent opportunities for conversion into stormwater LID treatment features with an educational emphasis in this well used community park. It appears one such area is near the intersection of Forest Avenue and Park Place, where runoff from Forest Avenue could be strategically diverted to a new bioretention feature with an overflow onto Park Place.

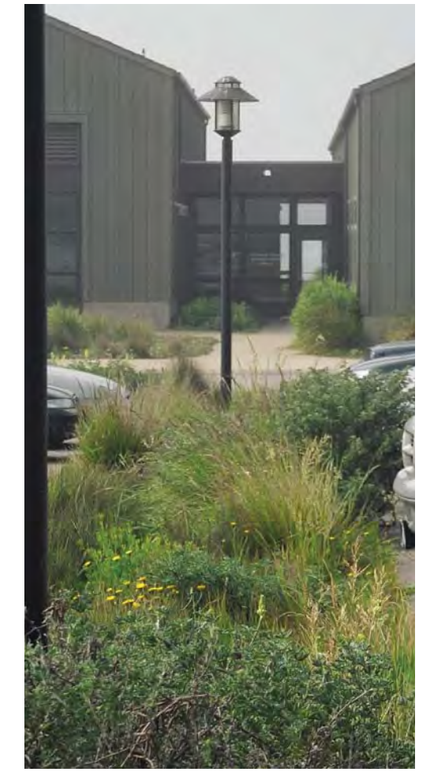
LEGEND

BIORETENTION PLANTERS WITH BOULDERS AND MIXED PLANTINGS

PERMEABLE PAVING

PROPOSED NEW TREE AND SHRUB PLANTING

LIGHTHOUSE AVENUE - GREEN STREET



PROPOSED L.I.D. IMPROVEMENTS

The center and side parking aisles and crosswalks in this downtown corridor could be converted into permeable pavement strips. Many of the existing and newly installed landscape bulbs could be converted to LID features by using curb cuts to divert and treat roadway runoff. A preliminary concept plan for the portion of Lighthouse Avenue between 16th Street and Forest Avenue could be modified to locate the proposed planters to become LID stormwater/bioretention planters providing water quality treatment of the roadway and parking area stormwater runoff.

LEGEND

- BIORETENTION WITH NATIVE GRASSES AND BOULDERS
- PERMEABLE PAVING
- DOWNSPOUT DISCONNECTION

CITY HALL - COURTYARD PLAZA RETROFITS

PROPOSED L.I.D. IMPROVEMENTS

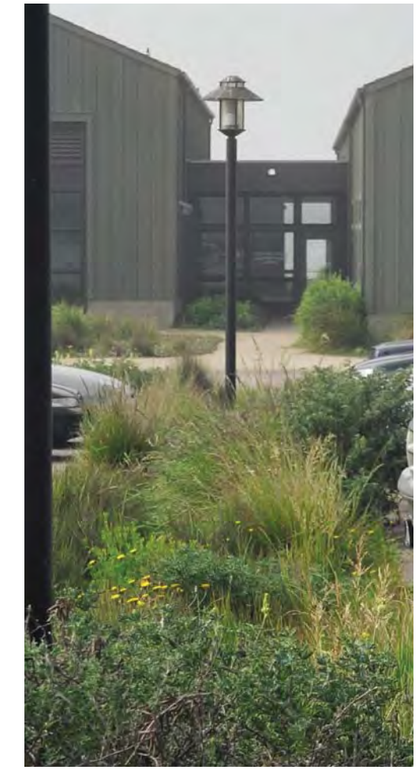
This project would retrofit the City Hall courtyard to highlight LID concepts and practices. Building downspouts for the portion of City Hall on the southern edge of the courtyard would be disconnected via stormwater art into the existing landscape planters, slightly modified to accommodate the diverted flows.

The Courtyard pavement would be replaced with permeable pavers with a stormwater art element that exhibits an educational and/or playful focus. New stormwater landscape tree wells would be installed along Laurel to treat roadway runoff.

LEGEND

- BIORETENTION PLANTERS WITH BOULDERS AND MIXED PLANTINGS
- PROPOSED NEW TREE AND SHRUB PLANTING
- PERMEABLE PAVING
- DOWNSPOUT DISCONNECTION

FANDANGO PARKING LOT RETROFIT



PROPOSED L.I.D. IMPROVEMENTS

The proposed treatment approach would convert the center parking aisles to bioretention planters with curb cuts to receive runoff from the parking lot surface. The current dumpster and grease collection barrel location and condition should be evaluated for consistency with best practices to manage runoff into the ASBS.

LEGEND

BIORETENTION PLANTERS WITH BOULDERS AND MIXED PLANTINGS

PERMEABLE PAVING

PROPOSED NEW TREE AND SHRUB PLANTING

LOVERS POINT PARKING LOT RETROFIT

PROPOSED L.I.D. IMPROVEMENTS

A Recreation Trail Accessibility Improvements site plan for the Lovers Point Parking Lot was reviewed and evaluated for incorporation of additional LID measures to provide water quality treatment of runoff from the parking lot and adjacent portions of Ocean View Boulevard. The current plan already includes the use of pervious pavers for the pedestrian trail access point at Forest Avenue and in all the crosswalks. Potential measures for incorporation include using landscape bulbs as bioretention features with curb cuts, installing pervious pavers along the parking stalls, and converting the landscape area at the intersection of 17th and Ocean View to a bioretention facility to treat runoff from this busy intersection.

LEGEND

BIORETENTION WITH NATIVE SHRUBS, GRASSES AND BOULDERS

OCEAN VIEW CURB CUTS TO RAIN GARDENS

PROPOSED L.I.D. IMPROVEMENTS

Curb cuts from Ocean View Boulevard could be used to direct runoff into the landscape area between the roadway and coastline. The landscape area could be converted into rain gardens with plants suited to bioretention applications and coastal environments. It is assumed that a portion of the runoff from storm drains extending beneath the roadway from Naiad Street to Clyte Street could be redirected into the new bioretention features. Existing curb cuts in this area should be maintained to allow the continued diversion of roadway runoff into the landscape area, to provide flow attenuation, and water quality treatment prior to entering the ASBS.

LEGEND

BIORETENTION WITH NATIVE GRASSES AND SHRUBS

BOULDERS

12TH TO 13TH STREET - BIORETENTION

PROPOSED L.I.D. IMPROVEMENTS

Numerous opportunities are available along the Recreational Trail alignment to provide water quality treatment of runoff from the trail and Ocean View Boulevard. Proposed methods involve retrofit of existing drain inlets to allow for conversion of existing landscape areas to bioretention facilities. One such landscape area is located downslope of the mural parallel to the Recreation Trail between 12th and 13th streets. The mural depicts Pacific Grove's coastal natural habitats and the historical progression of Pacific Grove's built environment in the Coastal Zone. This area could be modified to treat roadway and trail runoff while preserving the character and historical significance of the mural.

PINE AVENUE - GREEN STREET

PROPOSED L.I.D. IMPROVEMENTS

The existing width and drainage patterns on Pine Avenue are suitable for implementation of new LID landscape bulbs on both the north and south sides of the roadway corridor by reducing the number of traffic lanes from four to two. Adequate space for east and west bound bike lanes would likely be available while maintaining residential street parking. The combined width of the remaining two driving lanes and bike lanes would continue to be available for special events and parades that occur along the ROW. Additional benefits of this project concept include providing water quality treatment of runoff from this well used roadway in a high priority ASBS watershed and slowing traffic to support safe routes to the Robert Down Elementary School.

Cost Estimates			Project																			
			Central Avenue		Dewey to Eardley		7th Street		12th & 13th Streets		Robert Down Elementary		Middle School		Jewell Park		City Hall		Lovers Point Parking Lot		Ocean View Boulevard	
Capital Costs			Bioretention Bulbs		Dry Swale		Bioretention		Bioretention		EPIC System		Downspout Disonnection to Rain Garden		Bioretention		LID Courtyard		Bioretention Planters & Permeable Pavement		Rain Gardens	
Description	**Unit**	**Unit Price**	**Estimated Quantity**	**Estimated Cost**	**Estimated Quantity**	**Estimated Cost**	**Estimated Quantity**	**Estimated Cost**	**Estimated Quantity**	**Estimated Cost**	**Estimated Quantity**	**Estimated Cost**	**Estimated Quantity**	**Estimated Cost**	**Estimated Quantity**	**Estimated Cost**	**Estimated Quantity**	**Estimated Cost**	**Estimated Quantity**	**Estimated Cost**	**Estimated Quantity**	**Estimated Cost**
Mobilization/Demobilization	LS	$5,000	2	$10,000	2	$10,000	2	$10,000	2	$10,000	2	$10,000	1	$5,000	2	$10,000	2	$10,000	2	$10,000	2	$10,000
Excavation	CY	$20	500	$10,000	100	$2,000	100	$2,000	300	$6,000	6800	$136,000	100	$2,000	100	$2,000	300	$6,000	1200	$24,000	900	$18,000
Offhaul and Disposal	CY	$20	500	$10,000	100	$2,000	100	$2,000	300	$6,000	6800	$136,000	100	$2,000	100	$2,000	300	$6,000	1200	$24,000	900	$18,000
Inlet/Outlet	EA	$15,000	12	$180,000	10	$150,000	3	$45,000	3	$45,000	2	$30,000	0	$0	3	$45,000	10	$150,000	5	$75,000	10	$150,000
Pipeline	LF	$100	100	$10,000	500	$50,000	100	$10,000	100	$10,000	250	$25,000	120	$12,000	60	$6,000	150	$15,000	700	$70,000	600	$60,000
Manhole	LS	$5,000	3	$15,000	0	$0	1	$5,000	1	$5,000	2	$10,000	0	$0	0	$0	0	$0	0	$0	0	$0
Staging and Demolition	SF	$5	1900	$9,500	400	$2,000	400	$2,000	1400	$7,000	0	$0	400	$2,000	300	$1,500	400	$2,000	1100	$5,500	5700	$28,500
Erosion Control	SF	$1	3730	$3,730	680	$680	700	$700	2650	$2,650	1100	$1,100	690	$690	490	$490	700	$700	2100	$2,100	11380	$11,380
Landscaping	SF	$15	3800	$57,000	680	$10,200	700	$10,500	2700	$40,500	0	$0	687	$10,305	490	$7,350	500	$7,500	7083	$106,245	11380	$170,700
EPIC System	SF	$5	0	$0	0	$0	0	$0	0	$0	197000	$985,000	0	$0	0	$0	0	$0	0	$0	0	$0
Permeable Pavement	SF	$20	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	2635	$52,700	8101	$162,020	0	$0
Subtotal Costs				**$305,230**		**$226,880**		**$87,200**		**$132,150**		**$1,333,100**		**$33,995**		**$74,340**		**$249,900**		**$478,865**		**$466,580**
Contingency	20%			$61,046		$45,376		$17,440		$26,430		$266,620		$6,799		$14,868		$49,980		$95,773		$93,316
Complexity			15%	$45,785	15%	$34,032	20%	$17,440	25%	$33,038	15%	$199,965	15%	$5,099	15%	$11,151	15%	$37,485	15%	$71,830	20%	$93,316
Engineering Design	15%			$45,785		$34,032		$13,080		$19,823		$199,965		$5,099		$11,151		$37,485		$71,830		$69,987
Construction Management	10%			$30,523		$22,688		$8,720		$13,215		$133,310		$3,400		$7,434		$24,990		$47,887		$46,658
Administrative, Permitting, and Legal	10%			$30,523		$22,688		$8,720		$13,215		$133,310		$3,400		$7,434		$24,990		$47,887		$46,658
		TOTAL		**$518,891**		**$385,696**		**$152,600**		**$237,870**		**$2,266,270**		**$57,792**		**$126,378**		**$424,830**		**$814,071**		**$816,515**
Planning Level Cost Estimate Range	(+)	50%		$778,337		$578,544		$228,900		$356,805		$3,399,405		$86,687		$189,567		$637,245		$1,221,106		$1,224,773
	(-)	35%		$337,279		$250,702		$99,190		$154,616		$1,473,076		$37,564		$82,146		$276,140		$529,146		$530,735
O&M Costs																						
Labor	hr	$50	110	$5,500	55	$2,750	55	$2,750	75	$3,750	50	$2,500	10	$500	30	$1,500	50	$2,500	75	$3,750	120	$6,000
Material	EA	$500	2	$1,000	1	$500	1	$500	1	$500	1	$500	0.5	$250	0.5	$250	1	$500	1	$500	1	$500
Monitoring and Reporting	hr	$100	8	$800	4	$400	4	$400	4	$400	4	$400	4	$400	2	$200	4	$400	4	$400	6	$600
		TOTAL		**$7,300**		**$3,650**		**$3,650**		**$4,650**		**$3,400**		**$1,150**		**$1,950**		**$3,400**		**$4,650**		**$7,100**
Equivalent Annual Cost																						
Interest	i	0.05	$48,940		$34,600		$15,900		$23,740		$185,260		$5,790		$12,100		$37,490		$69,980		$72,620	
Years	n	20																				

Table 4. Preliminary Planning Level Cost Estimates for the Ten (10) LID Sites not Selected for Schematic Design Development

PART 3: LID SCHEMATIC DESIGN DEVELOPMENT

15% Schematic Design Plans were prepared as part of the Urban Greening Plan LID Assessment at five of the 15 project sites selected for concept development:

1. Pine Avenue Complete Street Corridor

2. (Fandango) City Parking Lot LID Improvements

3. Lighthouse Avenue Complete Street Concept

4. Library Rain Garden and Bioretention Bulbs

5. Berwick Park Bioretention

The accompanying plan sets have been reduced to 11x17 size and are included as Attachment B to this Urban Greening Plan Component.

PROJECT DESCRIPTIONS

1. PINE AVENUE COMPLETE STREET CORRIDOR

The existing Pine Avenue street configuration includes two-lanes each for east and west bound vehicle traffic, and includes the intersection with the highest recorded number of pedestrian vehicle collisions in the City (at Pine and Forest Avenues). The current street width is over-wide for the amount of vehicle traffic it receives and does not adequately provide safe pedestrian or bicycle pathways. Additionally, Pine Avenue transects multiple high priority subwatersheds, draining into the State designated Area of Special Biological Significance (ASBS) that extends along the City's coastline. The Pine Avenue Complete Street Corridor schematic design provides six (6) street layout alternatives for the City and the Community to consider during development of a Pine Avenue Complete Street Corridor Plan. Each alternative identifies LID bioretention stormwater treatment facilities, street parking, designated bicycle lanes, vehicle lanes, and some alternatives include central landscape medians, all within the existing Pine Avenue street and landscape width. Below is a list of the characteristics of each of the six (6) alternative street layouts.

The Pine Avenue drainage analysis assumed that runoff from the residential streets southwest of Pine Avenue would be managed in the proposed LID areas, in addition to the direct runoff from Pine Avenue. The drainage area was assumed to extend from the northeastern edge of Pine Avenue, southwest to Spruce Avenue, west to the edge of the ASBS watershed near Chestnut Street and south to 2nd Street.

PINE AVENUE COMPLETE STREET CORRIDOR ALTERNATIVES

Alternative 1: High Traffic Zone

- No landscape median
- Bioretention on the north and south sides of Pine Avenue, with 7' wide parking between larger bioretention bulbs located on the east and west ends of the block.
- 4' wide north bound bike lane with 2' buffer on both sides
- 4' wide south bound bike lane with 2' buffer on both sides
- 13' wide vehicle lanes

Alternative 2: School Safety Zone

- 8' wide landscape median
- Traffic table with permeable pavement
- 5' wide north bound bike lane with 3' buffer on both sides
- 5' wide south bound bike lane with 3' buffer on both sides
- 12' wide vehicle lanes

Alternative 3: Residential Zone 1

- 8' wide landscape median
- Retrofit of existing landscape/hardscape Strip to bioretention
- 7' wide parking on north and south
- 5' wide north bound bike lane with 3' buffer on both sides
- 5' wide south bound bike lane with 3' buffer on both sides
- 12' wide vehicle lanes

Alternative 4: Residential Zone 2

- 8' wide landscape median
- Bioretention bulbs at corners with partial retrofit of existing landscape/hardscape strip to bioretention
- 7' wide parking on north and south between bioretention bulbs
- 5' wide north bound bike lane with 3' buffer on both sides
- 5' wide south bound bike lane with 3' buffer on both sides
- 12' wide vehicle lanes

Alternative 5: Residential Zone 3

- 6' wide landscape median
- Bioretention on the north and south sides of Pine Avenue, with 7' wide parking between larger bioretention bulbs located on the east and west ends of the block.
- 4' wide north bound bike lane with 2' buffer on both sides
- 4' wide south bound bike lane with 2' buffer on both sides
- 12' wide vehicle lanes

Alternative 6: Residential Zone 4

- 10' wide central bike lane for north and south bound bike traffic with 6' wide landscape buffer on both sides
- Bioretention on the north and south sides of Pine Avenue, with 7' wide parking between larger bioretention bulbs located on the east and west ends of the block.
- 12' wide vehicle lanes

2. (FANDANGO) CITY PARKING LOT - LID IMPROVEMENTS

This City Parking Lot is located between 16th and 17th Street in the downtown business district, north of the Fandango Restaurant. The proposed LID retrofit of this parking lot converts the center parking aisles to bioretention planters with curb cuts to receive runoff from the parking lot surface. Permeable paver pathways and safe pedestrian "bridge" crossings have been located near existing light fixtures and across each of the linear bioretention facilities to safely convey pedestrians north to south along the parking lot. New bioretention bulbs with curb cuts to receive stormwater runoff are also proposed adjacent to the existing sidewalk on 17th Street to capture and treat runoff from this roadway.

The City parking lot drainage analysis assumed that runoff from 17th Street extending southwest to Laurel Avenue would be managed by the new biorention planters on 17th Street and the new bioretention planters in the parking lot would treat all the parking lot runoff.

3. LIGHTHOUSE AVENUE COMPLETE STREET CONCEPT

The Complete Street Concept has been developed for the section of Lighthouse Avenue extending just west of 16th Street east towards Grand Avenue. The proposed LID design concepts expand upon the 'Lighthouse Avenue Streetscape Improvements' schematic design prepared for the City of Pacific Grove by WR&D in January of 2016 (1/11/16). Specifically, the center and side parking aisles and crosswalks in this downtown corridor could be converted into permeable pavement strips for stormwater retention. Many of the existing and proposed landscape bulbs could be converted to bioretention LID features by using curb cuts to provide water quality treatment of the roadway and parking area stormwater runoff.

The Lighthouse Avenue drainage analysis assumed that runoff from 16th Street and Forest Avenue and 17th Street extending southwest to Laurel Avenue would be managed by the new bioretention planters and permeable pavement, in addition to the direct runoff from Lighthouse Avenue.

4. LIBRARY RAIN GARDEN AND BIORETENTION ISLANDS

New LID bioretention landscape islands could be installed near the Pacific Grove Public Library at the intersection of Central and Fountain Avenues to treat runoff from both roadways. The bioretention islands include curb cuts to allow diversion of stormwater runoff from the roadway and a planting medium composed of a structural soil to support plant growth and maximize pollutant removal capacity. The overflow from the new bioretention islands would be directed into the existing gutters on either Fountain Avenue or Central Avenue. A rain garden is also proposed on the Pacific Grove Library property at the corner of Central and Fountain Avenues. The rain garden would capture water diverted from an existing rooftop downspout that would be conveyed under an existing walkway, and into the new rain garden. The proposed rain garden design concept is consistent with the recently installed rain garden at the Pacific Grove Natural History Museum.

The Library drainage analysis assumed that runoff from Fountain Avenue extending southwest towards Lighthouse Avenue and in the vicinity of Central Avenue would be managed by the new bioretention planters, in addition to the portion of the library rooftop that would be diverted to the new rain garden.

5. BERWICK PARK BIORETENTION

Extending from 9th Avenue to Carmel Avenue, Berwick Park represents an opportunity to provide water quality treatment of runoff from Ocean View Boulevard and a portion of the residential neighborhood in the vicinity. A portion of the turf area at Berwick Park would be retrofitted to incorporate a bioretention feature to treat the diverted runoff. It is assumed that a portion of the runoff from storm drains extending beneath the park from Carmel Avenue and Monterey Avenue could be redirected into the new bioretention features along with roadway runoff, via new curb cuts along Ocean View Boulevard. An additional benefit of this proposed design is the visual and physical buffer the new bioretention feature provides between children and other users at the park and the traffic on Ocean View Boulevard.

Field investigations will be necessary to verify if the existing storm drain can be diverted into the proposed bioretention feature and/or used as an overflow for the bioretention feature. The Berwick Park drainage analysis assumed that runoff draining towards Ocean View Boulevard from Lighthouse Avenue northeast down 10th Street, Monterey Avenue, and 11th Street could potentially be diverted into the proposed bioretention feature.

COST ESTIMATE

A planning level cost estimate was prepared for the five LID facilities. The cost estimate includes necessary planning, design, permits, construction, and operation and maintenance, energy, and post construction performance monitoring. Table 5 summarizes the preliminary planning level cost estimates that will be further evaluated and updated as the project designs are further developed.

NEXT STEPS

Next steps in terms of design development include conducting detailed site surveys and community workshops to evaluate alternatives (in the case of Pine Avenue) and further develop the design concept to a 30% or 60% level of design development. At a 60% design development level it's recommended that the City begin preparing environmental review and permitting documents.

Future field and topographic surveys can be used to verify the limits of the identified drainage areas to each proposed LID feature. For example, at Berwick Park, field investigations will be necessary to verify if the existing storm drain can be diverted into the proposed bioretention feature and/or used as an overflow for the bioretention feature.

Cost Estimates			Project									
			Pine Avenue		16th/17th City Parking		Lighthouse Ave		Library		Berwick Park	
Capital Costs			Complete Street with Bioretention		Bioretention		Bioretention Planters & Permeable Pavement		Rain Garden & Bioretention Islands		Bioretention	
Description	Unit	Unit Price	Estimated Quantity	Estimated Cost	Estimated Quantity	Estimated Cost	Estimated Quantity	Estimated Cost	Estimated Quantity	Estimated Cost	Estimated Quantity	Estimated Cost
Mobilization/Demobilization	LS	$5,000	8	$40,000	1	$5,000	2	$10,000	1	$5,000	1	$5,000
Excavation	CY	$20	7600	$152,000	300	$6,000	1100	$22,000	300	$6,000	1000	$20,000
Offhaul and Disposal	CY	$20	7600	$152,000	300	$6,000	1100	$22,000	300	$6,000	1000	$20,000
Inlet/Outlet	EA	$15,000	30	$450,000	15	$225,000	10	$150,000	13	$195,000	6	$90,000
Pipeline	LF	$100	1500	$150,000	0	$0	500	$50,000	50	$5,000	400	$40,000
Manhole	LS	$5,000	40	$200,000	0	$0	0	$0	1	$5,000	3	$15,000
Staging and Demolition	SF	$5	18900	$94,500	1300	$6,500	1300	$6,500	800	$4,000	3400	$17,000
Erosion Control	SF	$1	37800	$37,800	2500	$2,500	2600	$2,600	1580	$1,580	6670	$6,670
Landscaping	SF	$15	37800	$567,000	2500	$37,500	3690	$55,350	1580	$23,700	6670	$100,050
Hardscape Improvements	LF	$25	10500	$262,500	1440	$36,000	1800	$45,000	400	$10,000	1000	$25,000
Permeable Pavement	SF	$20	30000	$600,000	975	$19,500	10100	$202,000	0	$0	0	$0
Subtotal Costs				**$2,705,800**		**$344,000**		**$565,450**		**$261,280**		**$338,720**
Contingency	20%			$541,160		$68,800		$113,090		$52,256		$67,744
Complexity			25%	$676,450	20%	$68,800	25%	$141,363	15%	$39,192	15%	$50,808
Engineering Design	15%			$405,870		$51,600		$84,818		$39,192		$50,808
Construction Management	10%			$270,580		$34,400		$56,545		$26,128		$33,872
Administrative, Permitting, and Legal	10%			$270,580		$34,400		$56,545		$26,128		$33,872
		TOTAL		**$4,870,440**		**$602,000**		**$1,017,810**		**$444,176**		**$575,824**
Planning Level Cost Estimate Range	(+)	50%		$7,305,660		$903,000		$1,526,715		$666,264		$863,736
	(-)	35%		$3,165,786		$391,300		$661,577		$288,714		$374,286
O&M Costs												
Labor	hr	$50	450	$22,500	75	$3,750	110	$5,500	30	$1,500	75	$3,750
Material	EA	$500	5	$2,500	1	$500	1	$500	0.5	$250	1	$500
Monitoring and Reporting	hr	$100	24	$2,400	6	$600	6	$600	2	$200	4	$400
		TOTAL		**$27,400**		**$4,850**		**$6,600**		**$1,950**		**$4,650**
Equivalent Annual Cost												
Interest	i	0.05	$418,220		$53,160		$88,280		$37,600		$50,860	
Years	n	20										

Table 5. Preliminary Planning Level Cost Estimates for the Five (5) LID Sites Selected for Schematic Design Development

STORMWATER LID ASSESSMENT

ATTACHMENT A: LID RETROFIT INVENTORY WORKSHEETS

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Unique Site ID: 1		**Watershed:** ASBS	
City: PG		**Subwatershed:**	
Date: 5/24/16	**Assessed By:** EMC/RLC	**Camera ID:**	**Pictures:**

Site Description

Name: FOREST AVE
Address or Nearest Intersection:
Parcel Number:
Comments:

Ownership: ☒ Public ☐ Private ☐ Unknown ROW
If Public, Government Jurisdiction: ☐ Local ☐ State ☒ DOT ☐ Other:

Potential Retrofit Location:

Storage
- ☐ Existing Pond
- ☐ Below Outfall
- ☐ In Transport ROW
- ☐ Other:
- ☐ Above Roadway Crossing
- ☐ In Conveyance System
- ☐ Large Parking Lot

On-Site
- ☐ Hotspot Operation
- ☐ Small Parking Lot
- ☒ Individual Street
- ☐ Individual Rooftop
- ☐ Small Impervious Area
- ☐ Landscape / Hardscape
- ☐ Underground
- ☐ Other:

Drainage Area to Site

Drainage Area ≈ _____
Imperviousness ≈ _____%
Impervious Area ≈ _____

Notes:

Drainage Area Land Use:
- ___% Residential
  - ___% SFH (< 1 ac lots)
  - ___% SFH (> 1 ac lots)
  - ___% Townhouses
  - ___% Multi-Family
- ___% Commercial
- ___% Institutional
- ___% Industrial
- ___% Transport-Related
- ___% Park
- ___% Undeveloped
- ___% Other:

Existing Site Conditions

Existing Stormwater BMP: ☐ Yes ☒ No ☐ Possible
If Yes, Describe:

Describe Existing Site Conditions, Including Existing Drainage and Conveyance Patterns:

Unique Site ID: 1

Considerations for Potential Retrofit Opportunity

Available Surface Area:

Paved:

Landscape:

Available Depth / Elevation Change:

Areas of Concern:

☐ Dumpsters ☐ Grease ☐ Chemicals ☐ Material Storage ☐ Erosion ☐ Pet waste ☐ Geese/Wildlife

Describe Obvious, Potential Retrofit Opportunity:

☒ Possible Demonstration / Education Project

Site Constraints

Adjacent Land Use:

☒ Residential ☐ Commercial ☐ Institutional
☐ Industrial ☒ Transport-Related ☐ Park
☐ Undeveloped ☐ Other: PARKING

Possible Conflicts Due to Adjacent Land Use? ☐ Yes ☐ No
If Yes, Describe: RESIDENTIAL ACCESS & WELLS

Access:

☐ No Access Constraints
Access Constrained due to
☐ Slope ☐ Space
☒ Utilities ☐ Tree Impacts
☐ Structures ☒ Property Ownership
☐ Other:

Conflicts with Existing Utilities:

☐ None
☐ Unknown

Yes	Possible	
☐	☒	Sewer
☐	☒	Water
☐	☒	Gas
☐	☒	Cable
☐	☒	Electric
☐	☒	Electric to Streetlights
☐		Overhead Wires
☐	☐	Other:

Potential Ecological Conflict:

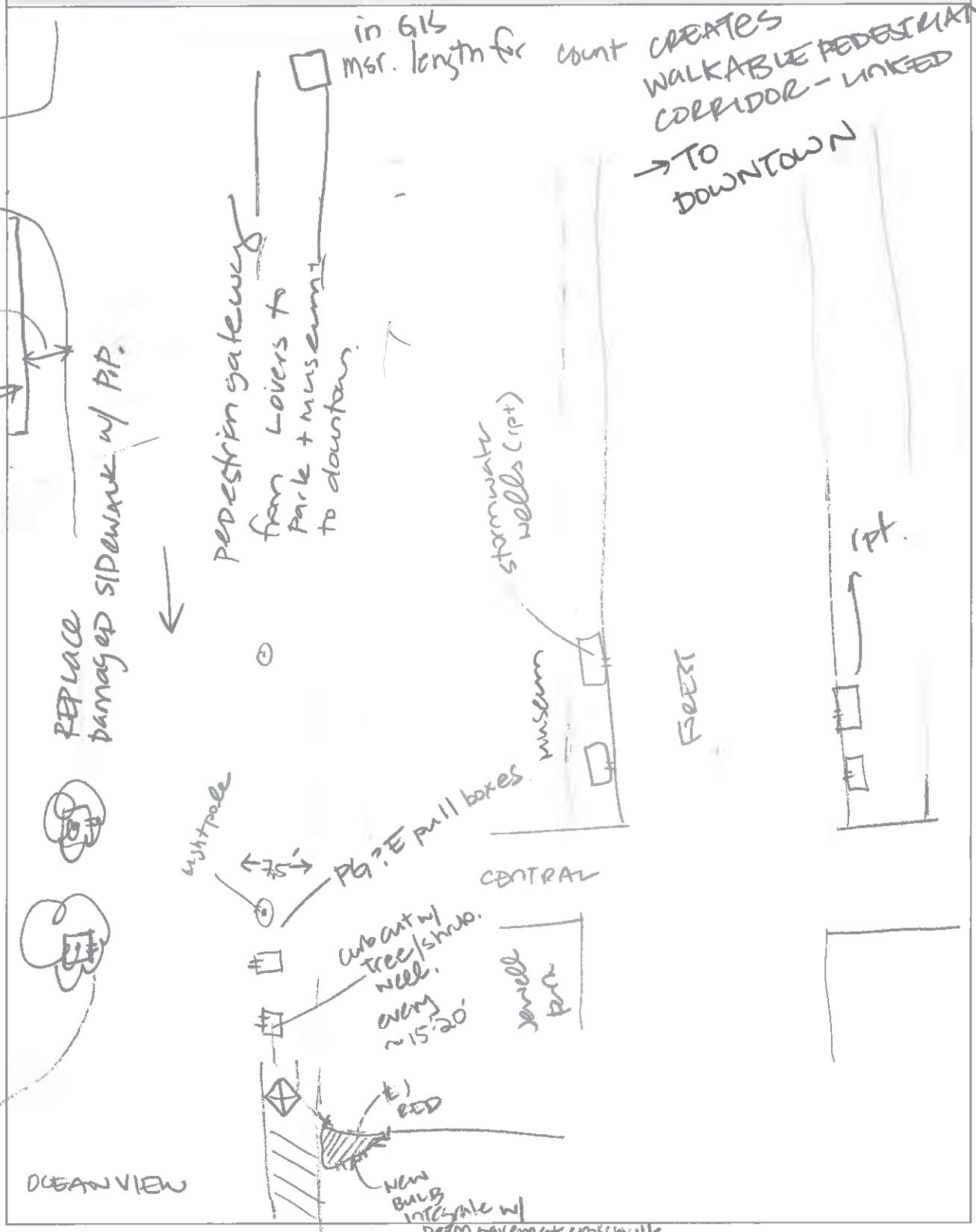
Existing mature trees: * some	☐ Yes	☒ No
Existing wetlands:	☐ Yes	☒ No
Existing stream or natural drainage:	☐ Yes	☒ No
Evidence of shallow bedrock:	☐ Yes	☒ No
Existing floodplain:	☐ Yes	☒ No

Other:

Site Candidate for Further Investigation: ☒ Yes ☐ No ☐ Maybe
If no, site candidate for Other Restoration Project(s): ☐ Yes ☐ No ☐ Maybe
If yes, type(s):

Unique Site ID:

Notes or Sketch



Unique Site ID: 2		**Watershed:**	
City:		**Subwatershed:**	
Date: 6/6/16	**Assessed By:**	**Camera ID:**	**Pictures:**

Site Description

Name: GRAND AVE ROW
Address or Nearest Intersection:
Parcel Number:
Comments:

Ownership: ☒ Public ☐ Private ☐ Unknown
If Public, Government Jurisdiction: ☒ Local ☐ State ☐ DOT ☐ Other:

Potential Retrofit Location:

Storage
- ☐ Existing Pond
- ☐ Below Outfall
- ☐ In Transport ROW
- ☐ Other:
- ☐ Above Roadway Crossing
- ☐ In Conveyance System
- ☐ Large Parking Lot

On-Site
- ☐ Hotspot Operation
- ☐ Small Parking Lot
- ☐ Individual Street
- ☐ Individual Rooftop
- ☐ Small Impervious Area
- ☐ Landscape / Hardscape
- ☐ Underground
- ☐ Other:

Drainage Area to Site

Drainage Area ≈
Imperviousness ≈ %
Impervious Area ≈

Notes:

Drainage Area Land Use:
- ___% Residential
  - ___% SFH (< 1 ac lots)
  - ___% SFH (> 1 ac lots)
  - ___% Townhouses
  - ___% Multi-Family
- ___% Commercial
- ___% Institutional
- ___% Industrial
- ___% Transport-Related
- ___% Park
- ___% Undeveloped
- ___% Other:

Existing Site Conditions

Existing Stormwater BMP: ☐ Yes ☒ No ☐ Possible
If Yes, Describe:

Describe Existing Site Conditions, Including Existing Drainage and Conveyance Patterns:

→ STEEP - MODERATELY STEEP AT ROADWAY, DIRECT DRAIN TO CB → S.D → ASBS.

→

Considerations for Potential Retrofit Opportunity

Available Surface Area:

Paved:

Landscape:

Available Depth / Elevation Change:

Areas of Concern:

☐ Dumpsters ☐ Grease ☐ Chemicals ☐ Material Storage ☐ Erosion ☐ Pet waste ☐ Geese/Wildlife

Describe Obvious, Potential Retrofit Opportunity:

→ NARROW ROADWAY → REPLACE AC w/ LID

→ P.P. IN FARMERS MARKET PLAZA

→ LANDSCAPE BULBS ADJACENT TO JEWELL PARK.

☐ Possible Demonstration / Education Project

Site Constraints

Adjacent Land Use:

☒ Residential ☐ Commercial ☒ Institutional
☐ Industrial ☐ Transport-Related ☒ Park
☐ Undeveloped ☐ Other:_____

Possible Conflicts Due to Adjacent Land Use? ☐ Yes ☒ No
If Yes, Describe:_____

Access:

☒ No Access Constraints
Access Constrained due to
☐ Slope ☐ Space
☐ Utilities ☐ Tree Impacts
☐ Structures ☐ Property Ownership
☐ Other:_____

Conflicts with Existing Utilities:

☐ None
☐ Unknown

Yes	Possible	
☐	☒	Sewer
☐	☒	Water
☐	☒	Gas
☐	☒	Cable
☐	☒	Electric
☐	☐	Electric to Streetlights
☐		Overhead Wires
☐	☐	Other:_____

Potential Ecological Conflict:

Existing mature trees: NO CONFLICT	☐ Yes	☒ No
Existing wetlands:	☐ Yes	☒ No
Existing stream or natural drainage:	☐ Yes	☒ No
Evidence of shallow bedrock:	☐ Yes	☒ No
Existing floodplain:	☐ Yes	☒ No

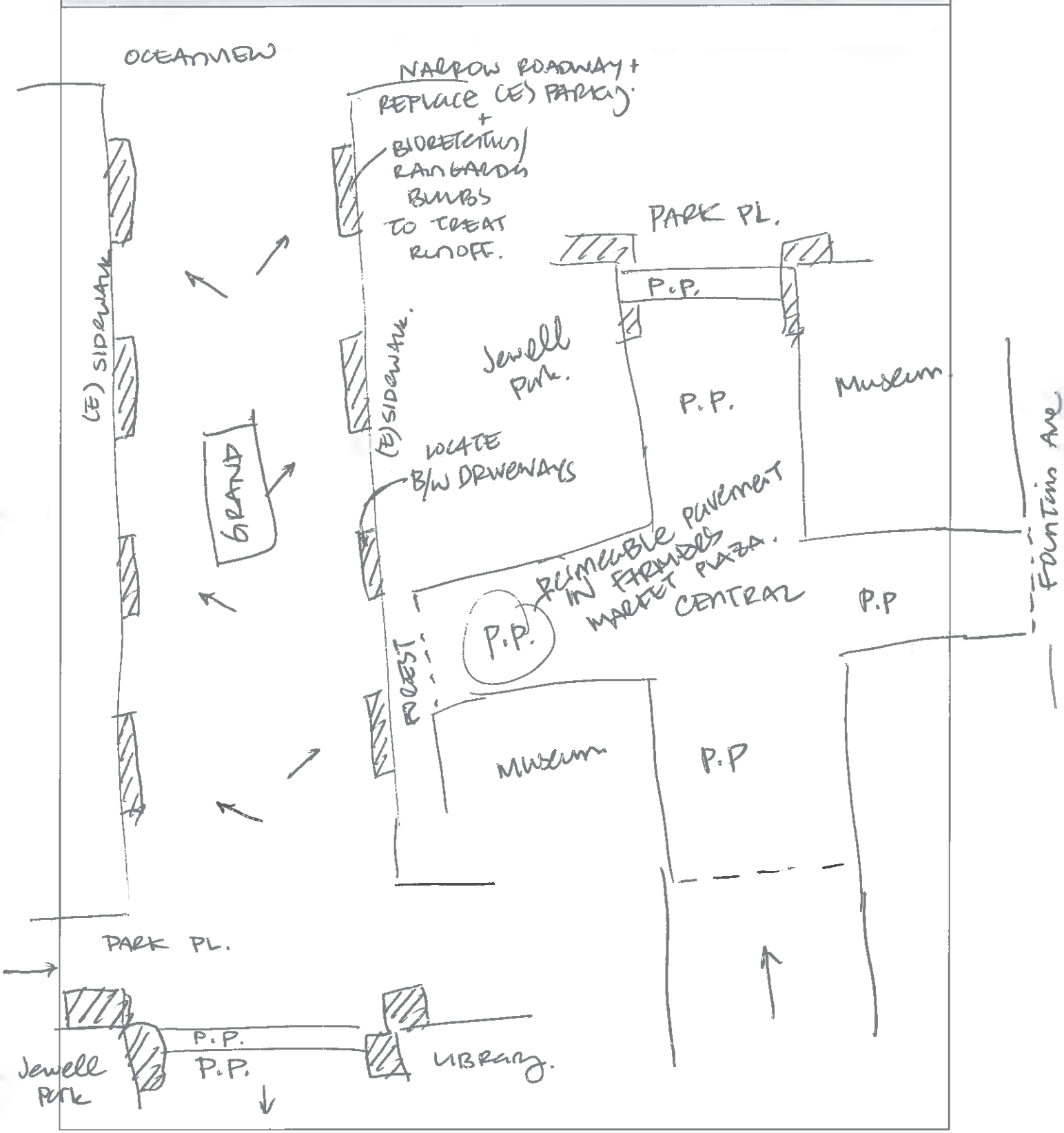
Other:_____

Site Candidate for Further Investigation: ☒ **Yes** ☐ **No** ☐ **Maybe**
If no, site candidate for Other Restoration Project(s): ☐ **Yes** ☐ **No** ☐ **Maybe**
If yes, type(s):_____

Unique Site ID:_____

NTS

Notes or Sketch



Unique Site ID: 2

Unique Site ID: 3		**Watershed:** ASBS	
City: PG		**Subwatershed:**	
Date: 5/31/16	**Assessed By:**	**Camera ID:**	**Pictures:**

Site Description

Name: Caledonia Park
Address or Nearest Intersection:
Parcel Number:
Comments:

Ownership: ☒ Public ☐ Private ☐ Unknown
If Public, Government Jurisdiction: ☐ Local ☐ State ☐ DOT ☐ Other:

Potential Retrofit Location:

Storage
- ☐ Existing Pond
- ☐ Below Outfall
- ☐ In Transport ROW
- ☐ Other:
- ☐ Above Roadway Crossing
- ☐ In Conveyance System
- ☐ Large Parking Lot

On-Site
- ☐ Hotspot Operation
- ☐ Small Parking Lot
- ☒ Individual Street
- ☒ Individual Rooftop
- ☐ Small Impervious Area
- ☐ Landscape / Hardscape
- ☐ Underground
- ☐ Other:

Drainage Area to Site

Drainage Area ≈ _____
Imperviousness ≈ _____%
Impervious Area ≈ _____

Notes:

Drainage Area Land Use:
- ___% Residential
  - ___% SFH (< 1 ac lots)
  - ___% SFH (> 1 ac lots)
  - ___% Townhouses
  - ___% Multi-Family
- ___% Commercial
- ___% Institutional
- ___% Industrial
- ___% Transport-Related
- ___% Park
- ___% Undeveloped
- ___% Other:

Existing Site Conditions

Existing Stormwater BMP: ☒ Yes ☐ No ☐ Possible
If Yes, Describe:

Describe Existing Site Conditions, Including Existing Drainage and Conveyance Patterns:

ROADRUNOFF TO CATCHBASINS.
~ 75% SELF-TREATING PARK → 25% TO CALEDONIA ST.

Unique Site ID: 3

Considerations for Potential Retrofit Opportunity

Available Surface Area:

Paved:

Landscape:

Available Depth / Elevation Change:

Areas of Concern:

NA

☐ Dumpsters ☐ Grease ☐ Chemicals ☐ Material Storage ☐ Erosion ☐ Pet waste ☐ Geese/Wildlife

Describe Obvious, Potential Retrofit Opportunity:

DIVERT ROADRUNOFF TO (N) LID IN PARK.
↳ + DOWNSPOUTS DISCHARGING TO STREET.

☒ Possible Demonstration / Education Project

Site Constraints

Adjacent Land Use:

☒ Residential ☐ Commercial ☐ Institutional
☐ Industrial ☐ Transport-Related ☐ Park
☐ Undeveloped ☐ Other: POST OFFICE

Possible Conflicts Due to Adjacent Land Use? ☐ Yes ☐ No
If Yes, Describe:

Access:

☒ No Access Constraints
Access Constrained due to
☐ Slope ☐ Space
☐ Utilities ☐ Tree Impacts
☐ Structures ☐ Property Ownership
☐ Other:

Conflicts with Existing Utilities:

☐ None
☐ Unknown

Yes	Possible	
☐	☒	Sewer
☐	☒	Water
☐	☒	Gas
☐	☒	Cable
☐	☒	Electric
☐	☒	Electric to Streetlights
☐	☒	Overhead Wires
☐	☐	Other:

Potential Ecological Conflict:

Existing mature trees:	☒ Yes	☐ No
Existing wetlands:	☐ Yes	☒ No
Existing stream or natural drainage:	☐ Yes	☒ No
Evidence of shallow bedrock:	☐ Yes	☒ No
Existing floodplain:	☐ Yes	☒ No

Other:

Site Candidate for Further Investigation: ☒ Yes ☐ No ☐ Maybe
If no, site candidate for Other Restoration Project(s): ☐ Yes ☐ No ☐ Maybe
If yes, type(s):

Unique Site ID:

Notes or Sketch
see field map

Unique Site ID: 3

Unique Site ID: 4		**Watershed:** ASBS	
City: PG		**Subwatershed:**	
Date: 5/31	**Assessed By:** BMC	**Camera ID:**	**Pictures:**

Site Description

Name: GREENWOOD PARK
Address or Nearest Intersection:
Parcel Number:
Comments:

Ownership: ☒ Public ☐ Private ☐ Unknown
If Public, Government Jurisdiction: ☐ Local ☐ State ☐ DOT ☐ Other:

Potential Retrofit Location:

Storage
- ☐ Existing Pond
- ☐ Below Outfall
- ☐ In Transport ROW
- ☐ Other:
- ☐ Above Roadway Crossing
- ☐ In Conveyance System
- ☐ Large Parking Lot

On-Site
- ☐ Hotspot Operation
- ☐ Small Parking Lot
- ☐ Individual Street
- ☐ Individual Rooftop
- ☐ Small Impervious Area
- ☒ Landscape / Hardscape
- ☐ Underground
- ☐ Other:

Drainage Area to Site

Drainage Area ≈
Imperviousness ≈ %
Impervious Area ≈

Notes:

Drainage Area Land Use:
- % Residential
  - % SFH (< 1 ac lots)
  - % SFH (> 1 ac lots)
  - % Townhouses
  - % Multi-Family
- % Commercial
- % Institutional
- % Industrial
- % Transport-Related
- % Park
- % Undeveloped
- % Other:

Existing Site Conditions

Existing Stormwater BMP: ☐ Yes ☒ No ☐ Possible
If Yes, Describe:

Describe Existing Site Conditions, Including Existing Drainage and Conveyance Patterns:

ROADWAY RUNOFF ON BOTH STREETS PARALLEL TO PARK (12th + 13th) RUNS DIRECTLY TO CB ON OCEANVIEW.

Considerations for Potential Retrofit Opportunity

Available Surface Area:

Paved:

Landscape:

Available Depth / Elevation Change:

Areas of Concern:

☐ Dumpsters ☐ Grease ☐ Chemicals ☐ Material Storage ☐ Erosion ☐ Pet waste ☐ Geese/Wildlife

Describe Obvious, Potential Retrofit Opportunity:

CURB CUTS FROM ROADWAYS TO (N) BIORETENTION IN OPEN AREAS OF PARK.

☒ Possible Demonstration / Education Project

Site Constraints

Adjacent Land Use:

☒ Residential ☐ Commercial ☐ Institutional
☐ Industrial ☐ Transport-Related ☐ Park
☐ Undeveloped ☐ Other: CATVRM

Possible Conflicts Due to Adjacent Land Use? ☐ Yes ☐ No
If Yes, Describe:

Access:

☐ No Access Constraints
Access Constrained due to
☒ Slope ☐ Space
☒ Utilities ☒ Tree Impacts
☐ Structures ☐ Property Ownership
☐ Other:

Conflicts with Existing Utilities:

☐ None
☐ Unknown

Yes	Possible	
☐	☒	Sewer
☐	☒	Water
☐	☒	Gas
☐	☒	Cable
☐	☒	Electric
☐	☒	Electric to Streetlights
☐		Overhead Wires
☐	☐	Other:

Potential Ecological Conflict:

Existing mature trees:	☒ Yes	☐ No
Existing wetlands: * NOT IN PROPOSED IMPROVEMENT AREA.	☐ Yes	☒ No
Existing stream or natural drainage:	☒ Yes	☐ No
Evidence of shallow bedrock:	☐ Yes	☒ No
Existing floodplain: * PARTIALLY	☒ Yes	☐ No

Other:

Site Candidate for Further Investigation: ☒ Yes ☐ No ☐ Maybe
If no, site candidate for Other Restoration Project(s): ☐ Yes ☐ No ☐ Maybe
If yes, type(s):

Unique Site ID:

Notes or Sketch

see sketch on field map.

Unique Site ID: 4

Unique Site ID: 5		**Watershed:** ASBS	
City: PG		**Subwatershed:**	
Date: 5/24/16	**Assessed By:** RLC/ EMC	**Camera ID:**	**Pictures:**

Site Description

Name: LIBRARY
Address or Nearest Intersection:
Parcel Number:
Comments:

Ownership: ☒ Public ☐ Private ☐ Unknown
If Public, Government Jurisdiction: ☐ Local ☐ State ☐ DOT ☐ Other:

Potential Retrofit Location:

Storage
- ☐ Existing Pond
- ☐ Below Outfall
- ☐ In Transport ROW
- ☐ Other:
- ☐ Above Roadway Crossing
- ☐ In Conveyance System
- ☐ Large Parking Lot

On-Site
- ☐ Hotspot Operation
- ☐ Small Parking Lot
- ☒ Individual Street
- ☐ Individual Rooftop
- ☐ Small Impervious Area
- ☒ Landscape / Hardscape
- ☐ Underground
- ☐ Other:

Drainage Area to Site

Drainage Area ≈
Imperviousness ≈ %
Impervious Area ≈

Notes:

Drainage Area Land Use:
- % Residential
  - % SFH (< 1 ac lots)
  - % SFH (> 1 ac lots)
  - % Townhouses
  - % Multi-Family
- % Commercial
- % Institutional
- % Industrial
- % Transport-Related
- % Park
- % Undeveloped
- % Other:

Existing Site Conditions

Existing Stormwater BMP: ☐ Yes ☒ No ☐ Possible
If Yes, Describe:

Describe Existing Site Conditions, Including Existing Drainage and Conveyance Patterns:

WELL VEGETATED

Unique Site ID: 5

Considerations for Potential Retrofit Opportunity

Available Surface Area:

Paved:

Landscape:

Available Depth / Elevation Change:

Areas of Concern:

NA

☐ Dumpsters ☐ Grease ☐ Chemicals ☐ Material Storage ☐ Erosion ☐ Pet waste ☐ Geese/Wildlife

Describe Obvious, Potential Retrofit Opportunity:

DIVERT ROAD RUNOFF TO LEAST ESTABLISHED (NEWLY PLANTED) LANDSCAPE AREA.

☒ Possible Demonstration / Education Project

Site Constraints

Adjacent Land Use:

☐ Residential ☒ Commercial ☐ Institutional
☐ Industrial ☐ Transport-Related ☒ Park
☐ Undeveloped ☐ Other:_____

Possible Conflicts Due to Adjacent Land Use? ☐ Yes ☒ No
If Yes, Describe:_____

Access:

☐ No Access Constraints
Access Constrained due to
☐ Slope ☐ Space
☐ Utilities ☒ Tree Impacts
☐ Structures ☐ Property Ownership
☐ Other:_____

Conflicts with Existing Utilities:

☐ None
☐ Unknown

Yes	Possible	
☐	☒	Sewer
☐	☒	Water
☐	☒	Gas
☐	☒	Cable
☐	☒	Electric
☐	☒	Electric to Streetlights
☐		Overhead Wires
☐	☐	Other:_____

Potential Ecological Conflict:

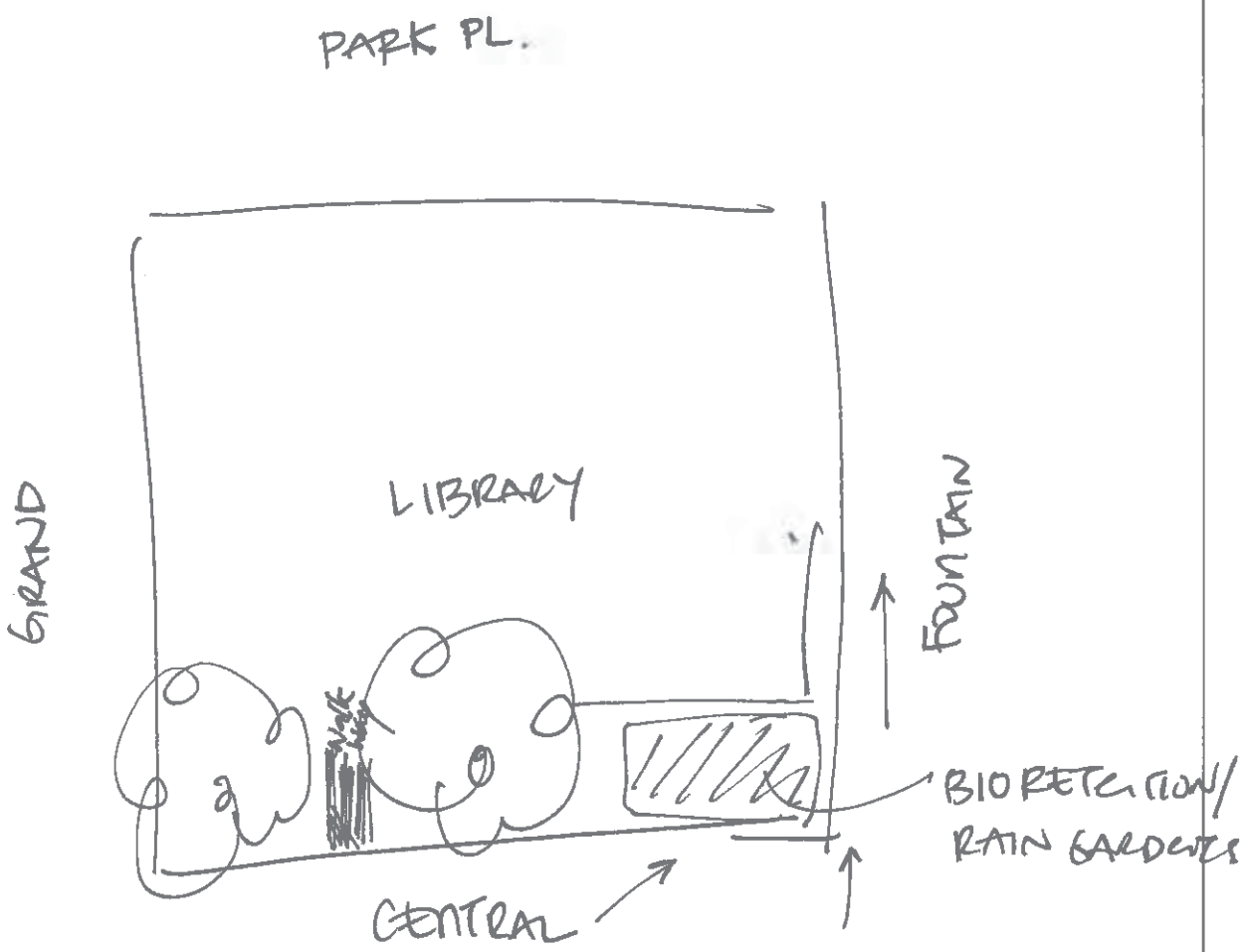
Existing mature trees:	☒ Yes	☐ No
Existing wetlands:	☐ Yes	☒ No
Existing stream or natural drainage:	☐ Yes	☒ No
Evidence of shallow bedrock:	☐ Yes	☒ No
Existing floodplain:	☐ Yes	☒ No

Other:_____

Site Candidate for Further Investigation: ☒ **Yes** ☐ **No** ☐ **Maybe**
If no, site candidate for Other Restoration Project(s): ☐ **Yes** ☐ **No** ☐ **Maybe**
If yes, type(s):_____

Unique Site ID:_____

Notes or Sketch



Unique Site ID: 5

Unique Site ID: 6		**Watershed:** ASB3	
City: PG		**Subwatershed:**	
Date: 5/31/16	**Assessed By:** DMC/RLC	**Camera ID:**	**Pictures:**

Site Description

Name: OUTLETS
Address or Nearest Intersection:
Parcel Number:
Comments:

Ownership: ☐ Public ☒ Private ☐ Unknown
If Public, Government Jurisdiction: ☐ Local ☐ State ☐ DOT ☐ Other:

Potential Retrofit Location:

Storage
- ☐ Existing Pond
- ☐ Below Outfall
- ☐ In Transport ROW
- ☐ Other:
- ☐ Above Roadway Crossing
- ☐ In Conveyance System
- ☐ Large Parking Lot

On-Site
- ☐ Hotspot Operation
- ☒ Small Parking Lot
- ☐ Individual Street
- ☒ Individual Rooftop
- ☒ ~~Small~~ Impervious Area
- ☐ Landscape / Hardscape
- ☐ Underground
- ☐ Other:

Drainage Area to Site

Drainage Area ≈
Imperviousness ≈ %
Impervious Area ≈

Notes:

Drainage Area Land Use:
- % Residential
  - % SFH (< 1 ac lots)
  - % SFH (> 1 ac lots)
  - % Townhouses
  - % Multi-Family
- % Commercial
- % Institutional
- % Industrial
- % Transport-Related
- % Park
- % Undeveloped
- % Other:

Existing Site Conditions

Existing Stormwater BMP: ☐ Yes ☒ No ☐ Possible
If Yes, Describe:

Describe Existing Site Conditions, Including Existing Drainage and Conveyance Patterns:

~100% SITE IMPERVIOUSNESS
~95% ROOFTOP w/ MAJORITY INTERNAL PLUMBED ROOF DRAINS.

Unique Site ID:

Considerations for Potential Retrofit Opportunity

Available Surface Area:

Paved:

Landscape:

Available Depth / Elevation Change:

Areas of Concern:

☒ Dumpsters ☒ Grease ☐ Chemicals ☐ Material Storage ☐ Erosion ☐ Pet waste ☐ Geese/Wildlife

Describe Obvious, Potential Retrofit Opportunity:

→ IMPROVE GREASE MANAGEMENT / CONTAINMENT
→ DISCONNECT DNSPTS TO CISTERN
→ GREEN ROOF? IN FUTURE CONSTRUCTION.

☐ Possible Demonstration / Education Project (N) CISTERNS REPLICATING STACKS TO MIMIC HISTORICAL SITE CHARACTER.

Site Constraints

Adjacent Land Use:

☐ Residential ☒ Commercial ☒ Institutional
☐ Industrial ☐ Transport-Related ☐ Park
☐ Undeveloped ☐ Other:_____

Possible Conflicts Due to Adjacent Land Use? ☐ Yes ☐ No
If Yes, Describe:_____

Access:

☒ No Access Constraints
Access Constrained due to
☐ Slope ☐ Space
☐ Utilities ☐ Tree Impacts
☐ Structures ☐ Property Ownership
☐ Other:_____

Conflicts with Existing Utilities:

☐ None
☐ Unknown

Yes	Possible	
☐	☒	Sewer
☐	☒	Water
☐	☒	Gas
☐	☒	Cable
☐	☒	Electric
☐	☒	Electric to Streetlights
☐	☒	Overhead Wires
☐	☐	Other:_____

Potential Ecological Conflict:

Existing mature trees:	☐ Yes	☒ No
Existing wetlands:	☐ Yes	☒ No
Existing stream or natural drainage:	☐ Yes	☒ No
Evidence of shallow bedrock:	☐ Yes	☒ No
Existing floodplain:	☐ Yes	☒ No

Other:_____

Site Candidate for Further Investigation: ☐ Yes ☒ No ☐ Maybe
If no, site candidate for Other Restoration Project(s): ☐ Yes ☐ No ☐ Maybe
If yes, type(s):_____

Unique Site ID:_____

Notes or Sketch

see sketch on field map

Unique Site ID: 6

Unique Site ID: 7		**Watershed:**	
City:		**Subwatershed:**	
Date: 5/31/16	**Assessed By:** ~~BMC~~ RLC	**Camera ID:**	**Pictures:**

Site Description

Name: OUTLET PARKING
Address or Nearest Intersection:
Parcel Number:
Comments:

Ownership: ☐ Public ☒ Private ☐ Unknown
If Public, Government Jurisdiction: ☐ Local ☐ State ☐ DOT ☐ Other:

Potential Retrofit Location:

Storage
- ☐ Existing Pond
- ☐ Below Outfall
- ☐ In Transport ROW
- ☐ Other:
- ☐ Above Roadway Crossing
- ☐ In Conveyance System
- ☐ Large Parking Lot

On-Site
- ☐ Hotspot Operation
- ☒ ~~Small~~ Parking Lot
- ☐ Individual Street
- ☐ Individual Rooftop
- ☐ Small Impervious Area
- ☐ Landscape / Hardscape
- ☐ Underground
- ☐ Other:

Drainage Area to Site

Drainage Area ≈ _____
Imperviousness ≈ _____%
Impervious Area ≈ _____

Notes:

Drainage Area Land Use:
- ___% Residential
  - ___% SFH (< 1 ac lots)
  - ___% SFH (> 1 ac lots)
  - ___% Townhouses
  - ___% Multi-Family
- ___% Commercial
- ___% Institutional
- ___% Industrial
- ___% Transport-Related
- ___% Park
- ___% Undeveloped
- ___% Other:

Existing Site Conditions

Existing Stormwater BMP: ☐ Yes ☒ No ☐ Possible
If Yes, Describe:

Describe Existing Site Conditions, Including Existing Drainage and Conveyance Patterns:

ASPHALT PARKING LOT, all draining to THREE CB.

Considerations for Potential Retrofit Opportunity

Available Surface Area:

Paved:

Landscape:

Available Depth / Elevation Change:

Areas of Concern:

☐ Dumpsters ☐ Grease ☐ Chemicals ☐ Material Storage ☐ Erosion ☐ Pet waste ☐ Geese/Wildlife

Describe Obvious, Potential Retrofit Opportunity:

→ P.P. PARKING STALLS
→ NARROW DRIVE AISLE + 4 PARKING STALLS.
→ INSTALL LID/BIO RETENTION W/ UNDERDRAIN IN CENTER OF CENTER PARKING AISLE

☐ Possible Demonstration / Education Project

Site Constraints

Adjacent Land Use:

☐ Residential ☐ Commercial ☐ Institutional
☐ Industrial ☐ Transport-Related ☐ Park
☐ Undeveloped ☐ Other: TO BE DEVELOPED? + WALLS.

Possible Conflicts Due to Adjacent Land Use? ☐ Yes ☒ No

If Yes, Describe:

Access:

☒ No Access Constraints

Access Constrained due to

☐ Slope ☐ Space
☐ Utilities ☐ Tree Impacts
☐ Structures ☐ Property Ownership
☐ Other:

Conflicts with Existing Utilities:

☐ None
☐ Unknown

Yes	Possible	
☐	☒	Sewer
☐	☒	Water
☐	☒	Gas
☐	☒	Cable
☐	☒	Electric
☐	☒	Electric to Streetlights
☐	☒	Overhead Wires
☐	☐	Other:

Potential Ecological Conflict:

Existing mature trees:	☒ Yes	☐ No
Existing wetlands:	☐ Yes	☒ No
Existing stream or natural drainage:	☐ Yes	☒ No
Evidence of shallow bedrock:	☐ Yes	☒ No
Existing floodplain:	☐ Yes	☒ No

Other:

Site Candidate for Further Investigation: ☐ Yes ☒ No ☐ Maybe

If no, site candidate for Other Restoration Project(s): ☐ Yes ☐ No ☐ Maybe

If yes, type(s):

Unique Site ID:

Notes or Sketch

See notes on field map

Unique Site ID: 7

Unique Site ID: 8		**Watershed:**	
City:		**Subwatershed:**	
Date: 5/31/16	**Assessed By:** BMC/RLC	**Camera ID:**	**Pictures:**

Site Description

Name: NOB Hill
Address or Nearest Intersection:
Parcel Number:
Comments:

Ownership: ☐ Public ☒ Private ☐ Unknown
If Public, Government Jurisdiction: ☐ Local ☐ State ☐ DOT ☐ Other:

Potential Retrofit Location:

Storage
- ☐ Existing Pond
- ☐ Below Outfall
- ☐ In Transport ROW
- ☐ Other:
- ☐ Above Roadway Crossing
- ☐ In Conveyance System
- ☐ Large Parking Lot

On-Site
- ☐ Hotspot Operation
- ☒ ~~Small~~ Parking Lot
- ☐ Individual Street
- ☐ Individual Rooftop
- ☐ Small Impervious Area
- ☒ Landscape / Hardscape
- ☐ Underground
- ☐ Other:

Drainage Area to Site

Drainage Area ≈
Imperviousness ≈ %
Impervious Area ≈

Notes:

Drainage Area Land Use:
- % Residential
  - % SFH (< 1 ac lots)
  - % SFH (> 1 ac lots)
  - % Townhouses
  - % Multi-Family
- % Commercial
- % Institutional
- % Industrial
- % Transport-Related
- % Park
- % Undeveloped
- % Other:

Existing Site Conditions

Existing Stormwater BMP: ☐ Yes ☒ No ☐ Possible
If Yes, Describe:

Describe Existing Site Conditions, Including Existing Drainage and Conveyance Patterns:

LARGE PARKING LOT → 1-WAY DRIVE AISLES WITH RETAINING WALL
(E) CATCH BASIN LOCATION NOT SUITABLE FOR LID RETROFIT.

* NEEDS TRASH COLLECTION. AROUND ENTIRE SITE.

Considerations for Potential Retrofit Opportunity

Available Surface Area:

Paved:

Landscape:

Available Depth / Elevation Change:

Areas of Concern:

☒ Dumpsters ☐ Grease ☐ Chemicals ☐ Material Storage ☐ Erosion ☐ Pet waste ☐ Geese/Wildlife

Describe Obvious, Potential Retrofit Opportunity:

- PERM. PAVEMENT IN PARKING STALLS
- RETROFIT LANDSCAPE ISLANDS TO LID.
- NATIVE PLANTING ON EXPOSED SLOPE TO CONTROL EROSION.

☐ Possible Demonstration / Education Project

Site Constraints

Adjacent Land Use:

☐ Residential ☒ Commercial ☒ Institutional
☐ Industrial ☐ Transport-Related ☐ Park
☐ Undeveloped ☐ Other: AQUARIUM

Possible Conflicts Due to Adjacent Land Use? ☐ Yes ☒ No
If Yes, Describe:

Access:

☐ No Access Constraints
Access Constrained due to
☐ Slope ☐ Space
☐ Utilities ☐ Tree Impacts
☐ Structures ☐ Property Ownership
☐ Other:

Conflicts with Existing Utilities:

☐ None
☐ Unknown

Yes	Possible	
☐	☒	Sewer
☐	☒	Water
☐	☒	Gas
☐	☒	Cable
☐	☒	Electric
☐	☒	Electric to Streetlights
☐		Overhead Wires
☐	☐	Other:

Potential Ecological Conflict:

Existing mature trees:	☒ Yes	☐ No
Existing wetlands:	☐ Yes	☒ No
Existing stream or natural drainage:	☐ Yes	☒ No
Evidence of shallow bedrock:	☐ Yes	☒ No
Existing floodplain:	☐ Yes	☒ No

Other:

Site Candidate for Further Investigation: ☐ Yes ☐ No ☒ Maybe
If no, site candidate for Other Restoration Project(s): ☐ Yes ☐ No ☐ Maybe
If yes, type(s):

Unique Site ID:

Notes or Sketch

See notes on field map.

Unique Site ID: 8

Unique Site ID: 9		**Watershed:**	
City:		**Subwatershed:**	
Date: 6/6/16	**Assessed By:**	**Camera ID:**	**Pictures:**

Site Description

Name: MOBILE HOME PARK
Address or Nearest Intersection:
Parcel Number:
Comments:

Ownership: ☐ Public ☒ Private ☐ Unknown
If Public, Government Jurisdiction: ☐ Local ☐ State ☐ DOT ☐ Other:

Potential Retrofit Location:

Storage
- ☐ Existing Pond
- ☐ Below Outfall
- ☐ In Transport ROW
- ☐ Other:
- ☐ Above Roadway Crossing
- ☐ In Conveyance System
- ☐ Large Parking Lot

On-Site
- ☐ Hotspot Operation
- ☐ Small Parking Lot
- ☐ Individual Street
- ☐ Individual Rooftop
- ☐ Small Impervious Area
- ☐ Landscape / Hardscape
- ☐ Underground
- ☐ Other:

Drainage Area to Site

Drainage Area ≈ _____
Imperviousness ≈ _____%
Impervious Area ≈ _____

Notes:

Drainage Area Land Use:
- ___% Residential
  - ___% SFH (< 1 ac lots)
  - ___% SFH (> 1 ac lots)
  - ___% Townhouses
  - ___% Multi-Family
- ___% Commercial
- ___% Institutional
- ___% Industrial
- ___% Transport-Related
- ___% Park
- ___% Undeveloped
- ___% Other:

Existing Site Conditions

Existing Stormwater BMP: ☐ Yes ☒ No ☐ Possible
If Yes, Describe:

Describe Existing Site Conditions, Including Existing Drainage and Conveyance Patterns:

→ ASPHALT ROADWAYS TO CATCH BASINS.

→ PRIVATE ? LIMITED ACCESS → PUBLIC ACCESS DISCOURAGED

Considerations for Potential Retrofit Opportunity

Available Surface Area:

Paved:

Landscape:

Available Depth / Elevation Change:

Areas of Concern:

☐ Dumpsters ☐ Grease ☐ Chemicals ☐ Material Storage ☐ Erosion ☐ Pet waste ☐ Geese/Wildlife

Describe Obvious, Potential Retrofit Opportunity:

PERMEABLE PAVEMENT
BIORETENTION/CONVERSION IN (N)/(E) LANDSCAPE
BULBS

☐ Possible Demonstration / Education Project

Site Constraints

Adjacent Land Use:

☒ Residential ☐ Commercial ☐ Institutional
☐ Industrial ☐ Transport-Related ☒ Park – GOLF Course
☐ Undeveloped ☐ Other:

Possible Conflicts Due to Adjacent Land Use? ☐ Yes ☒ No
If Yes, Describe:

Access:

☒ No Access Constraints
Access Constrained due to
☐ Slope ☐ Space
☐ Utilities ☐ Tree Impacts
☐ Structures ☒ Property Ownership
☐ Other:

Conflicts with Existing Utilities:

☐ None
☒ Unknown

Yes	Possible	
☐	☒	Sewer
☐	☒	Water
☐	☒	Gas
☐	☒	Cable
☐	☒	Electric
☐	☒	Electric to Streetlights
☐		Overhead Wires
☐	☐	Other:

Potential Ecological Conflict:

Existing mature trees:	☒ Yes	☐ No
Existing wetlands:	☐ Yes	☒ No
Existing stream or natural drainage:	☐ Yes	☒ No
Evidence of shallow bedrock:	☐ Yes	☒ No
Existing floodplain:	☐ Yes	☒ No

Other:

Site Candidate for Further Investigation: ☐ Yes ☐ No ☒ Maybe
If no, site candidate for Other Restoration Project(s): ☐ Yes ☐ No ☐ Maybe
If yes, type(s):

Unique Site ID:

Notes or Sketch

see notes on field map

Unique Site ID: 9

Unique Site ID: 10/11		**Watershed:**	
City:		**Subwatershed:**	
Date: 6/16	**Assessed By:**	**Camera ID:**	**Pictures:**

Site Description

Name: REC TRAIL (WEST) → LOVERS PT TO SIREN ST.
Address or Nearest Intersection:
Parcel Number:
Comments:

Ownership: ☒ Public ☐ Private ☐ Unknown
If Public, Government Jurisdiction: ☒ Local ☐ State ☐ DOT ☐ Other: ROW.

Potential Retrofit Location:

Storage
- ☐ Existing Pond
- ☐ Below Outfall
- ☐ In Transport ROW
- ☐ Other:
- ☐ Above Roadway Crossing
- ☐ In Conveyance System
- ☐ Large Parking Lot

On-Site
- ☐ Hotspot Operation
- ☐ Small Parking Lot
- ☐ Individual Street
- ☐ Individual Rooftop
- ☐ Small Impervious Area
- ☐ Landscape / Hardscape
- ☐ Underground
- ☐ Other:

Drainage Area to Site

Drainage Area ≈
Imperviousness ≈ %
Impervious Area ≈

Notes:

Drainage Area Land Use:
- ___% Residential
  - ___% SFH (< 1 ac lots)
  - ___% SFH (> 1 ac lots)
  - ___% Townhouses
  - ___% Multi-Family
- ___% Commercial
- ___% Institutional
- ___% Industrial
- ___% Transport-Related
- ___% Park
- ___% Undeveloped
- ___% Other:

Existing Site Conditions

Existing Stormwater BMP: ☐ Yes ☐ No ☒ Possible
If Yes, Describe:

(E) CURB CUTS NOT MAINTAINED. B/W SEA PALM AND SIREN.

Describe Existing Site Conditions, Including Existing Drainage and Conveyance Patterns:

→ OCEANVIEW BLVD RUNOFF TO CATCHBASINS DISCHARGING TO S.D. TO ASBS.

→ LANDSCAPE AREAS (ICE PLANT → PERKINS PARK @ SEA PALM) SELF TREATING.

→ UNMAINTAINED CURB CUTS (see above)

Considerations for Potential Retrofit Opportunity

Available Surface Area:

Paved:

Landscape:

Available Depth / Elevation Change:

Areas of Concern:

☐ Dumpsters ☐ Grease ☐ Chemicals ☐ Material Storage ☐ Erosion ☐ Pet waste ☐ Geese/Wildlife

Describe Obvious, Potential Retrofit Opportunity:

→ PERMEABLE PAVEMENT IN PARKING AISLES

→ CURB CUTS TO RETROFITED LANDSCAPE W/ RAIN GARDENS FOR SW TREATMENT → still have ice plant but in shallower depressions?

→ ROCK protection @ steep slopes.

☒ Possible Demonstration / Education Project

Site Constraints

Adjacent Land Use:

☒ Residential ☐ Commercial ☐ Institutional
☐ Industrial ☐ Transport-Related ☒ Park / trail
☐ Undeveloped ☐ Other:_____

Possible Conflicts Due to Adjacent Land Use? ☐ Yes ☐ No
If Yes, Describe:_____

Access:

☒ No Access Constraints
Access Constrained due to
☐ Slope ☐ Space
☐ Utilities ☐ Tree Impacts
☐ Structures ☐ Property Ownership
☐ Other:_____

Conflicts with Existing Utilities:

☐ None
☐ Unknown

Yes	Possible	
☐	☒	Sewer
☐	☒	Water
☐	☒	Gas
☐	☒	Cable
☐	☒	Electric
☐	☐	Electric to Streetlights
☐		Overhead Wires
☐	☐	Other:_____

Potential Ecological Conflict:

Existing mature trees: * Avoidable	☐ Yes	☒ No
Existing wetlands:	☐ Yes	☒ No
Existing stream or natural drainage:	☐ Yes	☒ No
Evidence of shallow bedrock:	☐ Yes	☒ No
Existing floodplain:	☐ Yes	☒ No

Other:_____

Site Candidate for Further Investigation: ☒ Yes ☐ No ☐ Maybe
If no, site candidate for Other Restoration Project(s): ☐ Yes ☐ No ☐ Maybe
If yes, type(s):_____

Unique Site ID:_____

Notes or Sketch

See notes on field map.

Unique Site ID: 10/11

Unique Site ID: 12/15		**Watershed:**	
City:		**Subwatershed:**	
Date: 6/6/16	**Assessed By:**	**Camera ID:**	**Pictures:**

Site Description

Name: APARTMENTS @ BRIGGS.
Address or Nearest Intersection:
Parcel Number:
Comments:

Ownership: ☐ Public ☒ Private ☐ Unknown
If Public, Government Jurisdiction: ☐ Local ☐ State ☐ DOT ☐ Other:

Potential Retrofit Location:

Storage
- ☐ Existing Pond
- ☐ Below Outfall
- ☐ In Transport ROW
- ☐ Other:
- ☐ Above Roadway Crossing
- ☐ In Conveyance System
- ☐ Large Parking Lot

On-Site
- ☐ Hotspot Operation
- ☐ Small Parking Lot
- ☐ Individual Street
- ☐ Individual Rooftop
- ☐ Small Impervious Area
- ☐ Landscape / Hardscape
- ☐ Underground
- ☐ Other:

Drainage Area to Site

Drainage Area ≈
Imperviousness ≈ %
Impervious Area ≈

Notes:

Drainage Area Land Use:
- ___% Residential
  - ___% SFH (< 1 ac lots)
  - ___% SFH (> 1 ac lots)
  - ___% Townhouses
  - ___% Multi-Family
- ___% Commercial
- ___% Institutional
- ___% Industrial
- ___% Transport-Related
- ___% Park
- ___% Undeveloped
- ___% Other:

Existing Site Conditions

Existing Stormwater BMP: ☐ Yes ☒ No ☐ Possible
If Yes, Describe:

Describe Existing Site Conditions, Including Existing Drainage and Conveyance Patterns:

→ SPRAY IRRIGATION. → SANDY SOIL

→ DRAIN INLETS IN LANDSCAPE AREAS ~ 3" BELOW GRADE, COULD RAISE BUT WOULD NEED TO RETROFIT ADJACENT PATIOS ? ACCESS GATES TO PREVENT FLOODING ? MAINTAIN PATHWAYS

Considerations for Potential Retrofit Opportunity

Available Surface Area:

Paved:

Landscape:

Available Depth / Elevation Change:

Areas of Concern:

☐ Dumpsters ☐ Grease ☐ Chemicals ☐ Material Storage ☐ Erosion ☐ Pet waste ☐ Geese/Wildlife

Describe Obvious, Potential Retrofit Opportunity:

→ CONVERSION OF LANDSCAPE/TURF AREAS TO BIORETENTION

→ PERMEABLE PAVEMENT PARKING + DRIVE AISLES

☒ Possible Demonstration / Education Project → ENTRANCE COURTYARD TO DEMO LID + PERMEABLE PAVEMENT → TURF REPLACEMENT

Site Constraints

Adjacent Land Use:

☒ Residential ☐ Commercial ☐ Institutional
☐ Industrial ☐ Transport-Related ☒ Park
☐ Undeveloped ☐ Other: SENIOR CENTER.

Possible Conflicts Due to Adjacent Land Use? ☐ Yes ☒ No
If Yes, Describe:

Access:

☒ No Access Constraints
Access Constrained due to
☐ Slope ☐ Space
☐ Utilities ☐ Tree Impacts
☐ Structures ☐ Property Ownership
☐ Other:

Conflicts with Existing Utilities:

☐ None
☐ Unknown

Yes	Possible	
☐	☒	Sewer
☐	☒	Water
☐	☒	Gas
☐	☒	Cable
☐	☒	Electric
☐	☐	Electric to Streetlights
☐		Overhead Wires
☐	☐	Other:

Potential Ecological Conflict:

Existing mature trees:	☒ Yes	☐ No
Existing wetlands:	☐ Yes	☒ No
Existing stream or natural drainage:	☐ Yes	☒ No
Evidence of shallow bedrock:	☐ Yes	☒ No
Existing floodplain:	☐ Yes	☒ No

Other:

Site Candidate for Further Investigation: ☒ Yes ☐ No ☐ Maybe
If no, site candidate for Other Restoration Project(s): ☐ Yes ☐ No ☐ Maybe
If yes, type(s):

Unique Site ID:

Notes or Sketch

see notes on field map

Unique Site ID: 12/15

☐ ADD pcs. High/Med/Low
Ability of site to
address ASBS exceedances

Unique Site ID: 13		**Watershed:** ASBS	
City: PG		**Subwatershed:**	
Date: 5/23/16	**Assessed By:** BMC/RC	**Camera ID:**	**Pictures:**

Site Description

Name: LOVER'S POINT PARKING
Address or Nearest Intersection:
Parcel Number:
Comments:

Ownership: ☒ Public ☐ Private ☐ Unknown
If Public, Government Jurisdiction: ☒ Local ☐ State ☐ DOT ☐ Other:

Potential Retrofit Location:

Storage
- ☐ Existing Pond
- ☐ Below Outfall
- ☐ In Transport ROW
- ☐ Other:
- ☐ Above Roadway Crossing
- ☐ In Conveyance System
- ☐ Large Parking Lot

On-Site
- ☐ Hotspot Operation
- ☐ Small Parking Lot
- ☐ Individual Street
- ☐ Individual Rooftop
- ☐ Small Impervious Area
- ☐ Landscape / Hardscape
- ☐ Underground
- ☐ Other:

Drainage Area to Site

Drainage Area ≈
Imperviousness ≈ %
Impervious Area ≈

Notes:

Drainage Area Land Use:

- ___% Residential
  - ___% SFH (< 1 ac lots)
  - ___% SFH (> 1 ac lots)
  - ___% Townhouses
  - ___% Multi-Family
- ___% Commercial
- ___% Institutional
- ___% Industrial
- ___% Transport-Related
- 95% Park
- ___% Undeveloped
- 5% Other: Landscaping

Existing Site Conditions

Existing Stormwater BMP: ☐ Yes ☐ No ☐ Possible
If Yes, Describe:

CDS on upstream SD on Ocean View Blvd.

Describe Existing Site Conditions, Including Existing Drainage and Conveyance Patterns:

ASPHALT PARKING LOT. w/ Landscape medians
medium/poor condition

Unique Site ID: 13

Considerations for Potential Retrofit Opportunity

Available Surface Area:

from GIS

Paved:

Landscape:

Available Depth / Elevation Change:

from GIS

Areas of Concern:

protect-in-place (E) walls.

☐ Dumpsters ☐ Grease ☐ Chemicals ☐ Material Storage ☐ Erosion ☐ Pet waste ☐ Geese/Wildlife

Describe Obvious, Potential Retrofit Opportunity:

see site plan.

☐ Possible Demonstration / Education Project

Site Constraints

Adjacent Land Use:

☒ Residential ☐ Commercial ☐ Institutional
☐ Industrial ☐ Transport-Related ☒ Park
☐ Undeveloped ☐ Other:_____

Possible Conflicts Due to Adjacent Land Use? ☐ Yes ☐ No
If Yes, Describe: Low lying veg. to prevent blocking views

Access:

☐ No Access Constraints
Access Constrained due to
☐ Slope ☐ Space
☒ Utilities ☒ Tree Impacts
☐ Structures ☐ Property Ownership
☐ Other:_____
→ WORKABLE

Conflicts with Existing Utilities:

☐ None
☐ Unknown

Yes	Possible	
☐	☒	Sewer
☐	☒	Water
☐	☐ ?	Gas
☐	☐ ?	Cable
☐	☒	Electric
☐	☒	Electric to Streetlights
☐		Overhead Wires
☐	☐	Other:_____

Potential Ecological Conflict:

Existing mature trees:	☒ Yes	☐ No
Existing wetlands:	☐ Yes	☒ No
Existing stream or natural drainage:	☐ Yes	☒ No
Evidence of shallow bedrock:	☐ Yes	☒ No
Existing floodplain:	☐ Yes	☒ No

→ But can design around

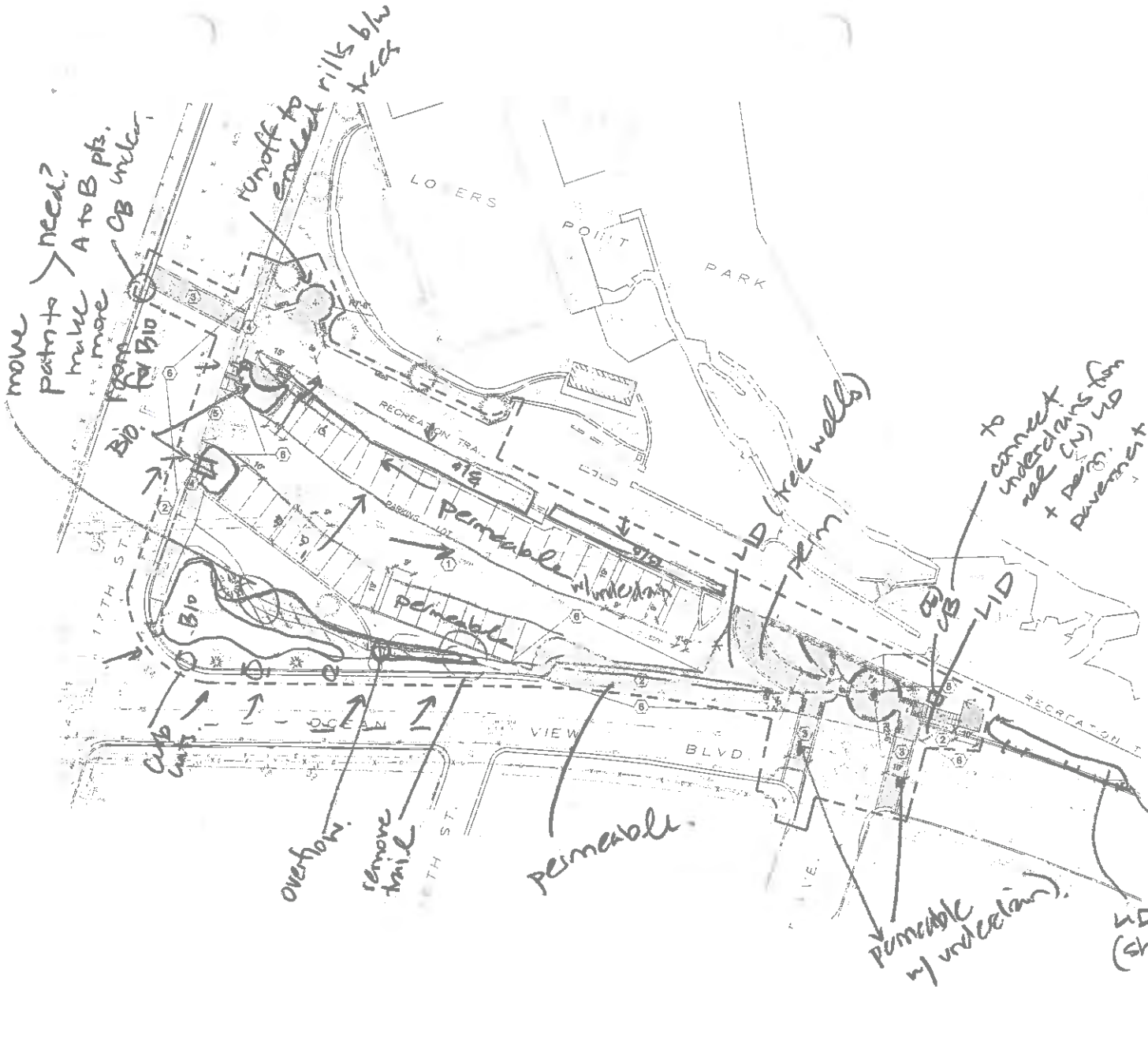
Other:_____

Site Candidate for Further Investigation: ☒ Yes ☐ No ☐ Maybe
If no, site candidate for Other Restoration Project(s): ☐ Yes ☐ No ☐ Maybe
If yes, type(s):_____

Unique Site ID:_____

Notes or Sketch
see attached

Unique Site ID: 13



CONSTRUCTION PLAN LEGEND

- Limit of Work Line
- Concrete or AC Paving: See Grading Plan
- Pervious Pavers, Type 1: Pedestrian load with metal edge restraint, See Detail 1/L-5.1
- Decking, including deck staircase: See Detail
- Rock Seal Wall: See Detail 4/L-5.1
- Retaining Wall: See Detail 3/L-5.1
- Split Rail Fence: See Detail 2/L-5.1
- Decorative Guardrail: See Detail 6/L-5.1
- CB Catch Basin: See Grading Plan
- Metal Edging: See Detail 1/L-5.1
- Planting Area: See Planting Plan
- Meet and match existing grade: See Grading Plan
- Bicycle Rack, Typ of 2: See Detail 6/L-5.1
- Directional or Educational Signage: See Detail 5/L-5.1

CONSTRUCTION PLAN REFERENCE NOTES

1. Parking lot to receive new slurry seal and striping. See Grading Plan.
2. New Parallel Parking Striping, See Grading Plan.
3. Pedestrian Crosswalks: Pervious paving for vehicular traffic with concrete band edging. See Grading Plan.
4. New Sidewalk. See Grading Plan.
5. New Standard Driveway, See Grading Plan.
6. New Curb and Gutter. See Grading Plan.
7. New Drain Pipe. See Grading Plan.
8. Statue on Concrete Base: Design to be determined. Statue estimated to be 3' Dia. at the base and 6' Max height. To commemorate a historical figure or an element in nature. Material to be bronze or similar. To be sitting on a concrete base. design to be determined, reinforcement per Structural Engineer.

CONSTRUCTION PLAN GENERAL NOTES

1. Walking surfaces shall comply with CBC 1124B Ground and Floor Surfaces. Finish shall be non-slip, see Grading Plan.
2. Curb ramps, including detectable warning surfaces, shall be in compliance with CBC 1127B.5 Curb Ramps, see Grading Plan.
3. Ramps, including handrails, shall be in compliance with CBC 1133B.5 Ramps, See Grading Plan.
4. Steps, including handrails, shall be in compliance with CBC 1133B.4 Stairways.
5. Accessible parking stalls shall be in compliance with CBC 1129B Accessible Parking Required, See Grading Plan.
6. All signs shall comply with Title 24 and CBC Section 1117B.5 thru 1117B.5.7, see Grading Plan.
7. See Electrical and Lighting Plan.

20' 0 20' 40'
1" = 20'

OONA JOHNSEN
LANDSCAPE ARCHITECTURE
527 Forest Avenue, Suite B
Pacific Grove, CA 93950
PH 831 916 6838
oona@OJLA.com

04-30-18

CONSULTANTS:

Civil Engineer:

Neill Engineers Corp.
P.O. Box L.L. - Mission & 5th
Carmel-by-the-Sea, CA 93921
phone: (831) 624-2100
info@neillcorp.com

Electrical Engineer:

Aurum Consulting Engineers
60 Garden Court, Ste 210
Monterey, CA 93940
Phone: (831) 649-5300
info@acenb.com

REVISION:	DATE:

PROJECT NAME:

REC TRAIL ACCESSIBILITY IMPROVEMENTS

OWNER:

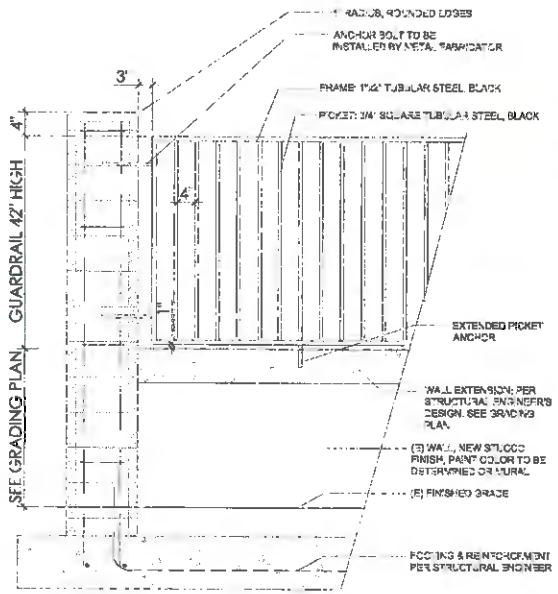
ISSUANCE:

DATE:	April 20, 2016
DRAWN BY:	OJ
CHECKED BY:	OJ
PROJECT #:	7415

SHEET NAME & NUMBER:

Construction & Layout Plan

L-5.0



7 DECORATIVE GUARDRAIL
NTS

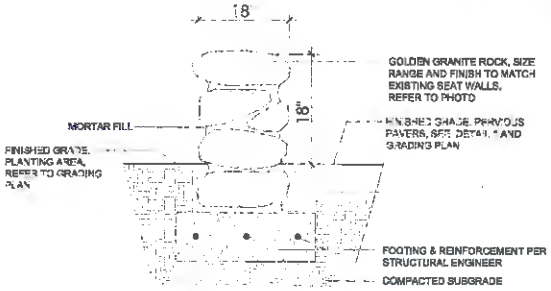
NOTES:
1. TO MATCH EXISTING SIGNAGE TYPE ON SITE. REFER TO IMAGES.

5 DIRECTIONAL & EDUCATIONAL SIGNAGE
NTS

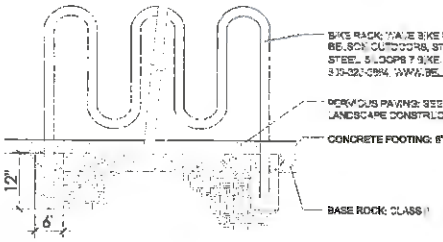
NOTES:
1. TO MATCH EXISTING SPLIT RAIL FENCE ON SITE, REFER TO IMAGE.

2 SPLIT RAIL FENCE
NTS

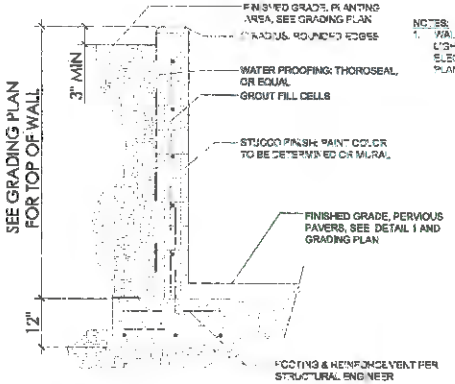
NOTES:
1. TO MATCH EXISTING GOLDEN GRANITE SEAT WALLS, REFER TO IMAGE.
2. WALL TO RECEIVE LIGHTING, SEE ELECTRICAL/LIGHTING PLANS.



4 ROCK SEAT WALL
NTS

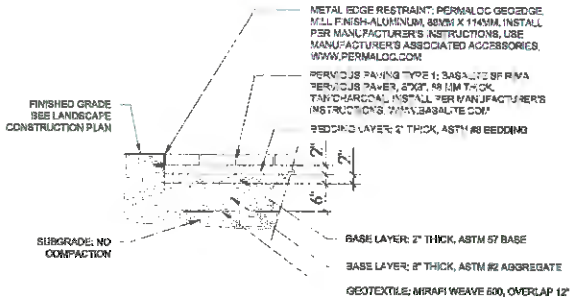


6 BICYCLE RACK
NTS



NOTES:
1. WALL TO RECEIVE LIGHTING, SEE ELECTRICAL/LIGHTING PLANS.

3 RETAINING WALL
NTS



1 PERVIOUS PAVING WITH METAL EDGE RESTRAINT
NTS

OONA JOHNSEN
LANDSCAPE ARCHITECTURE
257 Forest Avenue, Suite 6
Pacific Grove, CA 93950
PH: 831 655 [illegible]
oona@OJLA.com

CONSULTANTS:

Civil Engineer:

Neff Engineers Corp.
P.O. Box LL - Mission & 9th
Carmel-by-the-Sea, CA 93921
phone: (831) 624-2100
info@neffcorp.com

Structural Engineer:

Aulum Consulting Engineers
50 Garden Court, Ste 210
Monterey, CA 93940
Phone: (831) 649-3300
info@aucons.com

PROJECT NAME:

REC TRAIL ACCESSIBILITY IMPROVEMENTS

Pacific Grove, CA

OWNER:

City of Pacific Grove
Ocean View Blvd. between 7th St. & Forest Ave.

ISSUANCE:

PLANNING - REVIEW

DATE: April 20, 2016
DRAWN BY: OJ
CHECKED BY: OJ
PROJECT #: 7413

SHEET NAME & NUMBER:

Landscape Construction Details

L-5.1

Unique Site ID: 14		**Watershed:** ASBS.	
City: PG		**Subwatershed:**	
Date: 5/23/16	**Assessed By:** BMC/RLC	**Camera ID:**	**Pictures:**

Site Description

Name: JONELL PARK
Address or Nearest Intersection:
Parcel Number:
Comments:

Ownership: ☒ Public ☐ Private ☐ Unknown
If Public, Government Jurisdiction: ☒ Local ☐ State ☐ DOT ☐ Other:

Potential Retrofit Location:

Storage
- ☐ Existing Pond
- ☐ Below Outfall
- ☐ In Transport ROW
- ☐ Other:
- ☐ Above Roadway Crossing
- ☐ In Conveyance System
- ☐ Large Parking Lot

On-Site
- ☐ Hotspot Operation
- ☐ Small Parking Lot
- ☐ Individual Street
- ☐ Individual Rooftop
- ☐ Small Impervious Area
- ☐ Landscape / Hardscape
- ☐ Underground
- ☐ Other:

Drainage Area to Site

Drainage Area ≈
Imperviousness ≈ %
Impervious Area ≈

Notes:

Drainage Area Land Use:
- ___% Residential
  - ___% SFH (< 1 ac lots)
  - ___% SFH (> 1 ac lots)
  - ___% Townhouses
  - ___% Multi-Family
- ___% Commercial
- ___% Institutional
- ___% Industrial
- ___% Transport-Related
- ___% Park
- ___% Undeveloped
- ___% Other:

Existing Site Conditions

Existing Stormwater BMP: ☐ Yes ☒ No ☐ Possible
If Yes, Describe:

Describe Existing Site Conditions, Including Existing Drainage and Conveyance Patterns:

IRRIGATED TURF, MATURE TREES
+ MULCH AREA

PERGOLA, COMMUNITY BUILDING

Considerations for Potential Retrofit Opportunity

Available Surface Area:

Paved:

Landscape: TURF

Available Depth / Elevation Change:

Areas of Concern:

NA

☐ Dumpsters ☐ Grease ☐ Chemicals ☐ Material Storage ☐ Erosion ☐ Pet waste ☐ Geese/Wildlife

Describe Obvious, Potential Retrofit Opportunity:

DIVERSION OF ROAD RUNOFF FOR INFILTRA

☒ Possible Demonstration / Education Project

Site Constraints

Adjacent Land Use:

☒ Residential ☐ Commercial ☒ Institutional
☐ Industrial ☐ Transport-Related ☒ Park
☐ Undeveloped ☐ Other: LIBRARY/MUSEUM.

Possible Conflicts Due to Adjacent Land Use? ☐ Yes ☐ No
If Yes, Describe: Farmers Market

Access:

☐ No Access Constraints
Access Constrained due to
☒ Slope ☐ Space
☒ Utilities ☒ Tree Impacts
☐ Structures ☐ Property Ownership
☐ Other:

Conflicts with Existing Utilities:

☐ None
☐ Unknown

Yes	Possible	
☐	☒	Sewer
☐	☒	Water
☐	☒	Gas
☐	☐	Cable
☐	☒	Electric
☐	☐	Electric to Streetlights
☐		Overhead Wires
☐	☐	Other:

Potential Ecological Conflict:

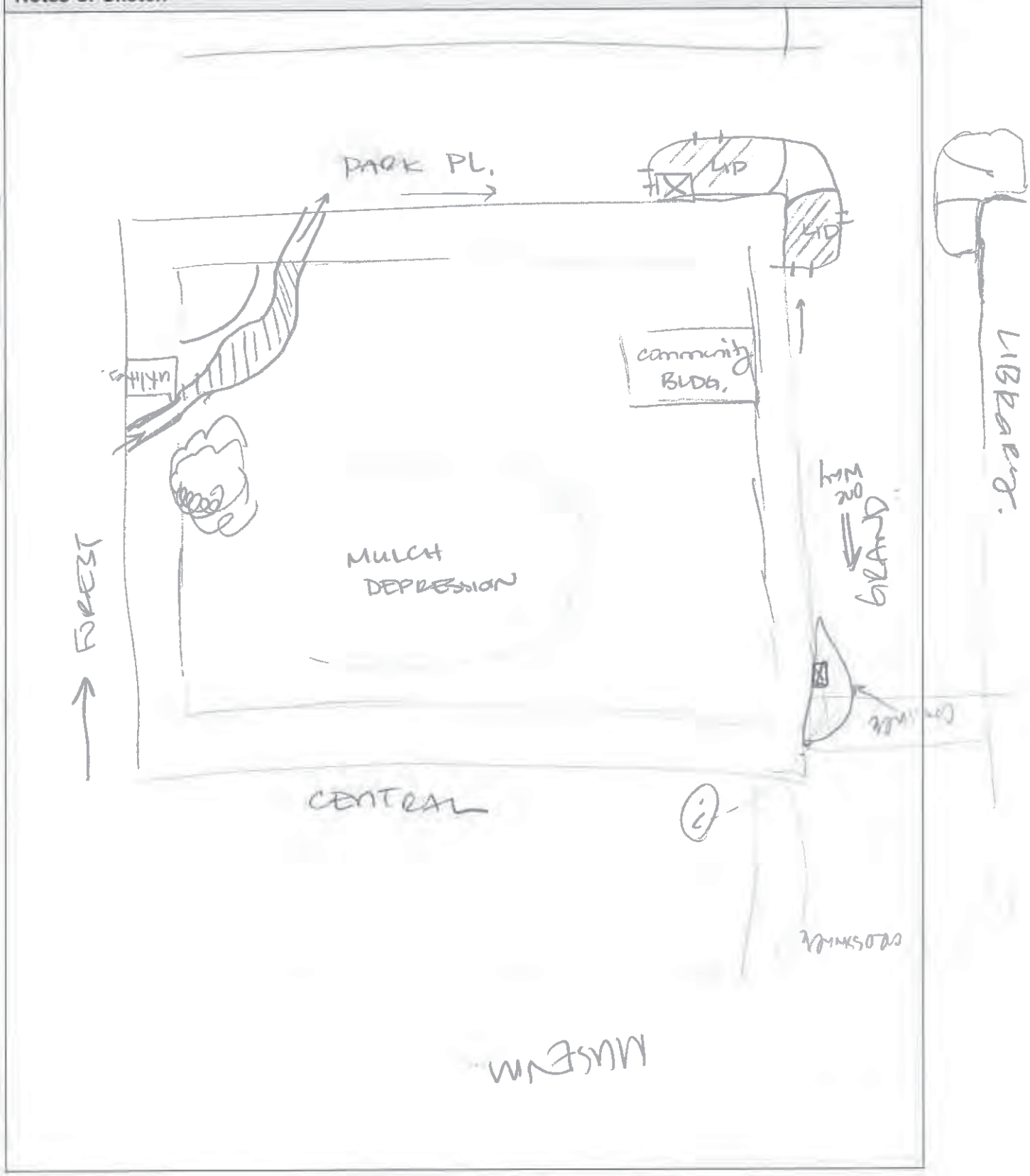
Existing mature trees:	☒ Yes	☐ No
Existing wetlands:	☐ Yes	☒ No
Existing stream or natural drainage:	☐ Yes	☒ No
Evidence of shallow bedrock:	☐ Yes	☒ No
Existing floodplain:	☐ Yes	☒ No

Other:

Site Candidate for Further Investigation: ☒ Yes ☐ No ☐ Maybe
If no, site candidate for Other Restoration Project(s): ☐ Yes ☐ No ☐ Maybe
If yes, type(s):

Unique Site ID:

Notes or Sketch



Unique Site ID: 14

Unique Site ID: 16		**Watershed:**	
City:		**Subwatershed:**	
Date: 6/6/16	**Assessed By:** BMC	**Camera ID:**	**Pictures:**

Site Description

Name: REC TRAIL (EAST)
Address or Nearest Intersection:
Parcel Number:
Comments:

Ownership: ☒ Public ☐ Private ☐ Unknown
If Public, Government Jurisdiction: ☒ Local ☐ State ☒ DOT ☐ Other:

Potential Retrofit Location:

Storage
- ☐ Existing Pond
- ☐ Below Outfall
- ☐ In Transport ROW
- ☐ Other:
- ☐ Above Roadway Crossing
- ☐ In Conveyance System
- ☐ Large Parking Lot

On-Site
- ☐ Hotspot Operation
- ☐ Small Parking Lot
- ☐ Individual Street
- ☐ Individual Rooftop
- ☐ Small Impervious Area
- ☐ Landscape / Hardscape
- ☐ Underground
- ☐ Other:

Drainage Area to Site

Drainage Area ≈
Imperviousness ≈ %
Impervious Area ≈

Notes:

Drainage Area Land Use:
- ___% Residential
  - ___% SFH (< 1 ac lots)
  - ___% SFH (> 1 ac lots)
  - ___% Townhouses
  - ___% Multi-Family
- ___% Commercial
- ___% Institutional
- ___% Industrial
- ___% Transport-Related
- ___% Park
- ___% Undeveloped
- ___% Other:

Existing Site Conditions

Existing Stormwater BMP: ☐ Yes ☒ No ☐ Possible
If Yes, Describe:

Describe Existing Site Conditions, Including Existing Drainage and Conveyance Patterns:

→ inlet @ fountain → retrofit/clear out ice plant to allow WQ. treatment. bfr entering Drain Inlet.

→ MRWPCA fountain ACCESS ROAD. → (E) AC replace w/ permeable pavement + slope runoff to (N) rain garden b/w access road and Ocean View Blvd.

→ inlet @ MRWPCA 15th fountain → retrofit/clear out ice plant allow WQ treatment bfr entering D.I. + STOP sediment from Entering ASBS.

MED. PRIORITY SITE

→ RPT. INLET @ 14th.

Unique Site ID: 16

Considerations for Potential Retrofit Opportunity

Available Surface Area:

Paved:

Landscape:

Available Depth / Elevation Change:

Areas of Concern:

☐ Dumpsters ☐ Grease ☐ Chemicals ☐ Material Storage ☐ Erosion ☐ Pet waste ☐ Geese/Wildlife

Describe Obvious, Potential Retrofit Opportunity:

→ see description of (E) conditions @ Mural @ Greenwood Park
→ Modify inlets + remove ivy plant → convert to rain garden, w/ native plants.
↳ WQ treatment to stop DG erosion.
↳ would capture portion of roadway runoff.

☐ Possible Demonstration / Education Project

Site Constraints

Adjacent Land Use:

☒ Residential ☐ Commercial ☐ Institutional
☐ Industrial ☐ Transport-Related ☒ Park
☐ Undeveloped ☐ Other:

Possible Conflicts Due to Adjacent Land Use? ☐ Yes ☐ No
If Yes, Describe:

Access:

☐ No Access Constraints
Access Constrained due to
☒ Slope ☒ Space
☒ Utilities ☒ Tree Impacts
☒ Structures ☐ Property Ownership
☐ Other:

Conflicts with Existing Utilities:

☐ None
☐ Unknown

Yes	Possible	
☐	☒	Sewer
☐	☒	Water
☐	☐	Gas
☐	☐	Cable
☐	☐	Electric
☐	☐	Electric to Streetlights
☐		Overhead Wires
☐	☐	Other:

Potential Ecological Conflict:

Existing mature trees:	☒ Yes	☐ No
Existing wetlands:	☐ Yes	☒ No
Existing stream or natural drainage:	~~☐ Yes~~	~~☐ No~~ → Greenwood.
Evidence of shallow bedrock:	☒ Yes	☐ No
Existing floodplain:	☐ Yes	☒ No

Other:

Site Candidate for Further Investigation: ☒ Yes ☐ No ☐ Maybe
If no, site candidate for Other Restoration Project(s): ☐ Yes ☐ No ☐ Maybe
If yes, type(s):

Unique Site ID:

Notes or Sketch

→ continued from Desc. of Opportunity:

→ EAST of GW PARK: AC Gutter → convert to P.P. swale or DRY ROCK BED to SLOW FLOW AND ALLOW some INFILTRATION → WOULD DRAIN TO MURAL Rain GARDEN. COULD CAPTURE/TREAT DRAIN LINE FROM CARMEL AVE → (UNCERTAIN DRAINAGE AREA?)

→ TURF EXTENDS from CARMEL TO. 9TH
→ P.P. PARKING AND/OR CURB CUTS TO RAIN GARDENS TO TREAT ROADWAY Runoff.
↳ 5' STRIPS REPLACING TURF w/ NATIVE/ DROUGHT TOLERANT PLANTS.

→ INLET @ Rec Trail + TENTH: Remove Ivy, MODIFY INLET, convert to Rain garden TO PROVIDE WQ TREATMENT FOR TRAIL.

→ @ 9th: MODIFY INLET TO inlet Rec trail, rain garden to TREAT DS. Runoff from Trail. Investigate potential to daylight/treat subdrain.

→ MRWPCA @ 9th → P. Pavement ⇒ to be self-treating (current AC) Landscape b/w P.S. and trail could be WQ.

→ @ 8th → CDS? w/ ~~Rain garden~~ Bioretention swale to treat trail RUNOFF. (w/ UNDERDRAIN. SLOW flow + WQ. treatment EROSION/SEDIMENT → also captures inlet from OCEAN VIEW. MED. PRIORITY OUTLET

Unique Site ID: 16

→ over

continued

→ Rec trail @ 7th. → retrofit to BIORetention → treat runoff from trail and roadway → underdrain connection (E) drain to ASBS.
(low complexity)

→ outlet across from Green Gables Inn → narrow ∴ limits possibility → P.P. (BUILD UP re: concern about shallow bedrock.) THIS SECTION of trail to provide WQ. treatment. OR P.P. parking on roadway above WALL → concern re: surcharge on wall. High complexity.

(1)

(2) → SAME FOR OUTLET @ Rec Trail ? 5TH

(3) " " " ? 4th

(4) " " " ? 1ST DISCOURAGE MOUNTAINBIKING ON HILLSIDE above DRAIN INLET.

(5) " " " across from 185 Ocean View.

→ EAST OF 3RD AVE NO WALL → ONLY BEDROCK B/W PARKING AND OCEANVIEW.

→ Drain Inlet ACROSS FROM 193 OCEANVIEW: size - available space limited → BUT POTENTIAL TO convert to RAIN GARDEN WITH SWALES CAPTURING RUNOFF FROM TRAIL. DIVERT (E) OUTLET FROM ROADWAY FOR WQ. TREATMENT.

→ @ DEWEY → curb cuts to (N) dry swale in landscape area.

Unique Site ID: 17		**Watershed:** ASBS	
City: PG		**Subwatershed:**	
Date: 5/30/16	**Assessed By:** EMC	**Camera ID:**	**Pictures:**

Site Description

Name: GARDENER'S ALLY
Address or Nearest Intersection:
Parcel Number:
Comments:

Ownership: ☒ Public ☒ Private ☐ Unknown
If Public, Government Jurisdiction: ☐ Local ☐ State ☐ DOT ☐ Other:

Potential Retrofit Location:

Storage
- ☐ Existing Pond
- ☐ Below Outfall
- ☐ In Transport ROW
- ☐ Other:
- ☐ Above Roadway Crossing
- ☐ In Conveyance System
- ☐ Large Parking Lot

On-Site
- ☐ Hotspot Operation
- ☐ Small Parking Lot
- ☒ Individual Street
- ☐ Individual Rooftop
- ☒ Small Impervious Area
- ☒ Landscape / Hardscape
- ☐ Underground
- ☐ Other:

Drainage Area to Site

Drainage Area ≈
Imperviousness ≈ %
Impervious Area ≈

Notes:

Drainage Area Land Use:
- ___% Residential
  - ___% SFH (< 1 ac lots)
  - ___% SFH (> 1 ac lots)
  - ___% Townhouses
  - ___% Multi-Family
- ___% Commercial
- ___% Institutional
- ___% Industrial
- ___% Transport-Related
- ___% Park
- ___% Undeveloped
- ___% Other:

Existing Site Conditions

Existing Stormwater BMP: ☐ Yes ☒ No ☐ Possible
If Yes, Describe:

Describe Existing Site Conditions, Including Existing Drainage and Conveyance Patterns:

NARROW ALLY → PARTIALLY BLOCKED TO THROUGH TRAFFIC. DRAINS TO (E) CB TO MANAGE DOWNSPOUTS DISCHARGING TO ALLY.

Considerations for Potential Retrofit Opportunity

Available Surface Area:

Paved:

Landscape:

Available Depth / Elevation Change:

Areas of Concern:

OWNERSHIP / LANDUSE COORDINATION / ACCESS.

☐ Dumpsters ☐ Grease ☐ Chemicals ☐ Material Storage ☐ Erosion ☐ Pet waste ☐ Geese/Wildlife

Describe Obvious, Potential Retrofit Opportunity:

PERMEABLE PAVEMENT
W/ SUB-BASE TO MANAGE
ROOFTOP RUNOFF. BURIED CISTERN?

☐ Possible Demonstration / Education Project

Site Constraints

Adjacent Land Use:

☐ Residential ☒ Commercial ☐ Institutional
☐ Industrial ☐ Transport-Related ☐ Park
☐ Undeveloped ☐ Other:_____

Possible Conflicts Due to Adjacent Land Use? ☐ Yes ☐ No
If Yes, Describe:_____

Access:

☐ No Access Constraints
Access Constrained due to
☐ Slope ☐ Space
☐ Utilities ☐ Tree Impacts
☐ Structures ☒ Property Ownership
☐ Other: NARROW.

Conflicts with Existing Utilities:

☐ None
☐ Unknown

Yes	Possible	
☐	☒	Sewer
☐	☒	Water
☐	☒	Gas
☐	☒	Cable
☐	☒	Electric
☐	☒	Electric to Streetlights
☐		Overhead Wires
☐	☐	Other:_____

Potential Ecological Conflict:

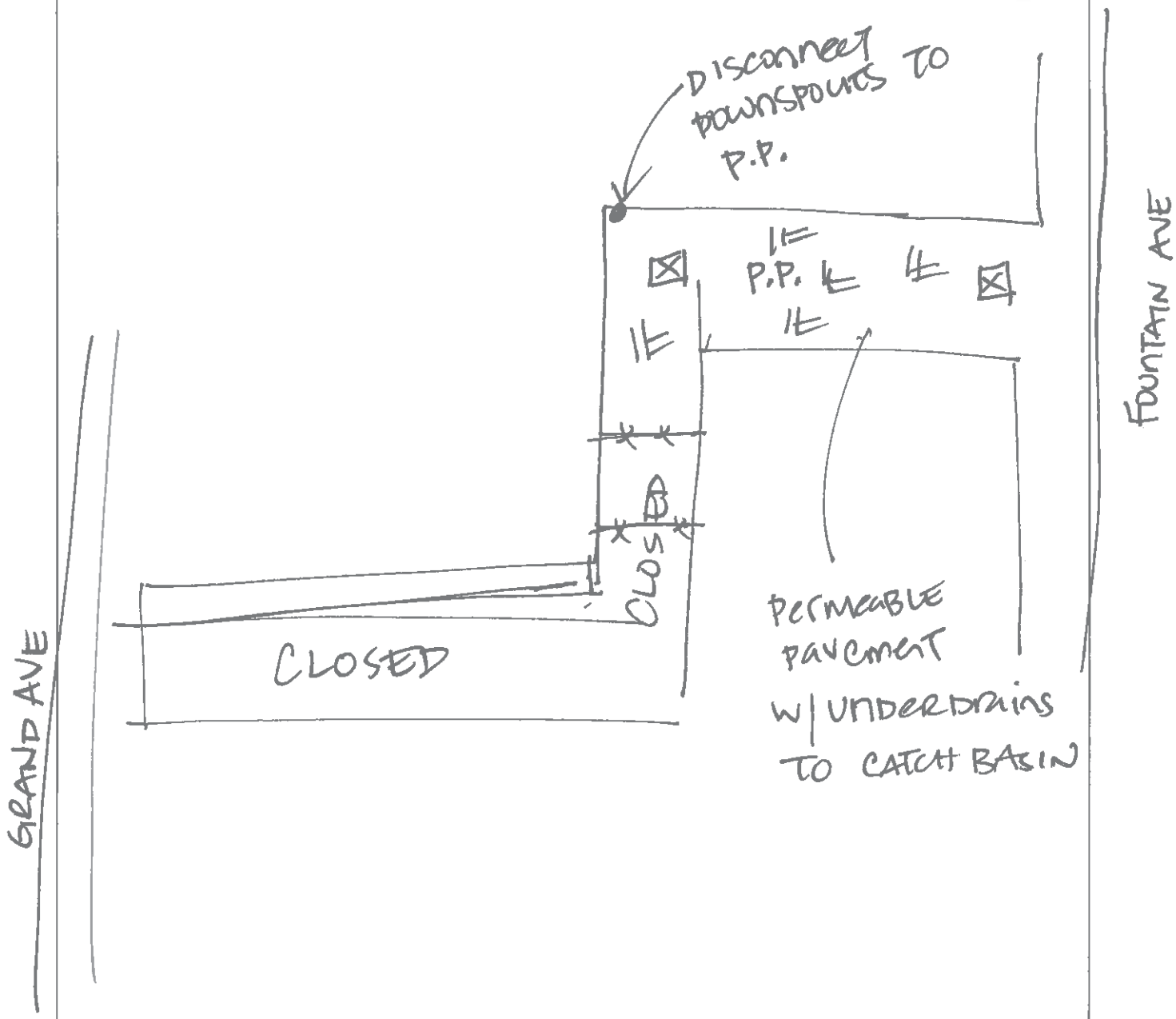
Existing mature trees:	☐ Yes	☒ No
Existing wetlands:	☐ Yes	☒ No
Existing stream or natural drainage:	☐ Yes	☒ No
Evidence of shallow bedrock:	☐ Yes	☒ No
Existing floodplain:	☐ Yes	☒ No

Other:_____

Site Candidate for Further Investigation: ☐ Yes ☐ No ☒ Maybe
If no, site candidate for Other Restoration Project(s): ☐ Yes ☐ No ☐ Maybe
If yes, type(s):_____

Unique Site ID:_____

Notes or Sketch



Unique Site ID: 17

Unique Site ID: 18		**Watershed:** ASBS	
City:		**Subwatershed:**	
Date: 6/6/16	**Assessed By:** EMC	**Camera ID:**	**Pictures:**

Site Description

Name: PINE AVE ROW
Address or Nearest Intersection:
Parcel Number:
Comments:

Ownership: ☒ Public ☐ Private ☐ Unknown
If Public, Government Jurisdiction: ☒ Local ☐ State ☒ DOT ☐ Other:

Potential Retrofit Location:

Storage
- ☐ Existing Pond
- ☐ Below Outfall
- ☐ In Transport ROW
- ☐ Other:
- ☐ Above Roadway Crossing
- ☐ In Conveyance System
- ☐ Large Parking Lot

On-Site
- ☐ Hotspot Operation
- ☐ Small Parking Lot
- ☒ Individual Street
- ☐ Individual Rooftop
- ☐ Small Impervious Area
- ☐ Landscape / Hardscape
- ☐ Underground
- ☐ Other:

Drainage Area to Site

Drainage Area ≈ _____
Imperviousness ≈ _____%
Impervious Area ≈ _____

Notes:

Drainage Area Land Use:
- ___% Residential
  - ___% SFH (< 1 ac lots)
  - ___% SFH (> 1 ac lots)
  - ___% Townhouses
  - ___% Multi-Family
- ___% Commercial
- ___% Institutional
- ___% Industrial
- ___% Transport-Related
- ___% Park
- ___% Undeveloped
- ___% Other:

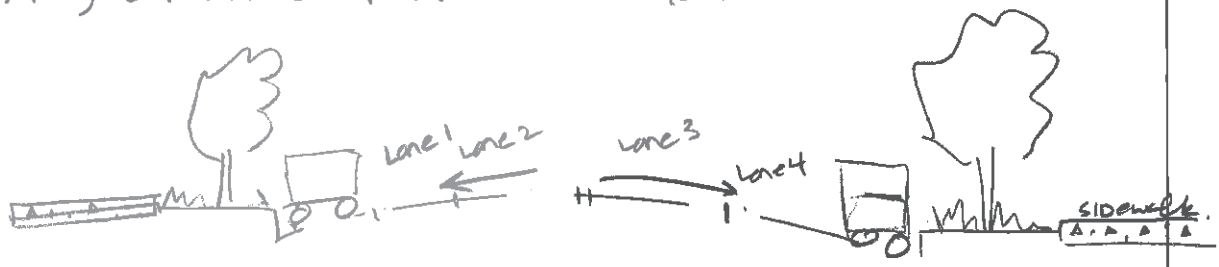
Existing Site Conditions

Existing Stormwater BMP: ☐ Yes ☒ No ☐ Possible
If Yes, Describe:

Describe Existing Site Conditions, Including Existing Drainage and Conveyance Patterns:

→ CROWDED 4-LANE ROAD W/ PARKING BOTH SIDES.

→ AC, SURFACE RUNOFF TO C.B.



Unique Site ID: 18

Considerations for Potential Retrofit Opportunity

Available Surface Area:

Paved:

Landscape:

Available Depth / Elevation Change:

Areas of Concern:

☐ Dumpsters ☐ Grease ☐ Chemicals ☐ Material Storage ☐ Erosion ☐ Pet waste ☐ Geese/Wildlife

Describe Obvious, Potential Retrofit Opportunity:

→ Green street: LID/BIORETENTION FACILITIES w/ UNDERDRAINS ALONG BOTH SIDES of STREET

☒ Possible Demonstration / Education Project

Site Constraints

Adjacent Land Use:

☒ Residential ☐ Commercial ☒ Institutional (School)
☐ Industrial ☐ Transport-Related ☐ Park
☐ Undeveloped ☐ Other:_____

Possible Conflicts Due to Adjacent Land Use? ☐ Yes ☐ No
If Yes, Describe:_____

Access:

☒ No Access Constraints
Access Constrained due to
☐ Slope ☐ Space
☒ Utilities ☐ Tree Impacts
☐ Structures ☐ Property Ownership
☐ Other:_____

Conflicts with Existing Utilities:

☐ None
☐ Unknown

Yes	Possible	
☐	☒	Sewer
☐	☒	Water
☐	☒	Gas
☐	☒	Cable
☐	☒	Electric
☐	☒	Electric to Streetlights
☐		Overhead Wires
☐	☐	Other:_____

Potential Ecological Conflict:

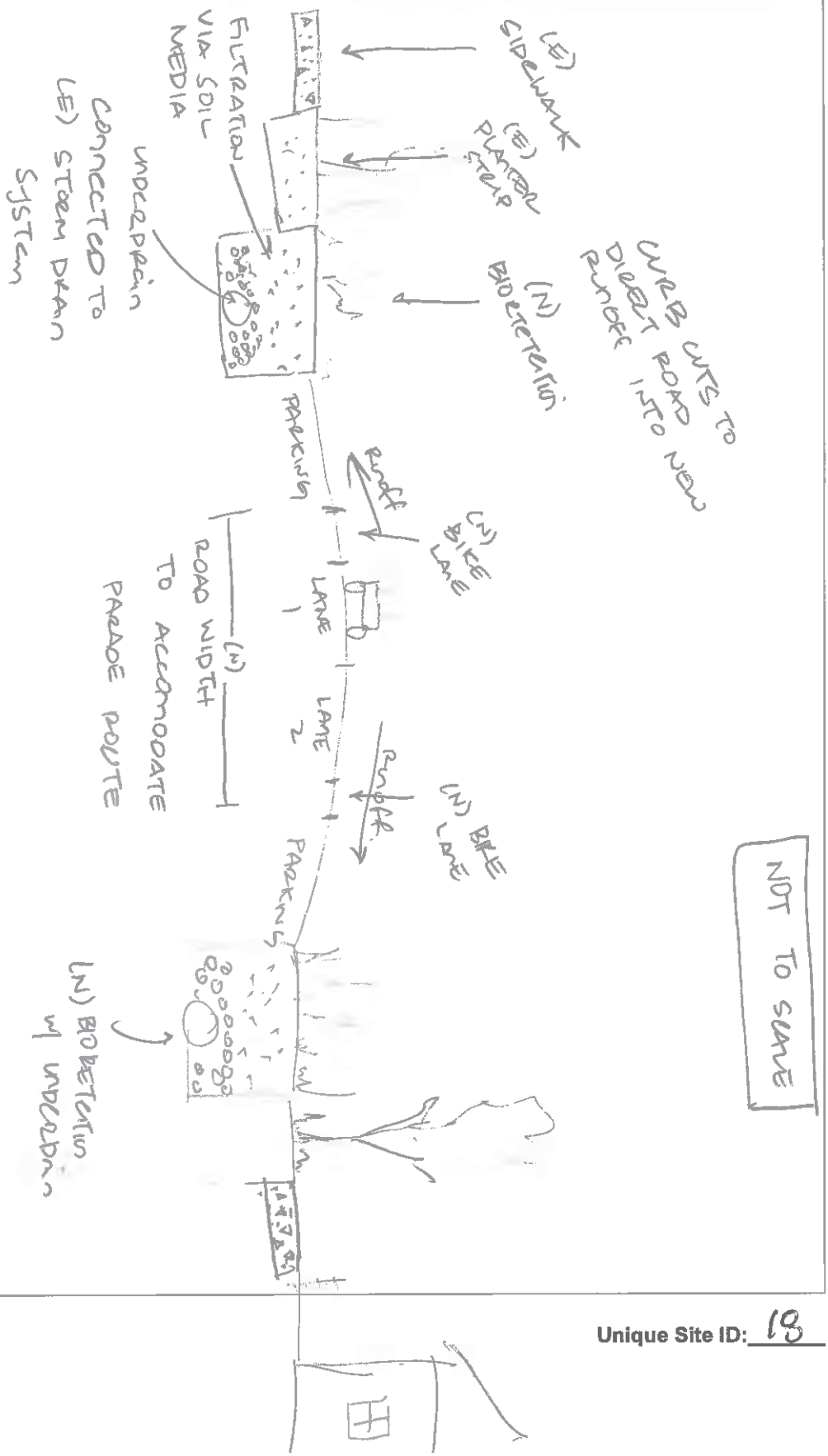
Existing mature trees:	☒ Yes	☐ No
Existing wetlands:	☐ Yes	☒ No
Existing stream or natural drainage:	☐ Yes	☒ No
Evidence of shallow bedrock:	☐ Yes	☒ No
Existing floodplain:	☐ Yes	☒ No

Other:_____

Site Candidate for Further Investigation: ☒ **Yes** ☐ **No** ☐ **Maybe**
If no, site candidate for Other Restoration Project(s): ☐ **Yes** ☐ **No** ☐ **Maybe**
If yes, type(s):_____

Unique Site ID:_____

Notes or Sketch



Unique Site ID: 18

Unique Site ID: 19		**Watershed:** ASBS	
City: PG		**Subwatershed:**	
Date: 5/24 + 5/31	**Assessed By:**	**Camera ID:**	**Pictures:**

Site Description

Name: LIGHTHOUSE AVE ROW.
Address or Nearest Intersection:
Parcel Number:
Comments:

Ownership: ☒ Public ☐ Private ☐ Unknown ROW
If Public, Government Jurisdiction: ☐ Local ☐ State ☒ DOT ☐ Other:

Potential Retrofit Location:

Storage
- ☐ Existing Pond
- ☐ Below Outfall
- ☐ In Transport ROW
- ☐ Other:
- ☐ Above Roadway Crossing
- ☐ In Conveyance System
- ☐ Large Parking Lot

On-Site
- ☐ Hotspot Operation
- ☒ Small Parking Lot
- ☐ Individual Street
- ☐ Individual Rooftop
- ☐ Small Impervious Area
- ☒ Landscape / Hardscape
- ☐ Underground
- ☐ Other:

Drainage Area to Site

Drainage Area ≈ _____
Imperviousness ≈ _____%
Impervious Area ≈ _____

Notes:

Drainage Area Land Use:
- ___% Residential
  - ___% SFH (< 1 ac lots)
  - ___% SFH (> 1 ac lots)
  - ___% Townhouses
  - ___% Multi-Family
- ___% Commercial
- ___% Institutional
- ___% Industrial
- ___% Transport-Related
- ___% Park
- ___% Undeveloped
- ___% Other:

Existing Site Conditions

Existing Stormwater BMP: ☐ Yes ☒ No ☐ Possible
If Yes, Describe:

Describe Existing Site Conditions, Including Existing Drainage and Conveyance Patterns:

DOWNTOWN CORRIDOR WITH PARKING ON EITHER SIDE OF ROAD AND IN CENTER BETWEEN DRIVE AISLES - RUNOFF GENERALLY TO NORTH TOWARDS ASBS.

Unique Site ID: 19

Considerations for Potential Retrofit Opportunity

Available Surface Area:

Paved:

Landscape:

Available Depth / Elevation Change:

Areas of Concern:

☐ Dumpsters ☐ Grease ☐ Chemicals ☐ Material Storage ☐ Erosion ☐ Pet waste ☐ Geese/Wildlife

Describe Obvious, Potential Retrofit Opportunity:

RETROFIT PARKING AREAS TO PERMEABLE PAVEMENT. LID PLANTERS IN AVAILABLE SPACE IN CENTER AISLES AND NORTHERN SIDE OF SIDEWALK.

☒ Possible Demonstration / Education Project

Site Constraints

Adjacent Land Use:

☐ Residential ☒ Commercial ☒ Institutional
☐ Industrial ☐ Transport-Related ☐ Park
☐ Undeveloped ☐ Other:_____

Possible Conflicts Due to Adjacent Land Use? ☐ Yes ☒ No
If Yes, Describe:_____

Access:

☐ No Access Constraints
Access Constrained due to
☐ Slope ☐ Space
☒ Utilities ☒ Tree Impacts
☐ Structures ☐ Property Ownership
☐ Other:_____

Conflicts with Existing Utilities:

☐ None
☐ Unknown

Yes	Possible	
☐	☒	Sewer
☐	☒	Water
☐	☒	Gas
☐	☒	Cable
☐	☒	Electric
☐	☒	Electric to Streetlights
☐		Overhead Wires
☐	☐	Other:_____

Potential Ecological Conflict:

Existing mature trees:	☒ Yes	☐ No
Existing wetlands:	☐ Yes	☒ No
Existing stream or natural drainage:	☐ Yes	☒ No
Evidence of shallow bedrock:	☐ Yes	☒ No
Existing floodplain:	☐ Yes	☒ No

Other:_____

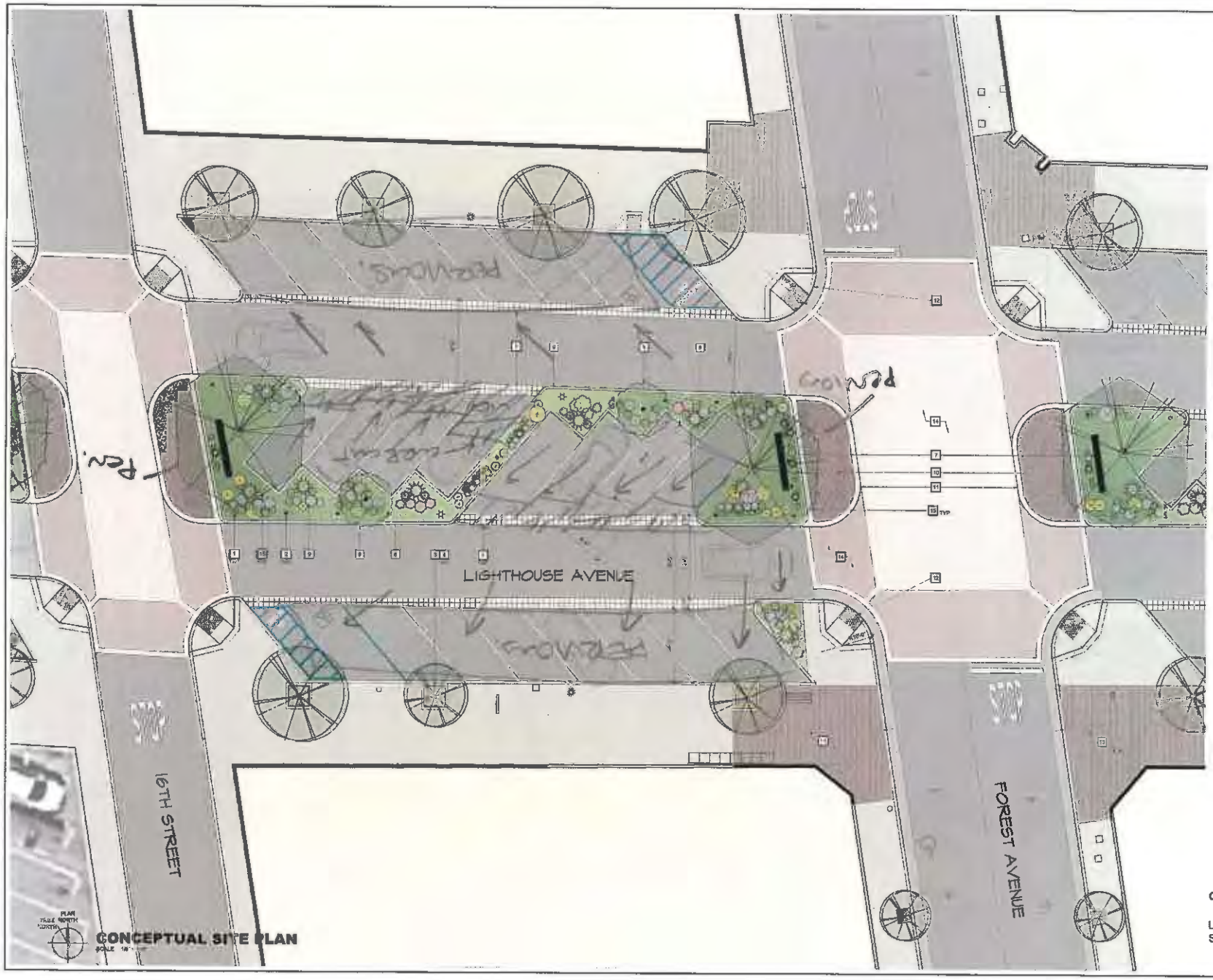
Site Candidate for Further Investigation: ☒ **Yes** ☐ **No** ☐ **Maybe**
If no, site candidate for Other Restoration Project(s): ☐ **Yes** ☐ **No** ☐ **Maybe**
If yes, type(s):_____

Unique Site ID:_____

Notes or Sketch

See attached

Unique Site ID: 19



CONCEPTUAL SITE PLAN

SCALE 1/8" = 1'-0"

KEY NOTES

THE KEY NOTES THAT FOLLOW APPLY TO THE DRAWING(S) ON THIS SHEET ONLY. REFER TO FOLLOWING SHEETS FOR NOTES THAT ARE APPLICABLE TO THOSE DRAWINGS.

1. INDICATES NEW CLASSIC LIGHTED PIPE BOLLARD, TYPICAL AS SHOWN. SEE SITE DETAILS SHEET.
2. INDICATES NEW 14'-0"TH LED STREET LIGHT AT 40'-0" ON CENTER, TYPICAL AS SHOWN. SEE SITE DETAILS SHEET.
3. INDICATES NEW IRON AGE 'LOCUST' TREE GRATE. TYPICAL AS SHOWN. SEE SITE DETAILS SHEET.
4. INDICATES NEW TREE GUARD. SEE SITE DETAILS SHEET.
5. INDICATES NEW STREET PAVING BAND, TYPICAL AS SHOWN. PAVING TO BE DETERMINED (BELGIUM BLOCK GRANITE SETS OR COLORED AND SCORED CONCRETE. SEE SITE DETAILS SHEET.
6. NEW CONCRETE CURB.
7. INDICATES NEW STREET SIGN MONUMENT. SEE SITE DETAILS SHEET.
8. INDICATES NEW GINGKO TREE AT 20'-0" ON CENTER. SEE SITE DETAILS.
9. NEW LANDSCAPED AREA.
10. NEW BRICK PAVING TO MATCH EXISTING STREET BRICK PAVING.
11. NEW COLORED CONCRETE BAND TO MATCH EXISTING.
12. NEW CONCRETE CURB AND RAMP.
13. EXISTING SIDEWALK BRICK PAVING.
14. EXISTING COLORED CONCRETE FINISH.
15. EXISTING CYPRESS TREE TO REMAIN.

CITY OF PACIFIC GROVE

LIGHTHOUSE AVENUE
STREETSCAPE IMPROVEMENTS

WRD #: 14028.1 SCHEMATIC DESIGN 1/11/16

50

WRD WALD RUHNKE & DOST ARCHITECTS LLP

→ car show location 1/yr.
→ Rec. web site has list of events.

EXISTING CONDITIONS SITE PLAN

KEY NOTES

THE KEY NOTES THAT FOLLOW APPLY TO THE DRAWINGS ON THIS SHEET ONLY. REFER TO ADDITIONAL SHEETS FOR NOTES THAT ARE APPLICABLE TO OTHER DRAWINGS.

CITY OF PACIFIC GROVE

LIGHTHOUSE AVENUE
STREETSCAPE IMPROVEMENTS

SCHEMATIC DESIGN

WRSD

Unique Site ID: 20		**Watershed:** ASBS	
City: PG		**Subwatershed:**	
Date: 5/24/16	**Assessed By:** BMC/RLC	**Camera ID:**	**Pictures:**

Site Description

Name: Fire Dept. / Heritage Society / Youth Center.
Address or Nearest Intersection:
Parcel Number:
Comments:

Ownership: ☒ Public ☐ Private ☐ Unknown
If Public, Government Jurisdiction: ☒ Local ☐ State ☐ DOT ☐ Other:

Potential Retrofit Location:

Storage
- ☐ Existing Pond
- ☐ Below Outfall
- ☐ In Transport ROW
- ☐ Other:
- ☐ Above Roadway Crossing
- ☐ In Conveyance System
- ☐ Large Parking Lot

On-Site
- ☐ Hotspot Operation
- ☒ Small Parking Lot
- ☒ Individual Street
- ☒ Individual Rooftop
- ☒ Small Impervious Area
- ☒ Landscape / Hardscape
- ☐ Underground
- ☐ Other:

Drainage Area to Site

Drainage Area ≈ _____
Imperviousness ≈ _____%
Impervious Area ≈ _____

Notes:

Drainage Area Land Use:
- ___% Residential
  - ___% SFH (< 1 ac lots)
  - ___% SFH (> 1 ac lots)
  - ___% Townhouses
  - ___% Multi-Family
- ___% Commercial
- ___% Institutional
- ___% Industrial
- ___% Transport-Related
- ___% Park
- ___% Undeveloped
- ___% Other:

Existing Site Conditions

Existing Stormwater BMP: ☐ Yes ☒ No ☐ Possible
If Yes, Describe:

Describe Existing Site Conditions, Including Existing Drainage and Conveyance Patterns:

Unique Site ID: 20

Considerations for Potential Retrofit Opportunity

Available Surface Area:

Paved:

Landscape:

Available Depth / Elevation Change:

Areas of Concern:

Erosion from planters in front of/adjacent to buildings

☐ Dumpsters ☐ Grease ☐ Chemicals ☐ Material Storage ☐ Erosion ☐ Pet waste ☐ Geese/Wildlife

Describe Obvious, Potential Retrofit Opportunity:

☒ Possible Demonstration / Education Project

Site Constraints

Adjacent Land Use:

☐ Residential ☐ Commercial ☐ Institutional
☐ Industrial ☐ Transport-Related ☐ Park
☐ Undeveloped ☐ Other:_____

Possible Conflicts Due to Adjacent Land Use? ☐ Yes ☐ No
If Yes, Describe:_____

Access:

☐ No Access Constraints
Access Constrained due to
☐ Slope ☐ Space
☐ Utilities ☐ Tree Impacts
☐ Structures ☐ Property Ownership
☐ Other:_____

Conflicts with Existing Utilities:

☐ None
☐ Unknown

Yes	Possible	
☐	☒	Sewer
☐	☒	Water
☐	☒	Gas
☐	☐	Cable
☐	☒	Electric
☐	☐	Electric to Streetlights
☐		Overhead Wires
☐	☐	Other:_____

Potential Ecological Conflict:

Existing mature trees:	☒ Yes	☐ No
Existing wetlands:	☐ Yes	☒ No
Existing stream or natural drainage:	☐ Yes	☒ No
Evidence of shallow bedrock:	☐ Yes	☐ No
Existing floodplain:	☐ Yes	☒ No

Other:_____

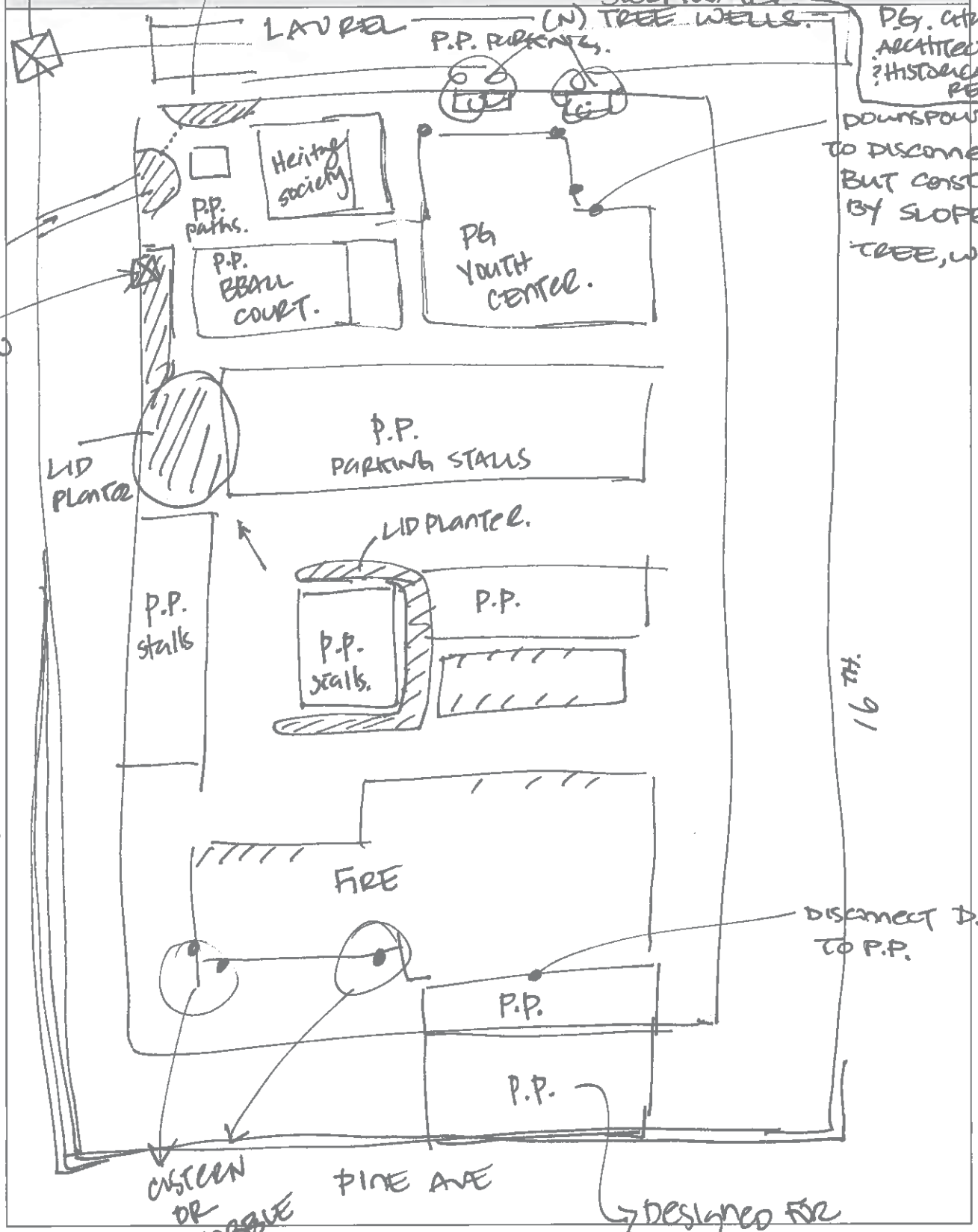
Site Candidate for Further Investigation: ☒ **Yes** ☐ **No** ☐ **Maybe**
If no, site candidate for Other Restoration Project(s): ☐ **Yes** ☐ **No** ☐ **Maybe**
If yes, type(s):_____

Unique Site ID:_____

LID DEMO COURTYARD GARDEN w/ (N) Permeable Pavement Paths. → DEMO HOW TO DO LID CONSISTENT w/ P.G. CHARACTER, ARCHITECTURE, ?HISTORICAL RESOURCES

[SALVAGE PLANTS + HARDWARE : REUSE]

Notes or Sketch



Unique Site ID: 20

Unique Site ID: 21		**Watershed:**	
City:		**Subwatershed:**	
Date: 6/6/16	**Assessed By:**	**Camera ID:**	**Pictures:**

Site Description

Name: THEATRE PARKING LOT
Address or Nearest Intersection:
Parcel Number:
Comments:

Ownership: ☐ Public ☒ Private ☐ Unknown
If Public, Government Jurisdiction: ☐ Local ☐ State ☐ DOT ☐ Other:

Potential Retrofit Location:

Storage
- ☐ Existing Pond
- ☐ Below Outfall
- ☐ In Transport ROW
- ☐ Other:
- ☐ Above Roadway Crossing
- ☐ In Conveyance System
- ☐ Large Parking Lot

On-Site
- ☐ Hotspot Operation
- ☒ ~~Small~~ Parking Lot
- ☐ Individual Street
- ☐ Individual Rooftop
- ☒ ~~Small~~ Impervious Area
- ☐ Landscape (Hardscape)
- ☐ Underground
- ☐ Other:

Drainage Area to Site

Drainage Area ≈
Imperviousness ≈ %
Impervious Area ≈

Notes:

Drainage Area Land Use:
- ___% Residential
  - ___% SFH (< 1 ac lots)
  - ___% SFH (> 1 ac lots)
  - ___% Townhouses
  - ___% Multi-Family
- ___% Commercial
- ___% Institutional
- ___% Industrial
- ___% Transport-Related
- ___% Park
- ___% Undeveloped
- ___% Other:

Existing Site Conditions

Existing Stormwater BMP: ☐ Yes ☒ No ☐ Possible
If Yes, Describe:

Describe Existing Site Conditions, Including Existing Drainage and Conveyance Patterns:

→ VERY STEEP PARKING LOT → AC

→ MINIMAL LANDSCAPING

→ SHEET FLOW TO 15TH ST.

Considerations for Potential Retrofit Opportunity

Available Surface Area:

Paved:

Landscape:

Available Depth / Elevation Change:

Areas of Concern:

SLOPE

☐ Dumpsters ☐ Grease ☐ Chemicals ☐ Material Storage ☐ Erosion ☐ Pet waste ☐ Geese/Wildlife

Describe Obvious, Potential Retrofit Opportunity:

→ REGRADE PARKING LOT TO TERRACE → REDUCE SLOPES TO WORK MORE EASILY W/ LID.

→ STEPPED BIORETENTION/CONCRETE PLANTERS B/W PARKING AISLES

☐ Possible Demonstration / Education Project

Site Constraints

Adjacent Land Use:

☒ Residential ☒ Commercial ☐ Institutional
☐ Industrial ☐ Transport-Related ☐ Park
☐ Undeveloped ☐ Other:_____

Possible Conflicts Due to Adjacent Land Use? ☐ Yes ☐ No
If Yes, Describe:_____

Access:

☐ No Access Constraints
Access Constrained due to
☒ Slope ☐ Space
☐ Utilities ☐ Tree Impacts
☐ Structures ☒ Property Ownership
☐ Other:_____

Conflicts with Existing Utilities:

☐ None
☐ Unknown

Yes	Possible	
☐	☒	Sewer
☐	☒	Water
☐	☒	Gas
☐	☒	Cable
☐	☒	~~Electric~~
☐	☒	Electric to Streetlights
☐		Overhead Wires
☐	☐	Other:_____

Potential Ecological Conflict:

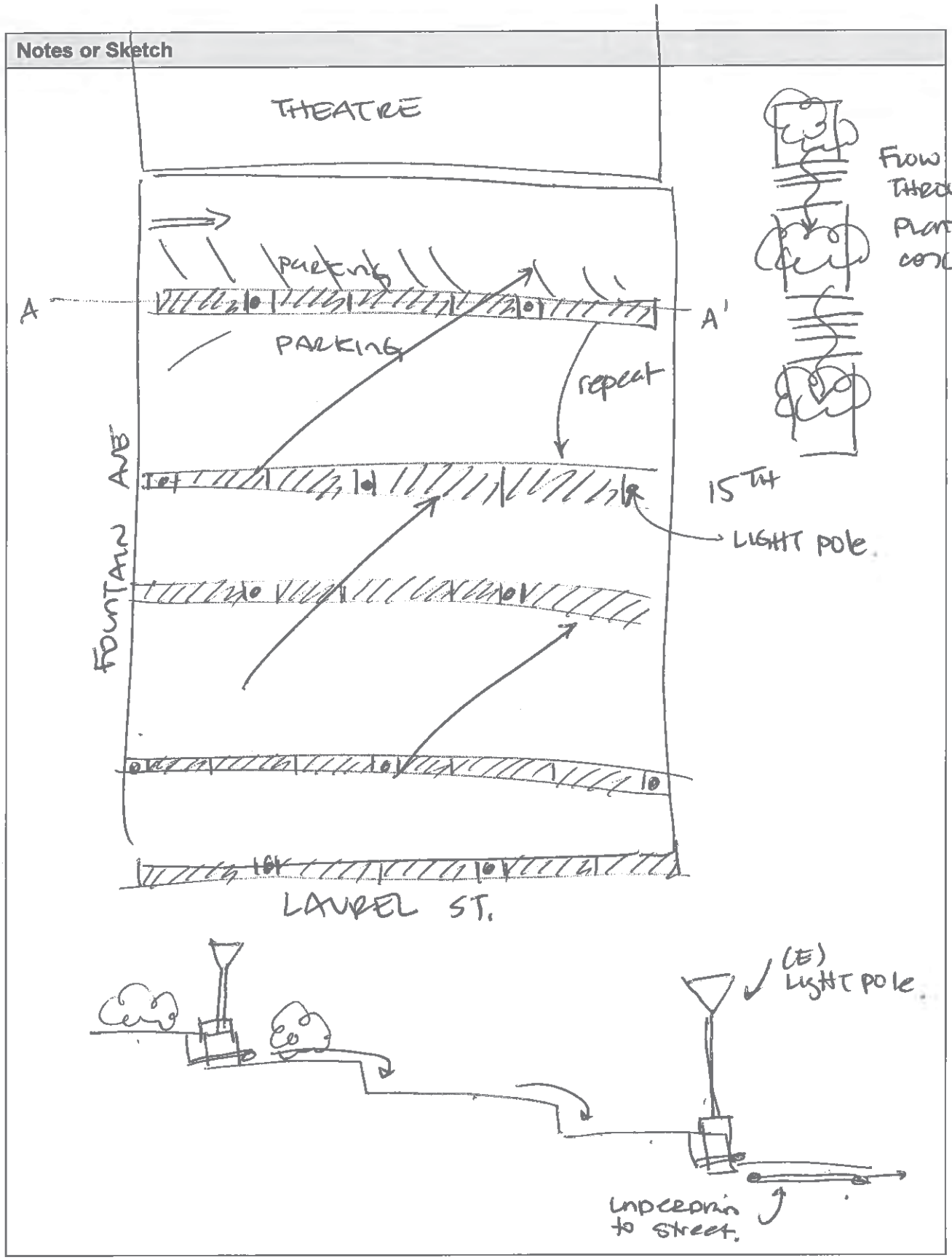
Existing mature trees: *NO DATA	☐ Yes	☒ No
Existing wetlands:	☐ Yes	☒ No
Existing stream or natural drainage:	☐ Yes	☒ No
Evidence of shallow bedrock:	☐ Yes	☒ No
Existing floodplain:	☐ Yes	☒ No

Other:_____

Site Candidate for Further Investigation: ☐ Yes ☐ No ☒ Maybe
If no, site candidate for Other Restoration Project(s): ☐ Yes ☐ No ☐ Maybe
If yes, type(s):_____

Unique Site ID:_____

Notes or Sketch



Unique Site ID: 21

Unique Site ID: 22		**Watershed:** ASBS	
City: PG		**Subwatershed:**	
Date: 5/24/16	**Assessed By:** BMC/RLC	**Camera ID:**	**Pictures:**

Site Description

Name: City Hall
Address or Nearest Intersection:
Parcel Number:
Comments:

Ownership: ☒ Public ☐ Private ☐ Unknown
If Public, Government Jurisdiction: ☒ Local ☐ State ☐ DOT ☐ Other:

Potential Retrofit Location:

Storage
- ☐ Existing Pond
- ☐ Below Outfall
- ☐ In Transport ROW
- ☐ Other:
- ☐ Above Roadway Crossing
- ☐ In Conveyance System
- ☐ Large Parking Lot

On-Site
- ☐ Hotspot Operation
- ☒ Small Parking Lot
- ☒ Individual Street
- ☒ Individual Rooftop
- ☒ Small Impervious Area
- ☒ Landscape / Hardscape
- ☐ Underground
- ☐ Other:

Drainage Area to Site

Drainage Area ≈ _____
Imperviousness ≈ _____%
Impervious Area ≈ _____

Notes:

Drainage Area Land Use:
- ___% Residential
  - ___% SFH (< 1 ac lots)
  - ___% SFH (> 1 ac lots)
  - ___% Townhouses
  - ___% Multi-Family
- ___% Commercial
- ___% Institutional
- ___% Industrial
- ___% Transport-Related
- ___% Park
- ___% Undeveloped
- ___% Other:

Existing Site Conditions

Existing Stormwater BMP: ☐ Yes ☒ No ☐ Possible
If Yes, Describe:

Describe Existing Site Conditions, Including Existing Drainage and Conveyance Patterns:

Considerations for Potential Retrofit Opportunity

Available Surface Area:

Paved:

Landscape:

Available Depth / Elevation Change:

Areas of Concern:

☐ Dumpsters ☐ Grease ☐ Chemicals ☐ Material Storage ☐ Erosion ☐ Pet waste ☐ Geese/Wildlife

Describe Obvious, Potential Retrofit Opportunity:

☒ Possible Demonstration / Education Project

Site Constraints

Adjacent Land Use:

☐ Residential ☒ Commercial ☐ Institutional
☐ Industrial ☐ Transport-Related ☐ Park
☐ Undeveloped ☐ Other:_____

Possible Conflicts Due to Adjacent Land Use? ☐ Yes ☒ No
If Yes, Describe:_____

Access:

☐ No Access Constraints
Access Constrained due to
☒ Slope ☒ Space
☐ Utilities ☐ Tree Impacts
☐ Structures ☐ Property Ownership
☐ Other:_____

Conflicts with Existing Utilities:

☐ None
☐ Unknown

Yes	Possible	
☒	☐	Sewer
☒	☐	Water
☒	☐	Gas
☐	☐	Cable
☒	☐	Electric
☒	☐	Electric to Streetlights
☐		Overhead Wires
☐	☐	Other:_____

Potential Ecological Conflict:

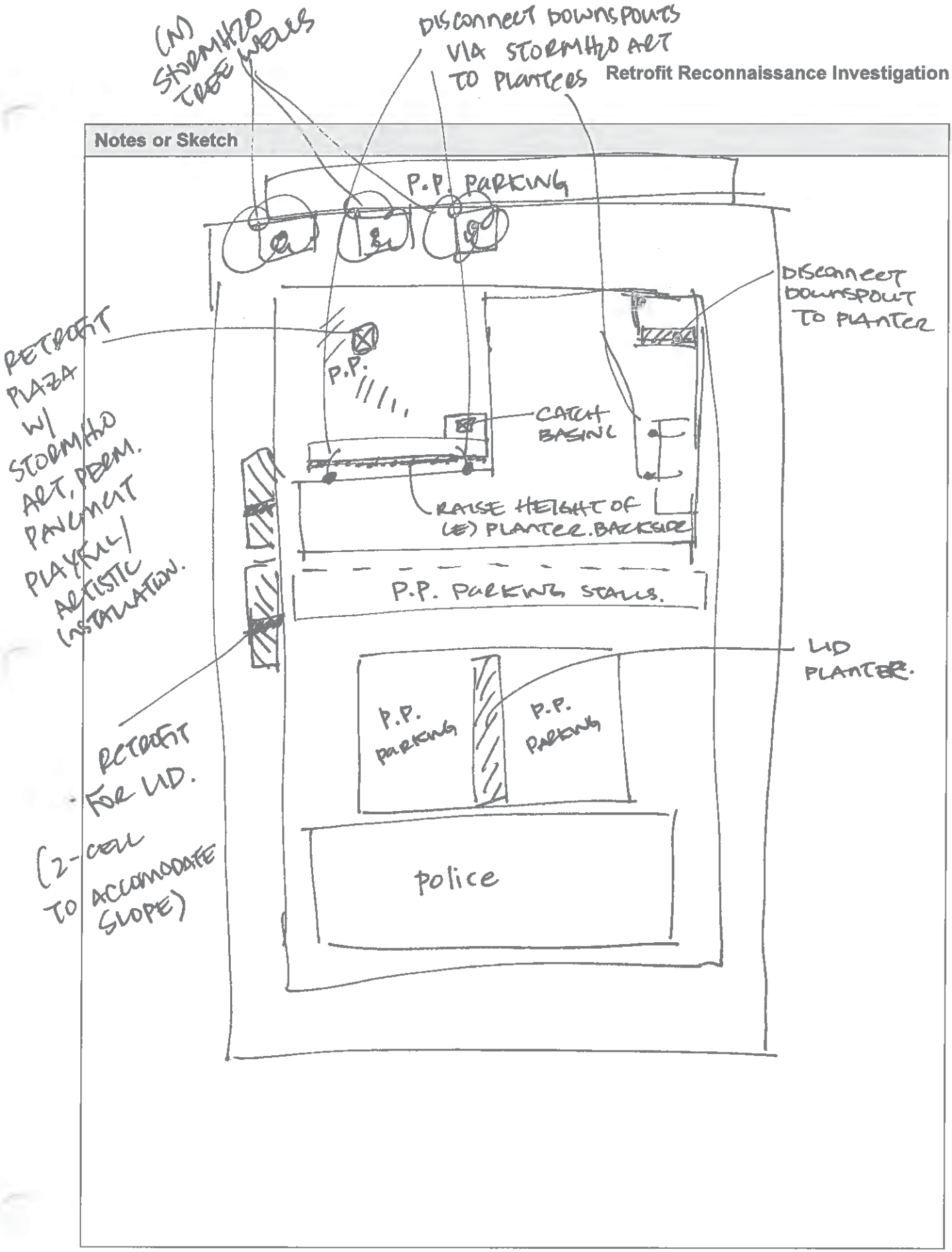
Existing mature trees:	☐ Yes	☒ No
Existing wetlands:	☐ Yes	☒ No
Existing stream or natural drainage:	☐ Yes	☒ No
Evidence of shallow bedrock:	☐ Yes	☒ No
Existing floodplain:	☐ Yes	☒ No

Other:_____

Site Candidate for Further Investigation: ☒ **Yes** ☐ **No** ☐ **Maybe**
If no, site candidate for Other Restoration Project(s): ☐ **Yes** ☐ **No** ☐ **Maybe**
If yes, type(s):_____

Unique Site ID:_____

Notes or Sketch



Unique Site ID: 22

Unique Site ID: 23		**Watershed:** ASBS	
City: PG		**Subwatershed:**	
Date: 5/30/16	**Assessed By:** BMC	**Camera ID:**	**Pictures:**

Site Description

Name: FANDANGO PARKING LOT
Address or Nearest Intersection:
Parcel Number:
Comments:

Ownership: ☐ Public ☐ Private ☒ Unknown
If Public, Government Jurisdiction: ☐ Local ☐ State ☐ DOT ☐ Other:

Potential Retrofit Location:

Storage
- ☐ Existing Pond
- ☐ Below Outfall
- ☐ In Transport ROW
- ☐ Other:
- ☐ Above Roadway Crossing
- ☐ In Conveyance System
- ☒ Large Parking Lot

On-Site
- ☐ Hotspot Operation
- ☐ Small Parking Lot
- ☐ Individual Street
- ☐ Individual Rooftop
- ☐ Small Impervious Area
- ☐ Landscape / Hardscape
- ☐ Underground
- ☐ Other:

Drainage Area to Site

Drainage Area ≈ _____
Imperviousness ≈ _____%
Impervious Area ≈ _____

Notes:

Drainage Area Land Use:
- ___% Residential
  - ___% SFH (< 1 ac lots)
  - ___% SFH (> 1 ac lots)
  - ___% Townhouses
  - ___% Multi-Family
- ___% Commercial
- ___% Institutional
- ___% Industrial
- ___% Transport-Related
- ___% Park
- ___% Undeveloped
- ___% Other:

Existing Site Conditions

Existing Stormwater BMP: ☐ Yes ☒ No ☐ Possible
If Yes, Describe:

Describe Existing Site Conditions, Including Existing Drainage and Conveyance Patterns:

PARKING LOT → SHEET FLOW
1 1/2 to 1-SMALL INLET LOCATED BENEATH DUMPSTER.

Considerations for Potential Retrofit Opportunity

Available Surface Area:

Paved:

Landscape:

Available Depth / Elevation Change:

Areas of Concern:

☒ Dumpsters ☐ Grease ☐ Chemicals ☐ Material Storage ☐ Erosion ☐ Pet waste ☐ Geese/Wildlife

Describe Obvious, Potential Retrofit Opportunity:

CONVERT CENTER OF PARKING AISLES TO LID BIORETENTION / PLANTERS → PARKING STALLS TO PERMEABLE PAVEMENT.

☐ Possible Demonstration / Education Project

Site Constraints

Adjacent Land Use:

☐ Residential ☒ Commercial ☐ Institutional
☐ Industrial ☐ Transport-Related ☐ Park
☐ Undeveloped ☐ Other: RESTAURANT.

Possible Conflicts Due to Adjacent Land Use? ☐ Yes ☐ No
If Yes, Describe:

Access:

☐ No Access Constraints
Access Constrained due to
☐ Slope ☐ Space
☐ Utilities ☐ Tree Impacts
☐ Structures ☒ Property Ownership
☐ Other:

Conflicts with Existing Utilities:

☐ None
☐ Unknown

Yes	Possible	
☐	☒	Sewer
☐	☒	Water
☐	☒	Gas
☐	☒	Cable
☐	☒	Electric
☐	☒	Electric to Streetlights
☐		Overhead Wires
☐	☐	Other:

Potential Ecological Conflict:

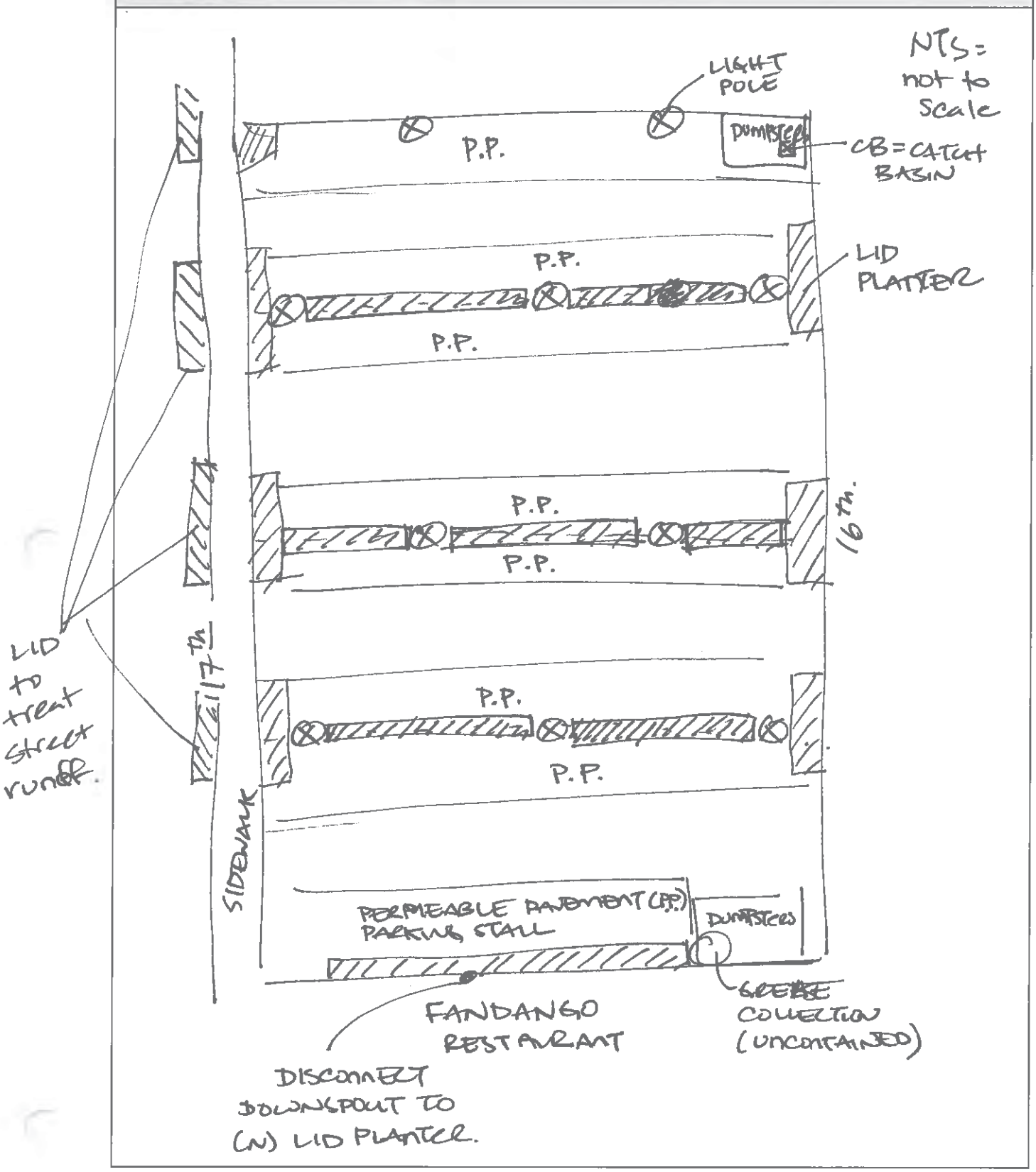
Existing mature trees: * POOR CONDN/	☒ Yes	☐ No
Existing wetlands:	☐ Yes	☒ No
Existing stream or natural drainage:	☐ Yes	☒ No
Evidence of shallow bedrock:	☐ Yes	☒ No
Existing floodplain:	☐ Yes	☒ No

Other:

Site Candidate for Further Investigation: ☒ Yes ☐ No ☐ Maybe
If no, site candidate for Other Restoration Project(s): ☐ Yes ☐ No ☐ Maybe
If yes, type(s):

Unique Site ID:

Notes or Sketch



Unique Site ID: 23

Unique Site ID: 24/25		Watershed: ASBS	
City: PG		Subwatershed:	
Date: 5/30/16	Assessed By: BMC	Camera ID:	Pictures:

Site Description

Name: GROVE MARKET PARKING LOT
Address or Nearest Intersection:
Parcel Number:
Comments:

likely.

Ownership: ☐ Public ☒ Private ☒ Unknown
If Public, Government Jurisdiction: ☐ Local ☐ State ☐ DOT ☐ Other:

Potential Retrofit Location:

Storage
- ☐ Existing Pond
- ☐ Below Outfall
- ☐ In Transport ROW
- ☐ Other:
- ☐ Above Roadway Crossing
- ☐ In Conveyance System
- ☐ Large Parking Lot

On-Site
- ☐ Hotspot Operation
- ☒ Small Parking Lot
- ☐ Individual Street
- ☐ Individual Rooftop
- ☐ Small Impervious Area
- ☒ Landscape / Hardscape
- ☐ Underground
- ☐ Other:

Drainage Area to Site

Drainage Area ≈ _____
Imperviousness ≈ _____%
Impervious Area ≈ _____

Notes:

Drainage Area Land Use:
- ___% Residential
  - ___% SFH (< 1 ac lots)
  - ___% SFH (> 1 ac lots)
  - ___% Townhouses
  - ___% Multi-Family
- ___% Commercial
- ___% Institutional
- ___% Industrial
- ___% Transport-Related
- ___% Park
- ___% Undeveloped
- ___% Other:

Existing Site Conditions

Existing Stormwater BMP: ☐ Yes ☒ No ☐ Possible
If Yes, Describe:

Describe Existing Site Conditions, Including Existing Drainage and Conveyance Patterns:

PARKING LOT W/ DRAINAGE TO SINGLE CATCHBASIN.

Considerations for Potential Retrofit Opportunity

Available Surface Area:

Paved:

Landscape:

Available Depth / Elevation Change:

Areas of Concern:

SLOPE + COORDINATION W/ PVT. LANDOWNERS

☐ Dumpsters ☐ Grease ☐ Chemicals ☐ Material Storage ☐ Erosion ☐ Pet waste ☐ Geese/Wildlife

Describe Obvious, Potential Retrofit Opportunity:

PERMEABLE PAVEMENT.

☐ Possible Demonstration / Education Project

Site Constraints

Adjacent Land Use:

☐ Residential ☒ Commercial ☐ Institutional
☐ Industrial ☐ Transport-Related ☐ Park
☐ Undeveloped ☐ Other:_____

Possible Conflicts Due to Adjacent Land Use? ☐ Yes ☒ No
If Yes, Describe:_____

Access:

☒ No Access Constraints
Access Constrained due to
☐ Slope ☐ Space
☐ Utilities ☐ Tree Impacts
☐ Structures ☐ Property Ownership
☐ Other:_____

Conflicts with Existing Utilities:

☐ None
☐ Unknown

Yes	Possible	
☐	☒	Sewer
☐	☒	Water
☐	☒	Gas
☐	☒	Cable
☐	☒	Electric
☐	☒	Electric to Streetlights
☐		Overhead Wires
☐	☐	Other:_____

Potential Ecological Conflict:

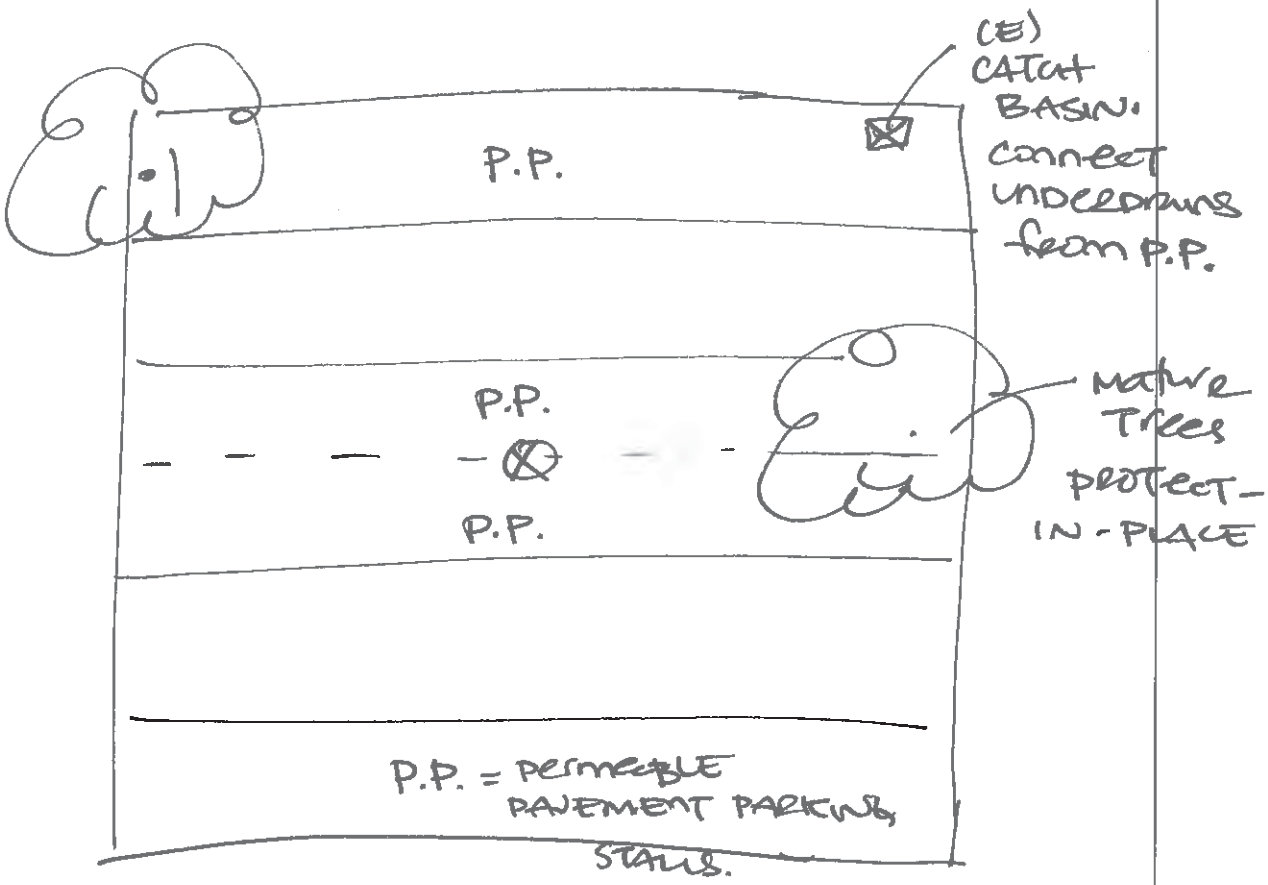
Existing mature trees: * IN CORNERS	☐ Yes	☒ No
Existing wetlands:	☐ Yes	☒ No
Existing stream or natural drainage:	☐ Yes	☒ No
Evidence of shallow bedrock:	☐ Yes	☒ No
Existing floodplain:	☐ Yes	☒ No

Other:_____

Site Candidate for Further Investigation: ☒ **Yes** ☐ **No** ☐ **Maybe**
If no, site candidate for Other Restoration Project(s): ☐ **Yes** ☐ **No** ☐ **Maybe**
If yes, type(s):_____

Unique Site ID:_____

Notes or Sketch



Unique Site ID: 24/25

Unique Site ID: 26		Watershed:	
City: PG		Subwatershed:	
Date: 5/31/16	Assessed By: BAC/RLC	Camera ID:	Pictures:

Site Description

Name: POST OFFICE
Address or Nearest Intersection:
Parcel Number:
Comments:

Ownership: ☒ Public ☐ Private ☐ Unknown
If Public, Government Jurisdiction: ☐ Local ☐ State ☐ DOT ☐ Other:

Potential Retrofit Location:

Storage
- ☐ Existing Pond
- ☐ Below Outfall
- ☐ In Transport ROW
- ☐ Other:
- ☐ Above Roadway Crossing
- ☐ In Conveyance System
- ☐ Large Parking Lot

On-Site
- ☐ Hotspot Operation
- ☒ Small Parking Lot
- ☒ Individual Street
- ☒ Individual Rooftop
- ☐ Small Impervious Area
- ☒ Landscape / Hardscape
- ☐ Underground
- ☐ Other:

Drainage Area to Site

Drainage Area ≈ _____
Imperviousness ≈ _____%
Impervious Area ≈ _____

Notes:

Drainage Area Land Use:
- ___% Residential
  - ___% SFH (< 1 ac lots)
  - ___% SFH (> 1 ac lots)
  - ___% Townhouses
  - ___% Multi-Family
- ___% Commercial
- ___% Institutional
- ___% Industrial
- ___% Transport-Related
- ___% Park
- ___% Undeveloped
- ___% Other:

Existing Site Conditions

Existing Stormwater BMP: ☐ Yes ☒ No ☐ Possible
If Yes, Describe:

Describe Existing Site Conditions, Including Existing Drainage and Conveyance Patterns:

→ DIRECTLY CONNECTED DOWNSPOUTS.
→ ROAD RUNOFF TO C.B.
→ NON-FUNCTIONAL TURF (UN-IRRIGATED)

Unique Site ID: 26

Considerations for Potential Retrofit Opportunity

Available Surface Area:

Paved:

Landscape:

Available Depth / Elevation Change:

Areas of Concern:

☒ Dumpsters ☐ Grease ☐ Chemicals ☐ Material Storage ☐ Erosion ☐ Pet waste ☐ Geese/Wildlife

Describe Obvious, Potential Retrofit Opportunity:

→ CONGRESS DIVERSION TO LANDSCAPE AREA
→ DISCONNECT S.D.S. TO (N) RAIN GARDENS / DRY SWALES IN NON-FUNCTIONAL TURF.
→ SW. TREE WELLS ON LIGHTHOUSE

☒ Possible Demonstration / Education Project

Site Constraints

Adjacent Land Use:

☐ Residential ☒ Commercial ☒ Institutional
☐ Industrial ☐ Transport-Related ☒ Park
☐ Undeveloped ☐ Other:

Possible Conflicts Due to Adjacent Land Use? ☐ Yes ☒ No
If Yes, Describe:

Access:

☐ No Access Constraints
Access Constrained due to
☐ Slope ☐ Space
☐ Utilities ☒ Tree Impacts
☐ Structures ☐ Property Ownership
☐ Other: NEWSPAPER KIOSKS.

Conflicts with Existing Utilities:

☐ None
☐ Unknown

Yes	Possible	
☐	☒	Sewer
☐	☒	Water
☐	☒	Gas
☐	☒	Cable
☐	☒	Electric
☐	☒	Electric to Streetlights
☐		Overhead Wires
☐	☐	Other:

Potential Ecological Conflict:

Existing mature trees:	☒ Yes	☐ No
Existing wetlands:	☐ Yes	☒ No
Existing stream or natural drainage:	☐ Yes	☒ No
Evidence of shallow bedrock:	☐ Yes	☒ No
Existing floodplain:	☐ Yes	☒ No

Other:

Site Candidate for Further Investigation: ☒ Yes ☐ No ☐ Maybe
If no, site candidate for Other Restoration Project(s): ☐ Yes ☐ No ☐ Maybe
If yes, type(s):

Unique Site ID:

Notes or Sketch

see field map

Unique Site ID: 26

Unique Site ID: 30		Watershed: A3BS	
City: PG		Subwatershed:	
Date: 5/31/16	Assessed By: BMC	Camera ID:	Pictures:

Site Description

Name: MAYFLOWER PRESBYTERIAN CHURCH
Address or Nearest Intersection:
Parcel Number:
Comments:

Ownership: ☐ Public ☒ Private ☐ Unknown
If Public, Government Jurisdiction: ☐ Local ☐ State ☐ DOT ☐ Other: CHURCH PRESCHOOL

Potential Retrofit Location:

Storage
- ☐ Existing Pond
- ☐ Below Outfall
- ☐ In Transport ROW
- ☐ Other:
- ☐ Above Roadway Crossing
- ☐ In Conveyance System
- ☐ Large Parking Lot

On-Site
- ☐ Hotspot Operation
- ☐ Small Parking Lot
- ☐ Individual Street
- ☒ Individual Rooftop (s)
- ☒ Small Impervious Area
- ☒ Landscape / Hardscape
- ☐ Underground
- ☐ Other:

Drainage Area to Site

Drainage Area ≈
Imperviousness ≈ %
Impervious Area ≈

Notes:

Drainage Area Land Use:
- % Residential
  - % SFH (< 1 ac lots)
  - % SFH (> 1 ac lots)
  - % Townhouses
  - % Multi-Family
- % Commercial
- % Institutional
- % Industrial
- % Transport-Related
- % Park
- % Undeveloped
- % Other:

Existing Site Conditions

Existing Stormwater BMP: ☐ Yes ☒ No ☐ Possible
If Yes, Describe:

DOWNSTREAM CATCH BASINS TO FLOW TO (N) CDS AT GREENWOOD PARK.

Describe Existing Site Conditions, Including Existing Drainage and Conveyance Patterns:

80% DOWNSPOUTS DIRECTLY CONNECTED ROAD RUNOFF TO (E) CATCHBASINS IN STREET. (E) TURF w/ POTENTIAL TO RETROFIT TO LID FOR DOWNSPOUT DIVERSION AND POSSIBLY ROADWAY RUNOFF COLLECTION.

Considerations for Potential Retrofit Opportunity

Available Surface Area:

Paved:

Landscape:

Available Depth / Elevation Change:

Areas of Concern:

☒ Dumpsters ☐ Grease ☐ Chemicals ☐ Material Storage ☐ Erosion ☐ Pet waste ☐ Geese/Wildlife

Describe Obvious, Potential Retrofit Opportunity:

NEW BIORETENTION / P.P. PATHWAY

☒ Possible Demonstration / Education Project

Site Constraints

Adjacent Land Use:

☒ Residential ☐ Commercial ☒ Institutional
☐ Industrial ☐ Transport-Related ☐ Park
☐ Undeveloped ☐ Other: CAMPUS

Possible Conflicts Due to Adjacent Land Use? ☐ Yes ☒ No
If Yes, Describe:

Access:

☐ No Access Constraints
Access Constrained due to
☒ Slope ☐ Space
☐ Utilities ☐ Tree Impacts
☒ Structures ☒ Property Ownership
☐ Other:

Conflicts with Existing Utilities:

☐ None
☐ Unknown

Yes	Possible	
☐	☐	Sewer
☐	☐	Water
☐	☐	Gas
☐	☐	Cable
☐	☐	Electric
☐	☐	Electric to Streetlights
☐	☐	Overhead Wires
☐	☐	Other:

Potential Ecological Conflict:

Existing mature trees: * NOT IN LOD	☐ Yes	☒ No
Existing wetlands: OPEN	☐ Yes	☒ No
Existing stream or natural drainage:	☐ Yes	☒ No
Evidence of shallow bedrock:	☐ Yes	☒ No
Existing floodplain:	☐ Yes	☒ No

Other:

Site Candidate for Further Investigation: ☒ Yes ☐ No ☐ Maybe
If no, site candidate for Other Restoration Project(s): ☐ Yes ☐ No ☐ Maybe
If yes, type(s):

Unique Site ID:

Notes or Sketch

see field map

Unique Site ID: 30

Unique Site ID: 31/32		**Watershed:** ABBS	
City: PG		**Subwatershed:**	
Date: 5/31/16	**Assessed By:** EMC	**Camera ID:**	**Pictures:**

Site Description

Name: 524 Central / ~~[illegible]~~ MONTEREY CREDIT UNION / PARKING private
Address or Nearest Intersection:
Parcel Number:
Comments:

Ownership: ☐ Public ☒ Private ☐ Unknown
If Public, Government Jurisdiction: ☐ Local ☐ State ☐ DOT ☐ Other:

Potential Retrofit Location:

Storage
- ☐ Existing Pond
- ☐ Below Outfall
- ☐ In Transport ROW
- ☐ Other:
- ☐ Above Roadway Crossing
- ☐ In Conveyance System
- ☐ Large Parking Lot

On-Site
- ☐ Hotspot Operation
- ☒ Small Parking Lot
- ☒ Individual Street
- ☒ Individual Rooftop
- ☐ Small Impervious Area
- ☒ Landscape / Hardscape
- ☐ Underground
- ☐ Other:

Drainage Area to Site

Drainage Area ≈ _____
Imperviousness ≈ _____%
Impervious Area ≈ _____

Notes:

Drainage Area Land Use:
- ___% Residential
  - ___% SFH (< 1 ac lots)
  - ___% SFH (> 1 ac lots)
  - ___% Townhouses
  - ___% Multi-Family
- ___% Commercial
- ___% Institutional
- ___% Industrial
- ___% Transport-Related
- ___% Park
- ___% Undeveloped
- ___% Other:

Existing Site Conditions

Existing Stormwater BMP: ☐ Yes ☒ No ☐ Possible
If Yes, Describe:

CAN DIVERT RUNOFF FROM 15th and FOUNTAIN TO NEW LID IN ROW. DIVERT DOWNSPOUTS TO RETROFITTED PLANTERS.

Describe Existing Site Conditions, Including Existing Drainage and Conveyance Patterns:

(E) RUNOFF TO CB. → SOME EVIDENCE OF PONDING @ LOW SPOT NEAR MONARCH KNITTING.

Considerations for Potential Retrofit Opportunity

Available Surface Area:

Paved:

Landscape:

Available Depth / Elevation Change:

Areas of Concern:

☒ Dumpsters ☐ Grease ☐ Chemicals ☐ Material Storage ☐ Erosion ☐ Pet waste ☐ Geese/Wildlife

Describe Obvious, Potential Retrofit Opportunity:

see previous description.

☐ Possible Demonstration / Education Project

Site Constraints

Adjacent Land Use:

☐ Residential ☒ Commercial ☐ Institutional
☐ Industrial ☐ Transport-Related ☐ Park
☐ Undeveloped ☐ Other:_____

Possible Conflicts Due to Adjacent Land Use? ☐ Yes ☒ No
If Yes, Describe:_____

Access:

☐ No Access Constraints
Access Constrained due to
☐ Slope ☐ Space
☐ Utilities ☐ Tree Impacts
☐ Structures ☒ Property Ownership
☐ Other:_____

Conflicts with Existing Utilities:

☐ None
☐ Unknown

Yes	Possible	
☐	☒	Sewer
☐	☒	Water
☐	☒	Gas
☐	☒	Cable
☐	☒	Electric
☐	☒	Electric to Streetlights
☐	☐	Overhead Wires
☐	☐	Other:_____

Potential Ecological Conflict:

Existing mature trees:	☐ Yes	☒ No
Existing wetlands:	☐ Yes	☒ No
Existing stream or natural drainage:	☐ Yes	☒ No
Evidence of shallow bedrock:	☐ Yes	☒ No
Existing floodplain:	☐ Yes	☒ No

Other:_____

Site Candidate for Further Investigation: ☒ **Yes** ☐ **No** ☐ **Maybe**
If no, site candidate for Other Restoration Project(s): ☐ **Yes** ☐ **No** ☐ **Maybe**
If yes, type(s):_____

Unique Site ID:_____

Notes or Sketch

see field map

Unique Site ID: 31/32

Unique Site ID: 34/35		**Watershed:**	
City: PG		**Subwatershed:**	
Date: 5/31/16	**Assessed By:**	**Camera ID:**	**Pictures:**

Site Description

Name: ~~CHATANUGA~~ CHATTAUQUA HALL.
Address or Nearest Intersection:
Parcel Number:
Comments: one res. private D.S. for disconnect.

Ownership: ☒ Public ☒ Private ☐ Unknown
If Public, Government Jurisdiction: ☐ Local ☐ State ☐ DOT ☐ Other:

Potential Retrofit Location:

Storage
- ☐ Existing Pond
- ☐ Below Outfall
- ☐ In Transport ROW
- ☐ Other:
- ☐ Above Roadway Crossing
- ☐ In Conveyance System
- ☐ Large Parking Lot

On-Site
- ☐ Hotspot Operation
- ☐ Small Parking Lot
- ☐ Individual Street
- ☒ Individual Rooftop
- ☐ Small Impervious Area
- ☒ Landscape / Hardscape
- ☐ Underground
- ☐ Other:

Drainage Area to Site

Drainage Area ≈
Imperviousness ≈ %
Impervious Area ≈

Notes:

Drainage Area Land Use:
- % Residential
  - % SFH (< 1 ac lots)
  - % SFH (> 1 ac lots)
  - % Townhouses
  - % Multi-Family
- % Commercial
- % Institutional
- % Industrial
- % Transport-Related
- % Park
- % Undeveloped
- % Other:

Existing Site Conditions

Existing Stormwater BMP: ☐ Yes ☒ No ☐ Possible
If Yes, Describe:

Describe Existing Site Conditions, Including Existing Drainage and Conveyance Patterns:

ARCHITECTURAL CU. DNSPTS AND GUTTER ~75% DIRECTLY CONNECTED. ROAD RUNOFF TO CATCH BASINS. PARK/BENCHES/TABLES ATT (E) PERVIOUS AREA.

Considerations for Potential Retrofit Opportunity

Available Surface Area:

Paved:

Landscape:

Available Depth / Elevation Change:

Areas of Concern:

☐ Dumpsters ☐ Grease ☐ Chemicals ☐ Material Storage ☐ Erosion ☐ Pet waste ☐ Geese/Wildlife

Describe Obvious, Potential Retrofit Opportunity:

DISCONNECT ?
DIVERT DOWNSPOUTS TO RETROFITTED RAIN GARDENS.

☒ Possible Demonstration / Education Project

Site Constraints

Adjacent Land Use:

☒ Residential ☒ Commercial ☐ Institutional
☐ Industrial ☐ Transport-Related ☐ Park
☐ Undeveloped ☐ Other: PARKING.

Possible Conflicts Due to Adjacent Land Use? ☐ Yes ☒ No
If Yes, Describe: \

Access:

☐ No Access Constraints
Access Constrained due to
☐ Slope ☐ Space
☐ Utilities ☐ Tree Impacts
☐ Structures ☐ Property Ownership
☐ Other:

Conflicts with Existing Utilities:

☐ None
☐ Unknown

Yes	Possible	
☐	☒	Sewer
☐	☒	Water
☐	☒	Gas
☐	☒	Cable
☐	☒	Electric
☐	☒	Electric to Streetlights
☐		Overhead Wires
☐	☐	Other:

Potential Ecological Conflict:

Existing mature trees:	☒ Yes	☐ No
Existing wetlands:	☐ Yes	☒ No
Existing stream or natural drainage:	☐ Yes	☒ No
Evidence of shallow bedrock:	☐ Yes	☒ No
Existing floodplain:	☐ Yes	☒ No

Other:

Site Candidate for Further Investigation: ☒ Yes ☐ No ☐ Maybe
If no, site candidate for Other Restoration Project(s): ☐ Yes ☐ No ☐ Maybe
If yes, type(s):

Unique Site ID:

Notes or Sketch

see field map.

Unique Site ID: 34/35

Unique Site ID: 37		**Watershed:**	
City:		**Subwatershed:**	
Date: 6/6/16	**Assessed By:** BMC	**Camera ID:**	**Pictures:**

Site Description SALLY GRIFFIN.

Name: SENIOR CENTER
Address or Nearest Intersection:
Parcel Number:
Comments:

Ownership: ☒ Public ☐ Private ☐ Unknown
If Public, Government Jurisdiction: ☐ Local ☐ State ☐ DOT ☐ Other:

Potential Retrofit Location:

Storage
- ☐ Existing Pond
- ☐ Below Outfall
- ☐ In Transport ROW
- ☐ Other:
- ☐ Above Roadway Crossing
- ☐ In Conveyance System
- ☐ Large Parking Lot

On-Site
- ☐ Hotspot Operation
- ☐ Small Parking Lot
- ☐ Individual Street
- ☐ Individual Rooftop
- ☐ Small Impervious Area
- ☐ Landscape / Hardscape
- ☐ Underground
- ☐ Other:

Drainage Area to Site

Drainage Area ≈
Imperviousness ≈ %
Impervious Area ≈

Notes:

Drainage Area Land Use:
- % Residential
  - % SFH (< 1 ac lots)
  - % SFH (> 1 ac lots)
  - % Townhouses
  - % Multi-Family
- % Commercial
- % Institutional
- % Industrial
- % Transport-Related
- % Park
- % Undeveloped
- % Other:

Existing Site Conditions

Existing Stormwater BMP: ☐ Yes ☒ No ☐ Possible
If Yes, Describe:

Describe Existing Site Conditions, Including Existing Drainage and Conveyance Patterns:

→ DRIP IRRIGATION to Native/DROUGHT TOLERANT LANDSCAPING → SOME SPRAY

→ INTERNAL DOWNSPOUTS.

→ UTILITIES IN FRONT (ON JEWELL) LANDSCAPE AREA. → limit/CONSTRICT DIVERSION OF ROAD RUNOFF TO RETROFITED BIORETENTION.

Considerations for Potential Retrofit Opportunity

Available Surface Area:

Paved:

Landscape:

Available Depth / Elevation Change:

Areas of Concern:

☐ Dumpsters ☐ Grease ☐ Chemicals ☐ Material Storage ☐ Erosion ☐ Pet waste ☐ Geese/Wildlife

Describe Obvious, Potential Retrofit Opportunity:

PERMEABLE PAVEMENT PARKING → WOULD CAPTURE/
TREAT ROOF DRAINS DISCHARGING TO STREET.
→ POTENTIAL LED BULB CONVERSIONS

☒ Possible Demonstration / Education Project

Site Constraints

Adjacent Land Use:

☐ Residential ☐ Commercial ☐ Institutional
☐ Industrial ☐ Transport-Related ☒ Park
☐ Undeveloped ☐ Other: GOLF

Possible Conflicts Due to Adjacent Land Use? ☐ Yes ☒ No
If Yes, Describe:

Access:

☒ No Access Constraints
Access Constrained due to
☐ Slope ☐ Space
☐ Utilities ☐ Tree Impacts
☐ Structures ☐ Property Ownership
☐ Other:

Conflicts with Existing Utilities:

☐ None
☐ Unknown

Yes	Possible	
☐	☒	Sewer
☐	☒	Water
☐	☒	Gas
☐	☒	Cable
☐	☒	Electric
☐	☐	Electric to Streetlights
☐		Overhead Wires
☐	☐	Other:

Potential Ecological Conflict:

Existing mature trees:	☒ Yes	☐ No
Existing wetlands:	☐ Yes	☒ No
Existing stream or natural drainage:	☐ Yes	☒ No
Evidence of shallow bedrock:	☐ Yes	☒ No
Existing floodplain:	☐ Yes	☒ No

Other:

Site Candidate for Further Investigation: ☒ Yes ☐ No ☐ Maybe
If no, site candidate for Other Restoration Project(s): ☐ Yes ☐ No ☐ Maybe
If yes, type(s):

Unique Site ID:

Notes or Sketch

see field map.

Unique Site ID: 37

Unique Site ID: 38		**Watershed:** ASBS	
City: PG		**Subwatershed:**	
Date: 5/31/16	**Assessed By:**	**Camera ID:**	**Pictures:**

Site Description

Name: MUSEUM
Address or Nearest Intersection:
Parcel Number:
Comments:

Ownership: ☒ Public ☐ Private ☐ Unknown
If Public, Government Jurisdiction: ☐ Local ☐ State ☐ DOT ☐ Other:

Potential Retrofit Location:

Storage
- ☐ Existing Pond
- ☐ Below Outfall
- ☐ In Transport ROW
- ☐ Other:
- ☐ Above Roadway Crossing
- ☐ In Conveyance System
- ☐ Large Parking Lot

On-Site
- ☐ Hotspot Operation
- ☐ Small Parking Lot
- ☑ Individual Street
- ☐ Individual Rooftop
- ☐ Small Impervious Area
- ☒ Landscape / Hardscape
- ☐ Underground
- ☐ Other:

Drainage Area to Site

Drainage Area ≈ _____
Imperviousness ≈ _____%
Impervious Area ≈ _____

Notes:

Drainage Area Land Use:
- ___% Residential
  - ___% SFH (< 1 ac lots)
  - ___% SFH (> 1 ac lots)
  - ___% Townhouses
  - ___% Multi-Family
- ___% Commercial
- ___% Institutional
- ___% Industrial
- ___% Transport-Related
- ___% Park
- ___% Undeveloped
- ___% Other:

Existing Site Conditions

Existing Stormwater BMP: ☐ Yes ☒ No ☐ Possible
If Yes, Describe:

Describe Existing Site Conditions, Including Existing Drainage and Conveyance Patterns:

DIRECTLY CONNECTED CU. DOWNSPOUTS
ROADWAY TO CATCH BASINS.

Considerations for Potential Retrofit Opportunity

Available Surface Area:

Paved:

Landscape:

Available Depth / Elevation Change:

Areas of Concern:

☐ Dumpsters ☐ Grease ☐ Chemicals ☐ Material Storage ☐ Erosion ☐ Pet waste ☐ Geese/Wildlife

Describe Obvious, Potential Retrofit Opportunity:

DOWNSPOUTS TO RAINGARDENS.
PERM PAVERS @ ENTRANCE

☒ Possible Demonstration / Education Project

Site Constraints

Adjacent Land Use:

☐ Residential ☒ Commercial ☒ Institutional
☐ Industrial ☐ Transport-Related ☒ Park LIBRARY.
☐ Undeveloped ☐ Other: PARKING

Possible Conflicts Due to Adjacent Land Use? ☐ Yes ☒ No
If Yes, Describe:

Access:

☒ No Access Constraints
Access Constrained due to
☐ Slope ☐ Space
☐ Utilities ☐ Tree Impacts
☐ Structures ☐ Property Ownership
☐ Other:

Conflicts with Existing Utilities:

☐ None
☐ Unknown

Yes	Possible	
☐	☒	Sewer
☐	☒	Water
☐	☒	Gas
☐	☒	Cable
☐	☒	Electric
☐	☒	Electric to Streetlights
☐	☒	Overhead Wires
☐	☐	Other:

Potential Ecological Conflict:

Existing mature trees:	☒ Yes	☐ No
Existing wetlands:	☐ Yes	☒ No
Existing stream or natural drainage:	☐ Yes	☒ No
Evidence of shallow bedrock:	☐ Yes	☒ No
Existing floodplain:	☐ Yes	☒ No

Other:

Site Candidate for Further Investigation: ☒ Yes ☐ No ☐ Maybe
If no, site candidate for Other Restoration Project(s): ☐ Yes ☐ No ☐ Maybe
If yes, type(s):

Unique Site ID:

Notes or Sketch

see field map

Unique Site ID: 38

Unique Site ID: 39		**Watershed:**	
City:		**Subwatershed:**	
Date: 6/6/31	**Assessed By:**	**Camera ID:**	**Pictures:**

Site Description

Name: Robert Down Elementary School
Address or Nearest Intersection:
Parcel Number:
Comments:

Ownership: ☒ Public ☐ Private ☐ Unknown
If Public, Government Jurisdiction: ☒ Local ☐ State ☐ DOT ☐ Other: PGUSD

Potential Retrofit Location:

Storage
- ☐ Existing Pond
- ☐ Below Outfall
- ☐ In Transport ROW
- ☐ Other:
- ☐ Above Roadway Crossing
- ☐ In Conveyance System
- ☐ Large Parking Lot

On-Site
- ☐ Hotspot Operation
- ☐ Small Parking Lot
- ☐ Individual Street
- ☐ Individual Rooftop
- ☐ Small Impervious Area
- ☐ Landscape / Hardscape
- ☐ Underground
- ☐ Other:

Drainage Area to Site

Drainage Area ≈
Imperviousness ≈ %
Impervious Area ≈

Notes:

Drainage Area Land Use:
- ___% Residential
  - ___% SFH (< 1 ac lots)
  - ___% SFH (> 1 ac lots)
  - ___% Townhouses
  - ___% Multi-Family
- ___% Commercial
- ___% Institutional
- ___% Industrial
- ___% Transport-Related
- ___% Park
- ___% Undeveloped
- ___% Other:

Existing Site Conditions

Existing Stormwater BMP: ☐ Yes ☒ No ☐ Possible
If Yes, Describe:

Describe Existing Site Conditions, Including Existing Drainage and Conveyance Patterns:

→ Directly connected Downspouts
→ Irrigated turf
→ AC roads + play yard
→ Concrete walkways

Considerations for Potential Retrofit Opportunity

Available Surface Area:

Paved:

Landscape:

Available Depth / Elevation Change:

Areas of Concern:

☐ Dumpsters ☐ Grease ☐ Chemicals ☐ Material Storage ☐ Erosion ☐ Pet waste ☐ Geese/Wildlife

Describe Obvious, Potential Retrofit Opportunity: → surface soils appear sandy.
→ DISCONNECT DOWNSPOUTS AT FRONT OF SCHOOL TO CREATE DEMONSTRATION AND GARDEN.
→ USE PORTION OF SCHOOL PROPERTY TO TREAT SPRUCE + 13TH RUNOFF

☒ Possible Demonstration / Education Project

Site Constraints → BURIED CISTERN CONCEPT from SMP.

Adjacent Land Use:
☒ Residential ☐ Commercial ☐ Institutional
☐ Industrial ☐ Transport-Related ☒ Park
☐ Undeveloped ☐ Other:_____

Possible Conflicts Due to Adjacent Land Use? ☐ Yes ☒ No
If Yes, Describe:_____

Access:
☒ No Access Constraints
Access Constrained due to
☐ Slope ☐ Space
☐ Utilities ☐ Tree Impacts
☐ Structures ☐ Property Ownership
☐ Other:_____

Conflicts with Existing Utilities:
☐ None
☐ Unknown

Yes	Possible	
☐	☒	Sewer
☐	☒	Water
☐	☒	Gas
☐	☒	Cable
☐	☒	Electric
☐	☐	Electric to Streetlights
☐		Overhead Wires
☐	☐	Other:_____

Potential Ecological Conflict:

Existing mature trees: ANDICABLE	☐ Yes	☒ No
Existing wetlands:	☐ Yes	☒ No
Existing stream or natural drainage:	☐ Yes	☒ No
Evidence of shallow bedrock:	☐ Yes	☒ No
Existing floodplain:	☐ Yes	☒ No

Other:_____

Site Candidate for Further Investigation: ☒ Yes ☐ No ☐ Maybe
If no, site candidate for Other Restoration Project(s): ☐ Yes ☐ No ☐ Maybe
If yes, type(s):_____

Unique Site ID:_____

Notes or Sketch

see field map.

Unique Site ID: 39

Unique Site ID: 40/41		**Watershed:**	
City:		**Subwatershed:**	
Date: 6/6/31	**Assessed By:**	**Camera ID:**	**Pictures:**

Site Description

Name: PG MIDDLE SCHOOL
Address or Nearest Intersection:
Parcel Number:
Comments:

Ownership: ☒ Public ☐ Private ☐ Unknown
If Public, Government Jurisdiction: ☒ Local ☐ State ☐ DOT ☐ Other:

Potential Retrofit Location:

Storage
- ☐ Existing Pond
- ☐ Below Outfall
- ☐ In Transport ROW
- ☐ Other:
- ☐ Above Roadway Crossing
- ☐ In Conveyance System
- ☐ Large Parking Lot

On-Site
- ☐ Hotspot Operation
- ☒ ~~Small~~ Parking Lot
- ☒ Individual Street
- ☒ Individual Rooftop
- ☒ Small Impervious Area
- ☒ Landscape / Hardscape
- ☐ Underground
- ☐ Other:

Drainage Area to Site

Drainage Area ≈ _____
Imperviousness ≈ _____%
Impervious Area ≈ _____

Notes:

Drainage Area Land Use:
- ___% Residential
  - ___% SFH (< 1 ac lots)
  - ___% SFH (> 1 ac lots)
  - ___% Townhouses
  - ___% Multi-Family
- ___% Commercial
- ___% Institutional
- ___% Industrial
- ___% Transport-Related
- ___% Park
- ___% Undeveloped
- ___% Other:

Existing Site Conditions

Existing Stormwater BMP: ☐ Yes ☒ No ☐ Possible
If Yes, Describe:

Describe Existing Site Conditions, Including Existing Drainage and Conveyance Patterns:

→ SCHOOL BLDGS w/ Down Spouts (D.S.)
→ A.C. ROADWAYS TO CATCH BASINS C.B.
→ FIELD/SPORTING AREA.

Considerations for Potential Retrofit Opportunity

Available Surface Area:

Paved:

Landscape:

Available Depth / Elevation Change:

~~**Areas of Concern:**~~

→ BIORETENTION TO TREAT ROAD RUNOFF
→ DISCONNECT S.D.s (STORM DRAINS) TO PLANTERS AND OR CISTERN TO H2O SCHOOL GARDEN, AND/OR PERM. PAVEMENT.
→ PERMEABLE PAVEMENT (P.P.) WALKWAYS + (N) PARKING AREA

☐ Dumpsters ☐ Grease ☐ Chemicals ☐ Material Storage ☐ Erosion ☐ Pet waste ☐ Geese/Wildlife

Describe Obvious, Potential Retrofit Opportunity:

- DIVERT ROADWAY runoff TO TURF @ SCHOOL ENTRANCE,
- CISTERN BENEATH PARKING AREA TO PROVIDE IRRIGATION TO TURF.

☒ Possible Demonstration / Education Project

Site Constraints

Adjacent Land Use:

☒ Residential ☐ Commercial ☒ Institutional
☐ Industrial ☐ Transport-Related ☐ Park
☐ Undeveloped ☐ Other:_____

Possible Conflicts Due to Adjacent Land Use? ☐ Yes ☒ No
If Yes, Describe:_____

Access:

☐ No Access Constraints
Access Constrained due to
☐ Slope ☐ Space
☒ Utilities ☒ Tree Impacts
☐ Structures ☐ Property Ownership
☐ Other:_____

Conflicts with Existing Utilities:

☐ None
☐ Unknown

Yes	Possible	
☐	☒	Sewer
☐	☒	Water
☐	☒	Gas
☐	☒	Cable
☐	☒	Electric
☐	☐	Electric to Streetlights
☐		Overhead Wires
☐	☐	Other:_____

Potential Ecological Conflict:

Existing mature trees:	☒ Yes	☐ No
Existing wetlands:	☐ Yes	☒ No
Existing stream or natural drainage:	☐ Yes	☒ No
Evidence of shallow bedrock:	☐ Yes	☒ No
Existing floodplain:	☐ Yes	☒ No

Other:_____

Site Candidate for Further Investigation: ☒ Yes ☐ No ☐ Maybe
If no, site candidate for Other Restoration Project(s): ☐ Yes ☐ No ☐ Maybe
If yes, type(s):_____

Unique Site ID:_____

Notes or Sketch

On FOUNTAIN AVE COURTYARD → perm. pavement
+ convert planters to bioretention w/ curb cuts.
connection to school → non-permeable pavers.

PGUSD offices P.L. → P.P. stalls. and/or → LID in b/w?
→ LID along Hillcrest → nuisance flows
take out parking aisle, on North side
replace w/ LID.
→ and/or L.A. (N) LID Bulbo @ ⊥ Hillcrest w/ camel.
→ (N) swale down toward. Sinex → signs of
(E) seep/spring.

→ (N) CB on Sinex (under construction) MISSED
OPPORTUNITY TO BE BIORETENTION/RAIN GARDEN
FACILITY

→ Divert runoff from Forest to (N) Bioretention
around sign (pocket-in place.) use (E)
Area drain in grass as overflow.
→ 3 SIMILAR OPPORTUNITIES (see MAP)

Unique Site ID: 40/41

Unique Site ID: 42		**Watershed:**	
City:		**Subwatershed:**	
Date: 6/6/16	**Assessed By:**	**Camera ID:**	**Pictures:**

Site Description

Name: PG HIGH SCHOOL
Address or Nearest Intersection:
Parcel Number:
Comments:

Ownership: ☒ Public ☐ Private ☐ Unknown
If Public, Government Jurisdiction: ☒ Local ☐ State ☐ DOT ☐ Other: PGUSD.

Potential Retrofit Location:

Storage
- ☐ Existing Pond
- ☐ Below Outfall
- ☐ In Transport ROW
- ☐ Other:
- ☐ Above Roadway Crossing
- ☐ In Conveyance System
- ☐ Large Parking Lot

On-Site
- ☐ Hotspot Operation
- ☐ Small Parking Lot
- ☐ Individual Street
- ☐ Individual Rooftop
- ☐ Small Impervious Area
- ☐ Landscape / Hardscape
- ☐ Underground
- ☐ Other:

Drainage Area to Site

Drainage Area ≈ _____
Imperviousness ≈ _____%
Impervious Area ≈ _____

Notes:

Drainage Area Land Use:
- ___% Residential
  - ___% SFH (< 1 ac lots)
  - ___% SFH (> 1 ac lots)
  - ___% Townhouses
  - ___% Multi-Family
- ___% Commercial
- ___% Institutional
- ___% Industrial
- ___% Transport-Related
- ___% Park
- ___% Undeveloped
- ___% Other:

Existing Site Conditions

Existing Stormwater BMP: ☐ Yes ☒ No ☐ Possible
If Yes, Describe:

Describe Existing Site Conditions, Including Existing Drainage and Conveyance Patterns:

AC PARKING LOTS DIRECT DRAIN TO CATCHBASINS.

Considerations for Potential Retrofit Opportunity

Available Surface Area:

Paved:

Landscape:

Available Depth / Elevation Change:

Areas of Concern:

☐ Dumpsters ☐ Grease ☐ Chemicals ☐ Material Storage ☐ Erosion ☐ Pet waste ☐ Geese/Wildlife

Describe Obvious, Potential Retrofit Opportunity:

→ PERMEABLE PAVEMENT AND/OR BIORETENTION.

☒ Possible Demonstration / Education Project

Site Constraints

Adjacent Land Use:

☒ Residential ☐ Commercial ☐ Institutional
☐ Industrial ☐ Transport-Related ☐ Park
☐ Undeveloped ☐ Other:_____

Possible Conflicts Due to Adjacent Land Use? ☐ Yes ☒ No
If Yes, Describe:_____

Access:

☒ No Access Constraints
Access Constrained due to
☒ Slope ☐ Space
☐ Utilities ☐ Tree Impacts
☐ Structures ☐ Property Ownership
☐ Other:_____

Conflicts with Existing Utilities:

☐ None
☐ Unknown

Yes	Possible	
☐	☒	Sewer
☐	☒	Water
☐	☒	Gas
☐	☒	Cable
☐	☒	Electric
☐	☐	Electric to Streetlights
☐		Overhead Wires
☐	☐	Other:_____

Potential Ecological Conflict:

Existing mature trees: *ANDIDARIE	☒ Yes	☐ No
Existing wetlands:	☐ Yes	☒ No
Existing stream or natural drainage:	☐ Yes	☒ No
Evidence of shallow bedrock:	☐ Yes	☒ No
Existing floodplain:	☐ Yes	☒ No

Other:_____

Site Candidate for Further Investigation: ☒ **Yes** ☐ **No** ☐ **Maybe**
If no, site candidate for Other Restoration Project(s): ☐ **Yes** ☐ **No** ☐ **Maybe**
If yes, type(s):_____

Unique Site ID:_____

STORMWATER LID ASSESSMENT

ATTACHMENT B: LID SCHEMATIC DESIGN SET

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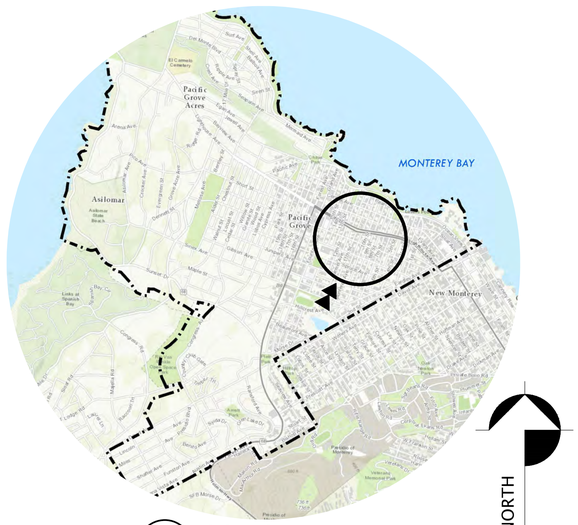
LOW IMPACT DEVELOPMENT (LID) SCHEMATIC DESIGNS

URBAN GREENING PLAN, PACIFIC GROVE, CALIFORNIA

1 VICINITY MAP
SCALE: NTS



2 LOCATION MAP
SCALE: NTS

3 PROJECT LOCATIONS
SCALE: NTS

PROJECT BACKGROUND

EMPLOYING LOW IMPACT DEVELOPMENT (LID) GREEN INFRASTRUCTURE TECHNIQUES TO MEET STORMWATER REGULATIONS ALLOWS STORMWATER MANAGERS TO MEET MULTIPLE OBJECTIVES IN A WAY THAT MIMICS A SITE'S NATURAL FUNCTION AND MAXIMIZES OVERALL WATER QUALITY AND QUANTITY IMPROVEMENTS.

THE FIVE LID PROJECTS IN THIS DRAWING SET WERE SELECTED THROUGH THE CITY OF PACIFIC GROVE'S URBAN GREENING PLAN STORMWATER LID ASSESSMENT (LID ASSESSMENT). THE LID ASSESSMENT CONSIDERED THE OUTCOMES OF ALL THE PREVIOUS URBAN GREENING PLAN ELEMENTS AND PUBLIC INPUT WITH THE PURPOSE OF:

- IDENTIFYING A SUITE OF POTENTIAL URBAN GREENING PROJECTS THAT MEET THE URBAN GREENING PLAN GOALS AND OBJECTIVES; AND
- DEVELOPING CONCEPT DESIGNS, AT A LEVEL SUFFICIENT TO SEEK FUNDING, FOR PROJECTS THAT PROVIDE MULTIPLE COMMUNITY BENEFITS.

TO BEGIN THE PROCESS OF SELECTING THE FIVE LID PROJECTS IN THIS DRAWING SET, FCE COMPLETED A GIS BASED DESKTOP EVALUATION TO IDENTIFY PRIORITY PARCELS FOR A SITE VISIT AND EVALUATION OF LID RETROFIT OPPORTUNITIES. OVER THE COURSE OF FOUR (4) FIELD DAYS IN MAY AND JUNE OF 2016 FCE VISITED THE TOP 40 SITES IDENTIFIED IN THE DESKTOP EVALUATION. EACH SITE WAS EVALUATED FOR POTENTIAL LID STRATEGIES AND DESIGNS USING A COMMON FIELD EVALUATION WORKSHEET. EMPHASIS WAS PLACED ON PROJECT CONCEPTS WITH HIGH PUBLIC VISIBILITY, EXISTING GRADING THAT COULD SUPPORT AN LID RETROFIT WITH RELATIVELY LOW COMPLEXITY, AND THE OPPORTUNITY TO PROVIDE WATER QUALITY TREATMENT TO SUPPORT ASBS COMPLIANCE. A SCORING TEMPLATE AND A PRIORITIZATION MATRIX WERE USED TO COMPARE ALL THE PARCELS AND IDENTIFY 15 SITES TO RECOMMEND FOR DEVELOPMENT INTO LID CONCEPT PLANS.

A FACILITATED PUBLIC WORKSHOP WAS HELD ON SEPTEMBER 16, 2016 FOR COMMUNITY MEMBERS TO PROVIDE VALUABLE INPUT ON THE LID AND URBAN GREENING PLAN DEVELOPMENT. THE WORKSHOP PROVIDED AN OVERVIEW OF THE DRAFT URBAN GREENING PLAN, INCLUDING THE APPROACH, POSSIBLE LID RETROFIT LOCATIONS, AND TIMELINE. THE TOP FIVE COMMUNITY AND CITY SELECTED PROJECTS WILL BE DEVELOPED INTO THE SCHEMATIC LEVEL DESIGN CONCEPTS IN THIS DRAWING SET.

PROJECT DESCRIPTIONS

THIS DRAWING SET INCLUDES SCHEMATIC DESIGN DEVELOPMENT TO THE 15% LEVEL OF COMPLETION FOR FIVE (5) LOW IMPACT DEVELOPMENT (LID) PROJECTS IN THE CITY OF PACIFIC GROVE.

1. PINE AVENUE COMPLETE STREET CORRIDOR
THE EXISTING PINE AVENUE STREET CONFIGURATION INCLUDES TWO-LANES EACH FOR EAST AND WEST BOUND VEHICLE TRAFFIC, AND INCLUDES THE INTERSECTION WITH THE HIGHEST RECORDED NUMBER OF PEDESTRIAN VEHICLE COLLISIONS IN THE CITY (AT PINE AND FOREST AVENUES). THE CURRENT STREET WIDTH IS OVER-WIDE FOR THE AMOUNT OF VEHICLE TRAFFIC IT RECEIVES AND DOES NOT ADEQUATELY PROVIDE SAFE PEDESTRIAN OR BICYCLE PATHWAYS. ADDITIONALLY, PINE AVENUE TRANSECTS MULTIPLE HIGH PRIORITY SUBWATERSHEDS DRAINING INTO THE STATE DESIGNATED AREA OF SPECIAL BIOLOGICAL SIGNIFICANCE (ASBS) THAT EXTENDS ALONG THE CITY'S COASTLINE. THE PINE AVENUE COMPLETE STREET CORRIDOR SCHEMATIC DESIGN PROVIDES SIX (6) STREET LAYOUT ALTERNATIVES FOR THE CITY AND THE COMMUNITY TO CONSIDER DURING DEVELOPMENT OF A PINE AVENUE COMPLETE STREET CORRIDOR PLAN. EACH ALTERNATIVE IDENTIFIES LID BIORETENTION STORMWATER TREATMENT FACILITIES, STREET PARKING, DESIGNATED BICYCLE LANES, VEHICLE LANES, AND SOME ALTERNATIVES INCLUDE CENTRAL LANDSCAPE MEDIANS, ALL WITHIN THE EXISTING PINE AVENUE STREET AND LANDSCAPE WIDTH.
2. (FANDANGO) CITY PARKING LOT LID IMPROVEMENTS
THIS CITY PARKING LOT IS LOCATED BETWEEN 16TH AND 17TH STREET IN THE DOWNTOWN BUSINESS DISTRICT, NORTH OF THE FANDANGO RESTAURANT. THE PROPOSED LID RETROFIT OF THIS PARKING LOT CONVERTS THE CENTER PARKING AISLES TO BIORETENTION PLANTERS WITH CURB CUTS TO RECEIVE RUNOFF FROM THE PARKING LOT SURFACE. PERMEABLE PAVER PATHWAYS AND SAFE PEDESTRIAN "BRIDGE" CROSSINGS HAVE BEEN LOCATED NEAR EXISTING LIGHT FIXTURES AND ACROSS EACH OF THE LINEAR BIORETENTION FACILITIES TO SAFELY CONVEY PEDESTRIANS NORTH TO SOUTH ALONG THE PARKING LOT. NEW BIORETENTION BULBS WITH CURB CUTS TO RECEIVE STORMWATER RUNOFF ARE ALSO PROPOSED ADJACENT TO THE EXISTING SIDEWALK ON 17TH STREET TO CAPTURE AND TREAT RUNOFF FROM THIS ROADWAY.
3. LIGHTHOUSE AVENUE COMPLETE STREET CONCEPT
THE COMPLETE STREET CONCEPT HAS BEEN DEVELOPED FOR THE SECTION OF LIGHTHOUSE AVENUE EXTENDING JUST WEST OF 16TH STREET EAST TOWARDS GRAND AVENUE. THE PROPOSED LID DESIGN CONCEPTS EXPAND UPON THE 'LIGHTHOUSE AVENUE STREETSCAPE IMPROVEMENTS' SCHEMATIC DESIGN PREPARED FOR THE CITY OF PACIFIC GROVE BY WR&D IN JANUARY OF 2016 (1/11/16). SPECIFICALLY, THE CENTER AND SIDE PARKING AISLES AND CROSSWALKS IN THIS DOWNTOWN CORRIDOR COULD BE CONVERTED INTO PERMEABLE PAVEMENT STRIPS FOR STORMWATER RETENTION. MANY OF THE EXISTING AND PROPOSED LANDSCAPE BULBS COULD BE CONVERTED TO BIORETENTION LID FEATURES BY USING CURB CUTS TO PROVIDE WATER QUALITY TREATMENT OF THE ROADWAY AND PARKING AREA STORMWATER RUNOFF.
4. LIBRARY RAIN GARDEN AND BIORETENTION ISLANDS
NEW LID BIORETENTION LANDSCAPE ISLANDS COULD BE INSTALLED NEAR THE PACIFIC GROVE PUBLIC LIBRARY AT THE CORNER OF CENTRAL AND FOUNTAIN AVENUE INTERSECTIONS TO TREAT RUNOFF FROM BOTH ROADWAYS. THE BIORETENTION ISLANDS INCLUDE CURB CUTS TO ALLOW DIVERSION OF STORMWATER RUNOFF FROM THE ROADWAY AND A PLANTING MEDIUM COMPOSED OF A STRUCTURAL SOIL TO SUPPORT PLANT GROWTH AND MAXIMIZE POLLUTANT REMOVAL CAPACITY. THE OVERFLOW FROM THE NEW BIORETENTION ISLANDS WOULD BE DIRECTED INTO THE EXISTING GUTTERS ON EITHER FOUNTAIN AVENUE OR CENTRAL AVENUE. A RAIN GARDEN IS ALSO PROPOSED ON THE PACIFIC GROVE LIBRARY PROPERTY AT THE CORNER OF CENTRAL AND FOUNTAIN AVENUES. THE RAIN GARDEN WOULD CAPTURE WATER DIVERTED FROM AN EXISTING ROOFTOP DOWNSPOUT THAT WOULD BE CONVEYED UNDER AN EXISTING WALKWAY, AND INTO THE NEW RAIN GARDEN. THE PROPOSED RAIN GARDEN DESIGN CONCEPT IS CONSISTENT WITH THE RECENTLY INSTALLED RAIN GARDEN AT THE PACIFIC GROVE NATURAL HISTORY MUSEUM.
5. BERWICK PARK BIORETENTION
EXTENDING FROM 9TH AVENUE TO CARMEL AVENUE, BERWICK PARK REPRESENTS AN OPPORTUNITY TO PROVIDE WATER QUALITY TREATMENT OF RUNOFF FROM OCEAN VIEW BOULEVARD AND A PORTION OF THE RESIDENTIAL NEIGHBORHOOD IN THE VICINITY. A PORTION OF THE TURF AREA AT BERWICK PARK WOULD BE RETROFITTED TO INCORPORATE A BIORETENTION FEATURE TO TREAT THE DIVERTED RUNOFF. IT IS ASSUMED THAT A PORTION OF THE RUNOFF FROM STORM DRAINS EXTENDING BENEATH THE PARK FROM CARMEL AVENUE AND MONTEREY AVENUE COULD BE REDIRECTED INTO THE NEW BIORETENTION FEATURES ALONG WITH ROADWAY RUNOFF, VIA NEW CURB CUTS ALONG OCEAN VIEW BOULEVARD. AN ADDITIONAL BENEFIT OF THIS PROPOSED DESIGN IS THE VISUAL AND PHYSICAL BUFFER THE NEW BIORETENTION FEATURE PROVIDES BETWEEN CHILDREN AND OTHER USERS AT THE PARK AND THE TRAFFIC ON OCEAN VIEW BOULEVARD.

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SANTA CRUZ, CA 95060
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CONTACT: AMY WEST, RLA

SHEET INDEX

#	SHEET	TITLE
1	C0.0	COVER SHEET
2	C1.0	PINE AVENUE COMPLETE STREET CORRIDOR CIVIL SITE PLAN
3	C2.0	PINE AVENUE COMPLETE STREET CORRIDOR ALTERNATIVES #1-#3 PLAN AND SECTION
4	C2.1	PINE AVENUE COMPLETE STREET CORRIDOR ALTERNATIVES #4-#6 PLAN AND SECTION
5	C3.0	(FANDANGO) CITY PARKING LOT LID IMPROVEMENTS CIVIL SITE PLAN
6	C4.0	LIGHTHOUSE AVENUE COMPLETE STREET CONCEPT CIVIL SITE PLAN
7	C5.0	LIBRARY RAIN GARDEN & BIORETENTION ISLANDS CIVIL SITE PLAN
8	C6.0	BERWICK PARK BIORETENTION CIVIL SITE PLAN
9	C7.0	CIVIL SCHEMATIC DETAILS
10	L1.0	PINE AVENUE COMPLETE STREET CORRIDOR LANDSCAPE SITE PLAN
11	L1.1	(FANDANGO) CITY PARKING LOT LID IMPROVEMENTS LANDSCAPE SITE PLAN
12	L1.2	LIGHTHOUSE AVENUE COMPLETE STREET CONCEPT LANDSCAPE SITE PLAN
13	L1.3	LIBRARY RAIN GARDEN & BIORETENTION ISLANDS LANDSCAPE SITE PLAN
14	L1.4	BERWICK PARK BIORETENTION LANDSCAPE SITE PLAN
15	L2.0	PINE AVENUE COMPLETE STREET CORRIDOR PLANT AND MATERIALS IMAGES
16	L2.1	(FANDANGO) CITY PARKING LOT LID IMPROVEMENTS PLANT AND MATERIALS IMAGES
17	L2.2	LIGHTHOUSE AVENUE COMPLETE STREET CONCEPT PLANT AND MATERIALS IMAGES
18	L2.3	LIBRARY RAIN GARDEN & BIORETENTION ISLANDS PLANT AND MATERIALS IMAGES
19	L2.4	BERWICK PARK BIORETENTION PLANT AND MATERIALS IMAGES
20	L3.0	MATERIALS DETAILS
21	L3.1	PLANTING NOTES AND DETAILS

ABBREVIATIONS:

BSM	BIORETENTION SOIL MEDIA
(E)	EXISTING
EL	ELEVATION
MAX	MAXIMUM
MIN	MINIMUM
(N)	NEW
NTS	NOT TO SCALE
SD	STORM DRAIN
TYP	TYPICAL

TECHNICAL REFERENCES:

1. GIS LAYERS FOR EXISTING SITE FEATURES INCLUDING BUILDINGS, HARDSCAPE, AND UTILITIES FROM THE CITY OF PACIFIC GROVE AND IN DIGITIZED FROM 2013 AMBAG AERIAL IMAGERY.

24"X36" SHEET. IF SHEET SIZE IS SMALLER, DRAWING HAS BEEN REDUCED.

PRELIMINARY DRAWINGS NOT FOR CONSTRUCTION

SHEET TITLE: COVER SHEET

CLIENT: CITY OF PACIFIC GROVE
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PROJECT TITLE: LID ASSESSMENT
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REGISTERED PROFESSIONAL ENGINEER
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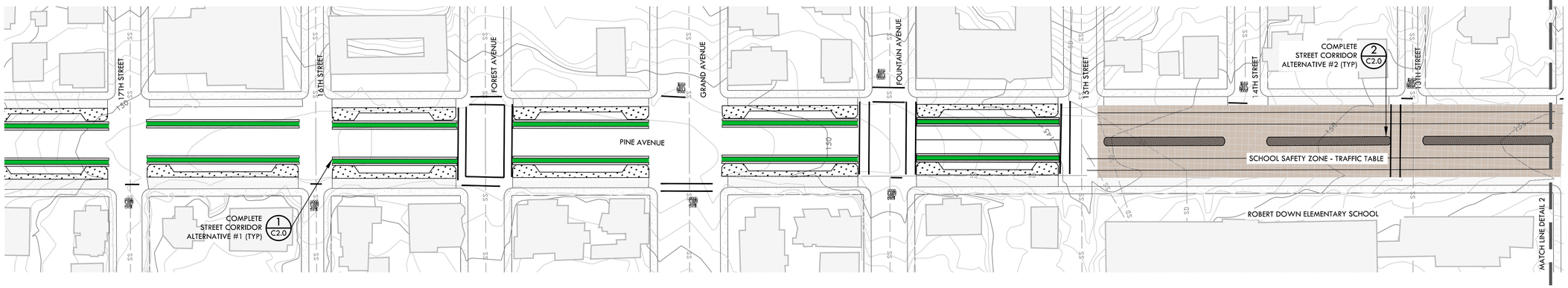
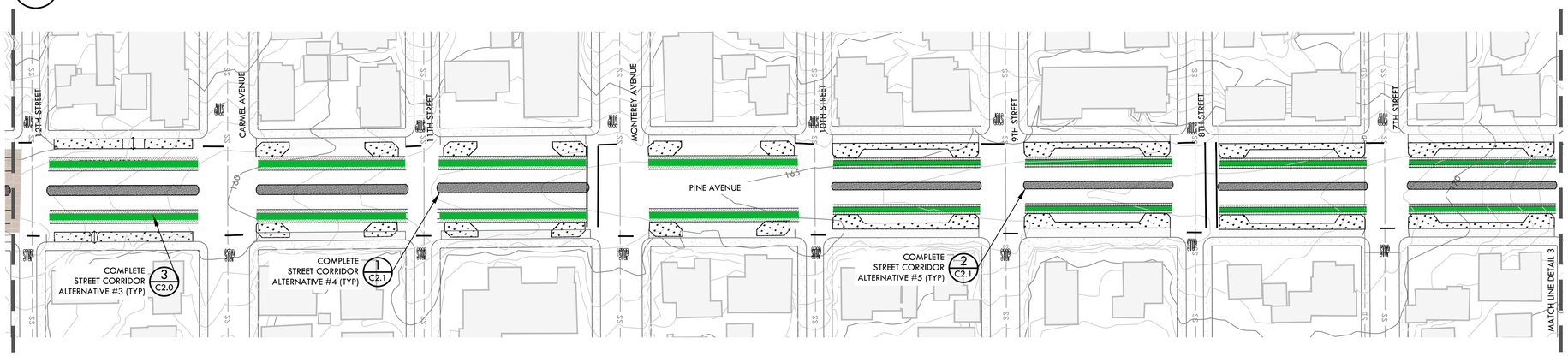
NO. 78568
EXP. 6/30/17
CIVIL
CALIFORNIA
SCHEMATIC DESIGN

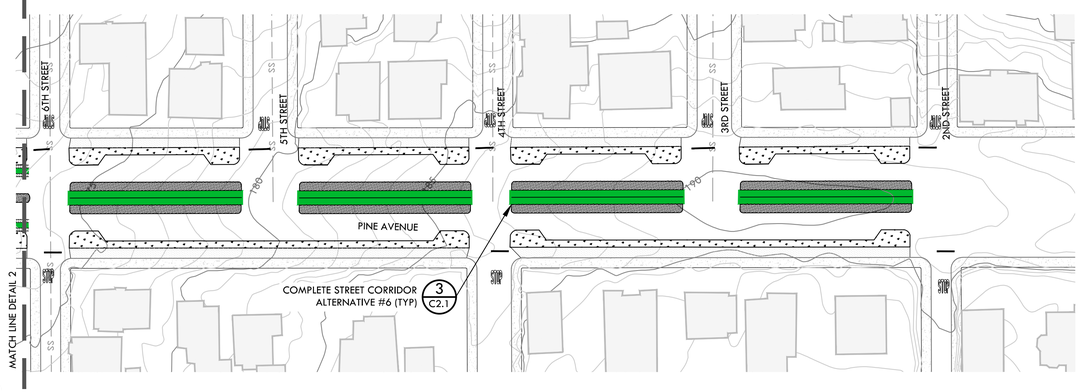
DRAWN BY:	EMC
CHECKED BY:	RLC
DATE:	DECEMBER 16, 2016
JOB NO:	21613
SCALE:	
SHEET:	C0.0



1 PINE AVENUE COMPLETE STREET CORRIDOR - 17TH STREET TO 12TH STREET



2 PINE AVENUE COMPLETE STREET CORRIDOR - 12TH STREET TO 6TH STREET



3 PINE AVENUE COMPLETE STREET CORRIDOR - 6TH STREET TO 2ND STREET

LEGEND:

- (E) CONTOUR
- (E) SANITARY SEWER PIPELINE
- (E) STORM DRAIN PIPELINE
- (E) STREET MARKING
- (E) CONCRETE
- (E) LANDSCAPING AND/OR HARDSCAPE STRIP
- (N) BIORETENTION
- (N) LANDSCAPING
- (N) BIKE LANE
- (N) BIKE LANE BUFFER STRIP
- (N) PERMEABLE PAVEMENT - COLORED

NOTES:

1. THE IDENTIFIED COMPLETE STREET ALTERNATIVES REPRESENT POTENTIAL DESIGN APPROACHES THAT COULD BE IMPLEMENTED ALONG PORTIONS OR ALL OF THE PINE AVENUE CORRIDOR. THE ALTERNATIVES ARE NOT INTENDED TO BE SPECIFIC TO EACH OF THE IDENTIFIED BLOCK SEGMENTS.
2. THE IDENTIFIED COMPLETE STREET ALTERNATIVE ELEMENTS, LAYOUT, LOCATION, AND SIZING ARE PRELIMINARY AND SUBJECT TO CHANGE BASED ON COMMUNITY INPUT AND ADDITIONAL DATA AND SURVEY COLLECTION.
3. ACCESS LOCATIONS, FOR EXAMPLE FOR DRIVEWAYS OR PATHWAYS, ACROSS THE PROPSOED BIORETENTION AREAS WILL BE IDENTIFIED AND LOCATED DURING FUTURE DESIGN DEVELOMENT PHASES AND AFTER A MORE DETAILED SURVEY OF THE PROJECT AREA IS CONDUCTED.
4. THE PROPOSED BIORETENTION AREAS WILL BE SIZED AND LOCATED TO PROVIDE ADEQUATE ACCESS FOR ALL USERS ACCESSING BUILDINGS ON PINE AVENUE.
5. THE IDENTIFIED COMPLETE STREET ALTERNATIVES REPRESENT POTENTIAL DESIGN APPROACHES THAT COULD BE IMPLEMENTED ALONG PORTIONS OR ALL OF THE PINE AVENUE CORRIDOR. THE ALTERNATIVES ARE NOT INTENDED TO BE SPECIFIC TO EACH OF THE IDENTIFIED BLOCK SEGMENTS.
6. FUTURE SURVEY AND DATA COLLECTION WITHIN THE PROPOSED IMPROVEMENT AREA WILL IDENTIFY THE LOCATION, CONDITION, AND ADEQUACY OF EXISTING CURB RAMPS. IMPROVEMENTS WILL BE INCORPORATED INTO FUTURE DESIGN DEVELOPMENT PLANS BASED ON CURRENT DESIGN AND SAFETY STANDARDS.

0 50' 100'
SCALE: 1" = 50' @ 24" X 36"

NORTH

24"X36" SHEET. IF SHEET SIZE IS SMALLER, DRAWING HAS BEEN REDUCED.

PRELIMINARY DRAWINGS NOT FOR CONSTRUCTION

SHEET TITLE:
PINE AVENUE
COMPLETE STREET CORRIDOR
CIVIL SITE PLAN

CLIENT:
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PROJECT TITLE:
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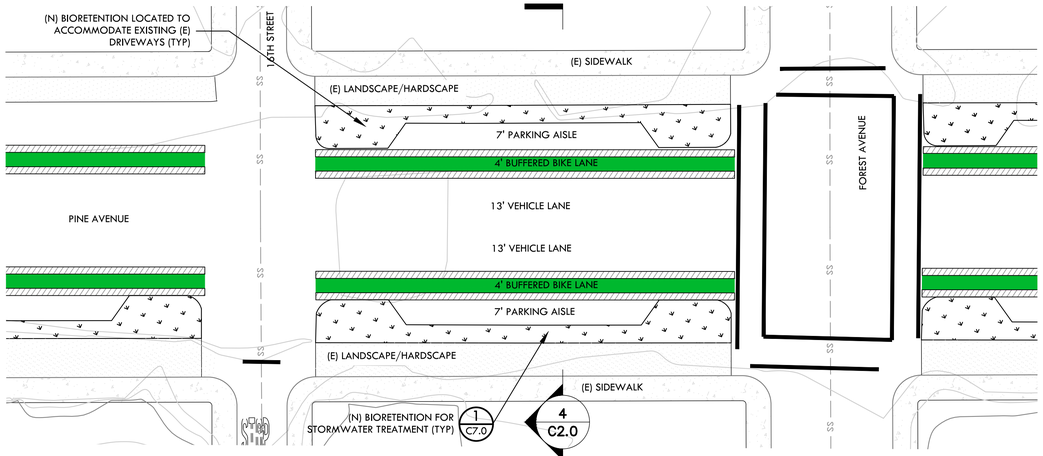
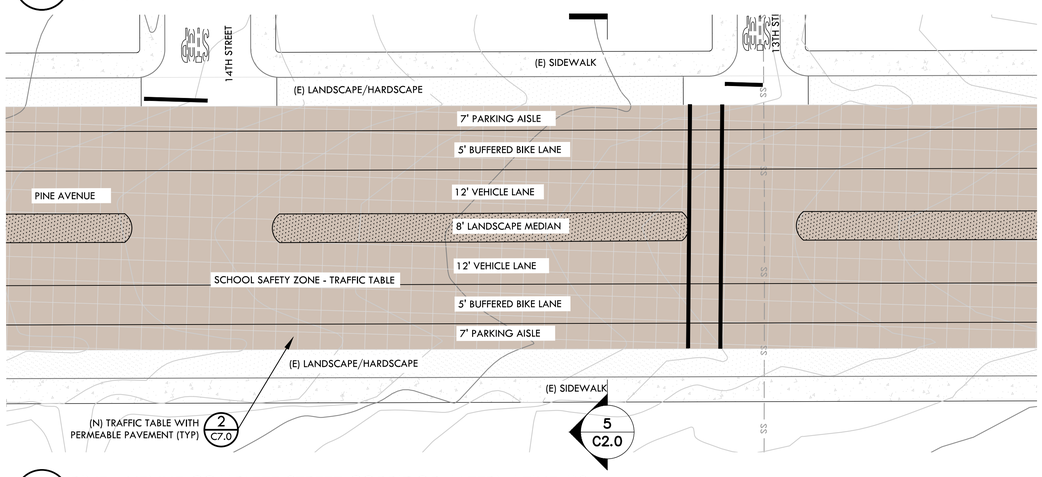
DRAWN BY:	EMC
CHECKED BY:	RLC
DATE:	DECEMBER 16, 2016
JOB NO:	21613
SCALE:	
SHEET:	C1.0



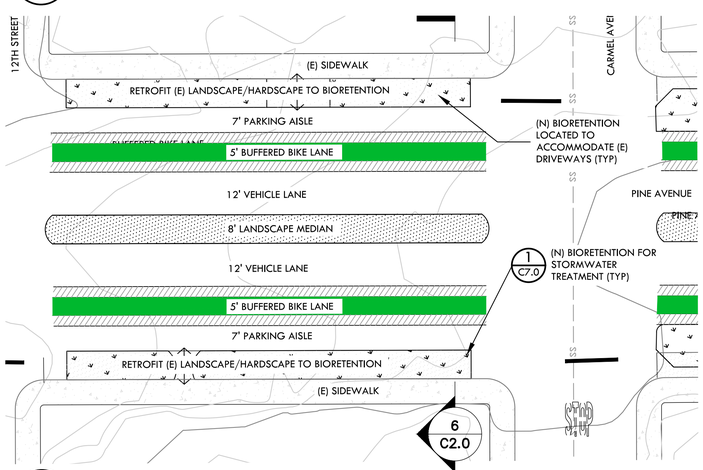
1 PINE AVENUE COMPLETE STREET CORRIDOR ALTERNATIVE #1

HIGH TRAFFIC ZONE



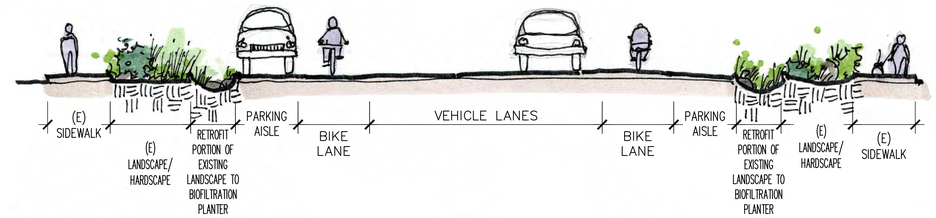
2 PINE AVENUE COMPLETE STREET CORRIDOR ALTERNATIVE #2

SCHOOL SAFETY ZONE



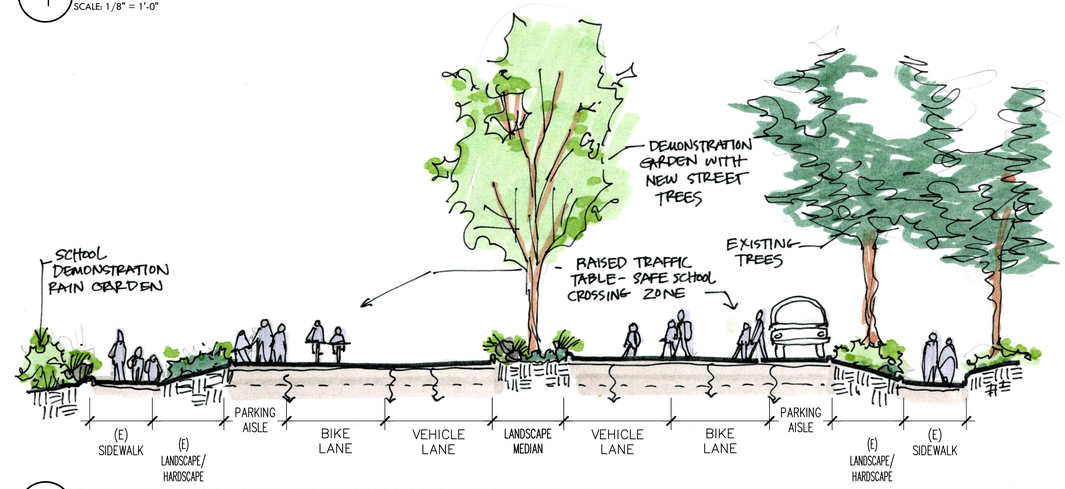
3 PLAN: PINE AVENUE COMPLETE STREET CORRIDOR ALTERNATIVE #3

RESIDENTIAL ZONE #1



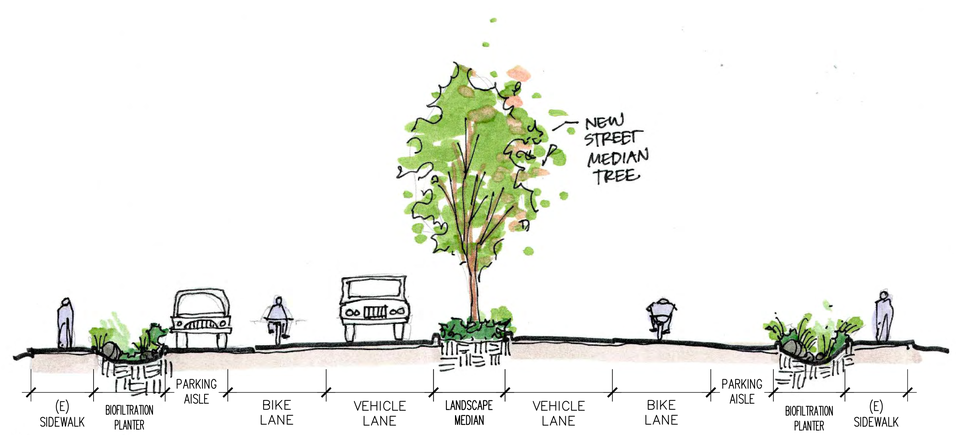
4 PINE AVENUE COMPLETE STREET CORRIDOR ALTERNATIVE #1

SCALE: 1/8" = 1'-0"



5 PINE AVENUE COMPLETE STREET CORRIDOR ALTERNATIVE #2

SCALE: 1/8" = 1'-0"



6 SECTION: PINE AVENUE COMPLETE STREET CORRIDOR ALTERNATIVE #6

SCALE: 1/8" = 1'-0"

LEGEND:

- (E) CONTOUR
- (E) SANITARY SEWER PIPELINE
- (E) STORM DRAIN PIPELINE
- (E) STREET MARKING
- (E) CONCRETE
- (E) LANDSCAPING AND/OR HARDSCAPE STRIP
- (N) BIORETENTION
- (N) LANDSCAPING
- (N) BIKE LANE
- (N) BIKE LANE BUFFER STRIP
- (N) PERMEABLE PAVEMENT - COLORED

0 20' 40'

SCALE: 1" = 20' @ 24" X 36"

NORTH

NOTES:

1. THE IDENTIFIED COMPLETE STREET ALTERNATIVES REPRESENT POTENTIAL DESIGN APPROACHES THAT COULD BE IMPLEMENTED ALONG PORTIONS OR ALL OF THE PINE AVENUE CORRIDOR. THE ALTERNATIVES ARE NOT INTENDED TO BE SPECIFIC TO EACH OF THE IDENTIFIED BLOCK SEGMENTS.
2. ACCESS LOCATIONS, FOR EXAMPLE FOR DRIVEWAYS OR PATHWAYS, ACROSS THE PROPSOED BIORETENTION AREAS WILL BE IDENTIFIED AND LOCATED DURING FUTURE DESIGN DEVELOMENT PHASES AND AFTER A MORE DETAILED SURVEY OF THE PROJECT AREA IS CONDUCTED.

24"x36" SHEET. IF SHEET SIZE IS SMALLER, DRAWING HAS BEEN REDUCED.

PRELIMINARY DRAWINGS NOT FOR CONSTRUCTION

SHEET TITLE:
PINE AVENUE
COMPLETE STREET ALTERNATIVES
#1-#3 PLAN AND SECTION

CLIENT:
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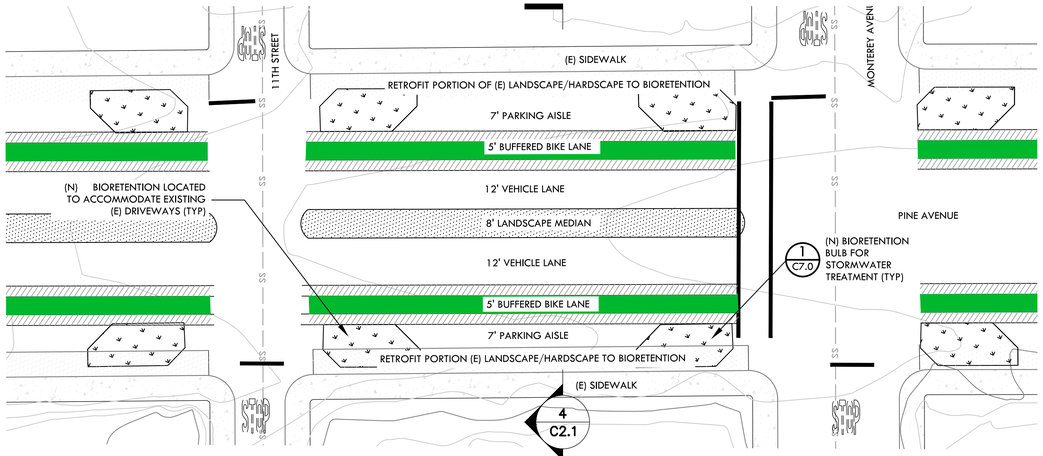
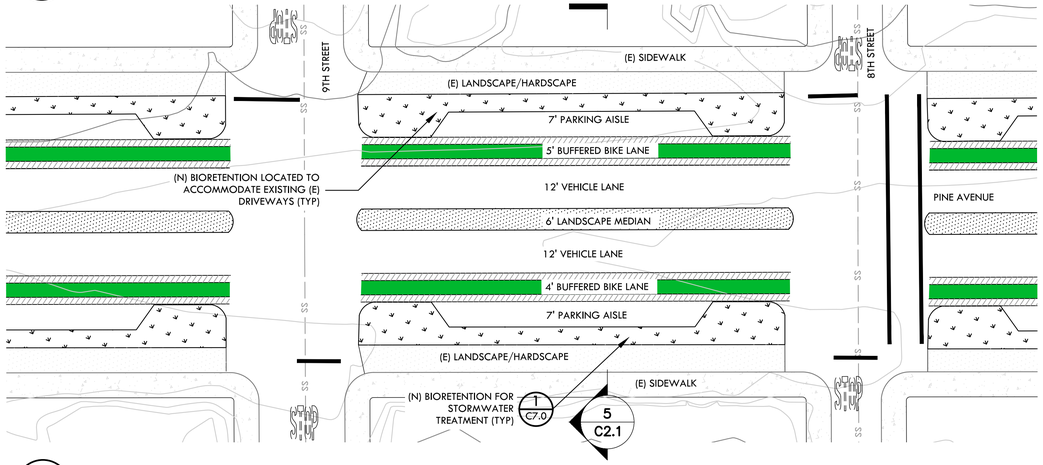
REGISTERED PROFESSIONAL ENGINEER
ERIK M. COMPTON
No. 78568
EXP. 6/30/17
CIVIL
CALIFORNIA
SCHEMATIC DESIGN

DRAWN BY:	EMC
CHECKED BY:	RLC
DATE:	DECEMBER 16, 2016
JOB NO:	21613
SCALE:	
SHEET:	C2.0



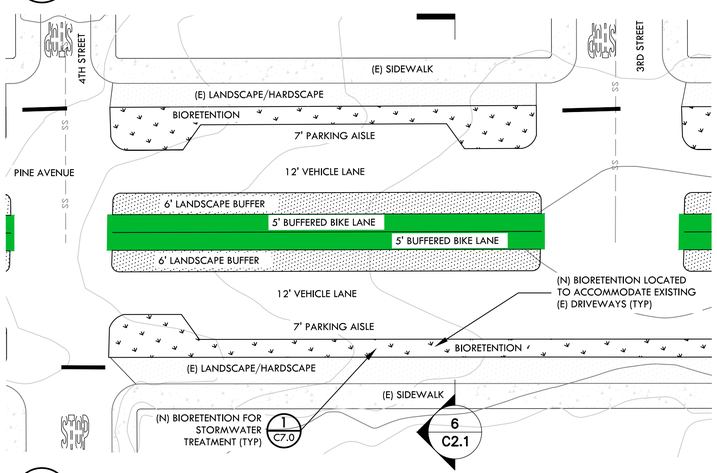
1 PLAN: PINE AVENUE COMPLETE STREET CORRIDOR ALTERNATIVE #4

RESIDENTIAL ZONE #2



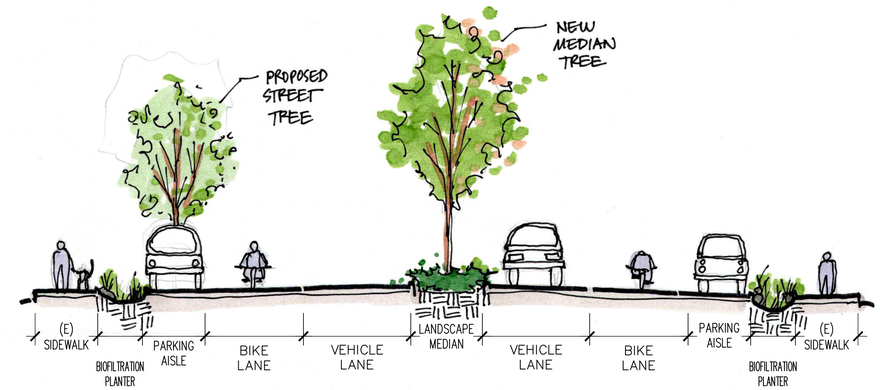
2 PLAN: PINE AVENUE COMPLETE STREET CORRIDOR ALTERNATIVE #5

RESIDENTIAL ZONE #3



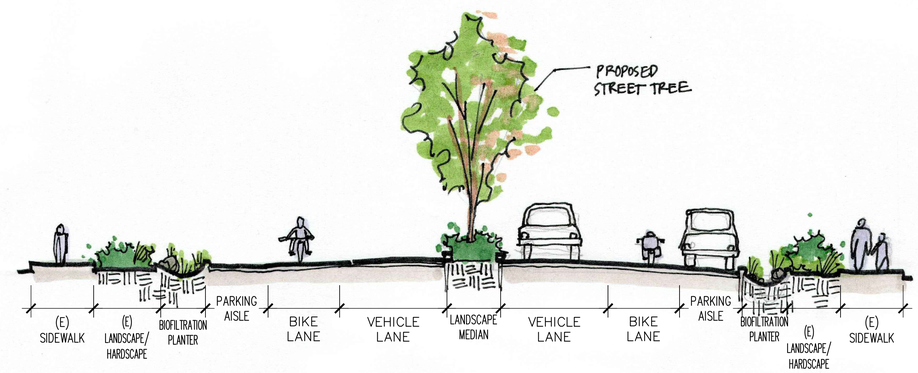
3 PLAN: PINE AVENUE COMPLETE STREET CORRIDOR ALTERNATIVE #6

RESIDENTIAL ZONE #4



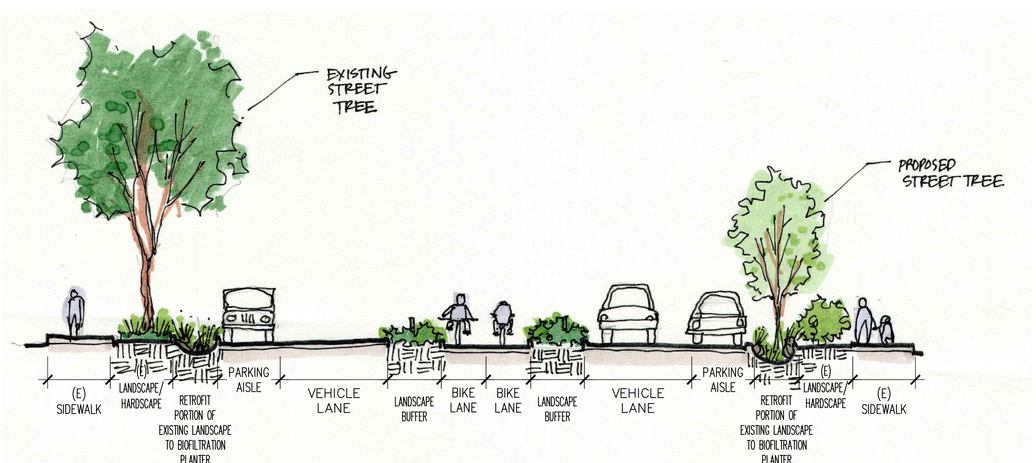
4 SECTION: PINE AVENUE COMPLETE STREET CORRIDOR ALTERNATIVE #4

SCALE: 1/8" = 1'-0"



5 SECTION: PINE AVENUE COMPLETE STREET CORRIDOR ALTERNATIVE #5

SCALE: 1/8" = 1'-0"



6 SECTION: PINE AVENUE COMPLETE STREET CORRIDOR ALTERNATIVE #6

SCALE: 1/8" = 1'-0"

LEGEND:

- (E) CONTOUR
- (E) SANITARY SEWER PIPELINE
- (E) STORM DRAIN PIPELINE
- (E) STREET MARKING
- (E) CONCRETE
- (E) LANDSCAPING AND/OR HARDSCAPE STRIP
- (N) BIORETENTION
- (N) LANDSCAPING
- (N) BIKE LANE
- (N) BIKE LANE BUFFER STRIP
- (N) PERMEABLE PAVEMENT

0 20' 40'

SCALE: 1" = 20' @ 24" X 36"

NORTH

NOTES:

1. THE IDENTIFIED COMPLETE STREET ALTERNATIVES REPRESENT POTENTIAL DESIGN APPROACHES THAT COULD BE IMPLEMENTED ALONG PORTIONS OR ALL OF THE PINE AVENUE CORRIDOR. THE ALTERNATIVES ARE NOT INTENDED TO BE SPECIFIC TO EACH OF THE IDENTIFIED BLOCK SEGMENTS.
2. ACCESS LOCATIONS, FOR EXAMPLE FOR DRIVEWAYS OR PATHWAYS, ACROSS THE PROPSOED BIORETENTION AREAS WILL BE IDENTIFIED AND LOCATED DURING FUTURE DESIGN DEVELOMENT PHASES AND AFTER A MORE DETAILED SURVEY OF THE PROJECT AREA IS CONDUCTED.

PRELIMINARY DRAWINGS NOT FOR CONSTRUCTION

2'-4.08" SHEET: IF SHEET SIZE IS SMALLER, DRAWING HAS BEEN REDUCED.

SHEET TITLE:
PINE AVENUE
COMPLETE STREET ALTERNATIVES
#4-#6 PLAN AND SECTION

CLIENT:
CITY OF PACIFIC GROVE
CONTACT: DANIEL GHO
300 FOREST AVENUE
PACIFIC GROVE, CA 93950

PROJECT TITLE:
LID ASSESSMENT
CITY OF PACIFIC GROVE
300 FOREST AVENUE
PACIFIC GROVE, CA 93950

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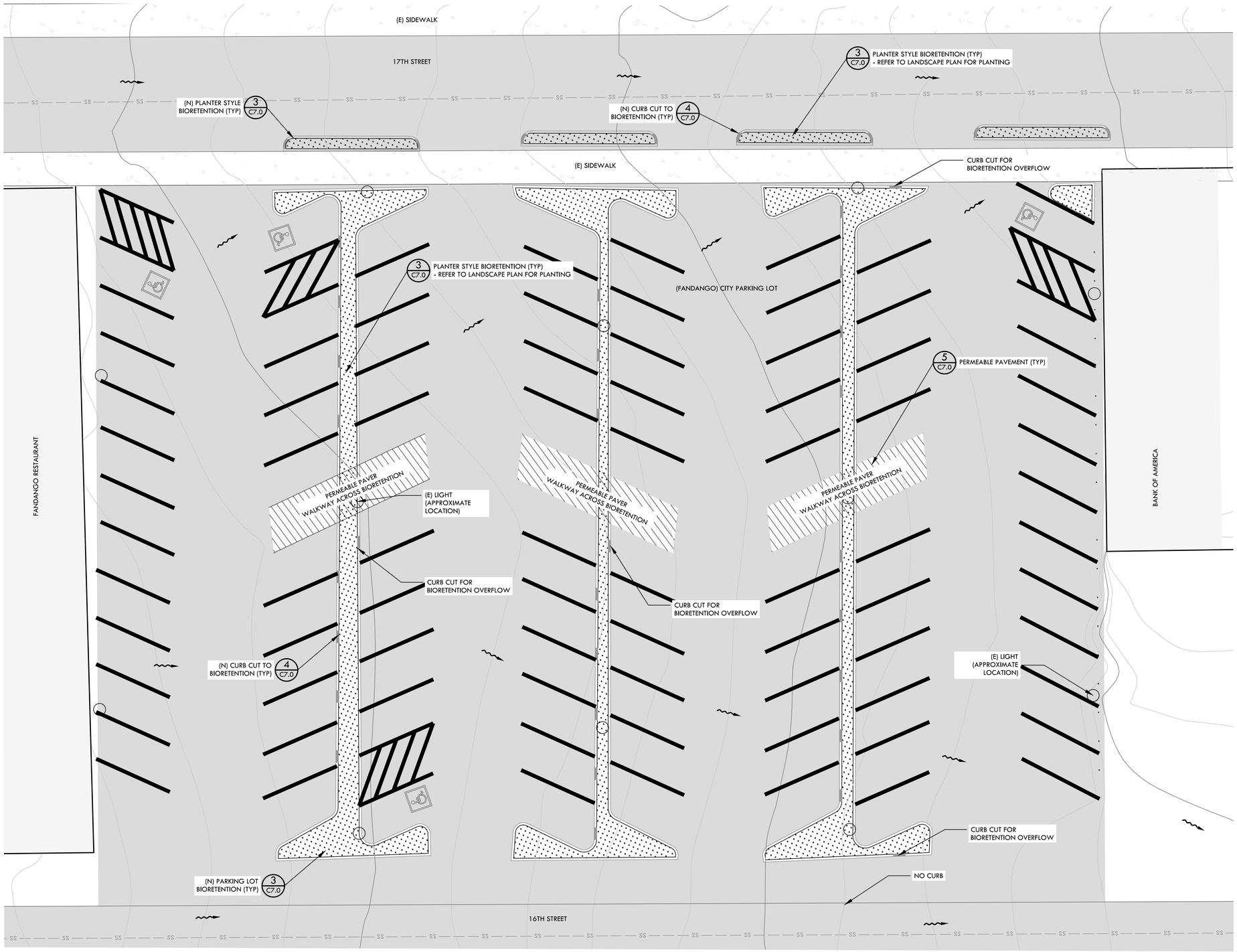
REGISTERED PROFESSIONAL ENGINEER
ERIK M. COMPTON
No. 78568
EXP. 9/30/17
CIVIL
STATE OF CALIFORNIA
SCHEMATIC DESIGN

DRAWN BY:	EMC
CHECKED BY:	RLC
DATE:	DECEMBER 16, 2016
JOB NO:	21613
SCALE:	
SHEET:	C2.1



1 (FANDANGO) CITY PARKING LOT LID SITE IMPROVEMENTS

LEGEND:

- (E) CONTOUR
- SS (E) SANITARY SEWER PIPELINE
- SD (E) STORM DRAIN PIPELINE
- (E) STREET MARKING
- (E) CONCRETE
- (E) ASPHALT
- (N) BIORETENTION
- (N) PERMEABLE PAVEMENT PEDESTRIAN PATHWAY
- (E) LIGHT
- (E) SURFACE FLOW DIRECTION

NORTH

0 10' 20'

SCALE: 1" = 10' @ 24" X 36"

PRELIMINARY DRAWINGS NOT FOR CONSTRUCTION

24"X36" SHEET: IF SHEET SIZE IS SMALLER, DRAWING HAS BEEN REDUCED.

SHEET TITLE:
(FANDANGO) CITY PARKING LOT LID IMPROVEMENTS CIVIL SITE PLAN

CLIENT:
CITY OF PACIFIC GROVE
CONTACT: DANIEL GHO
300 FOREST AVENUE
PACIFIC GROVE, CA 93950

PROJECT TITLE:
LID ASSESSMENT
CITY OF PACIFIC GROVE
300 FOREST AVENUE
PACIFIC GROVE, CA 93950

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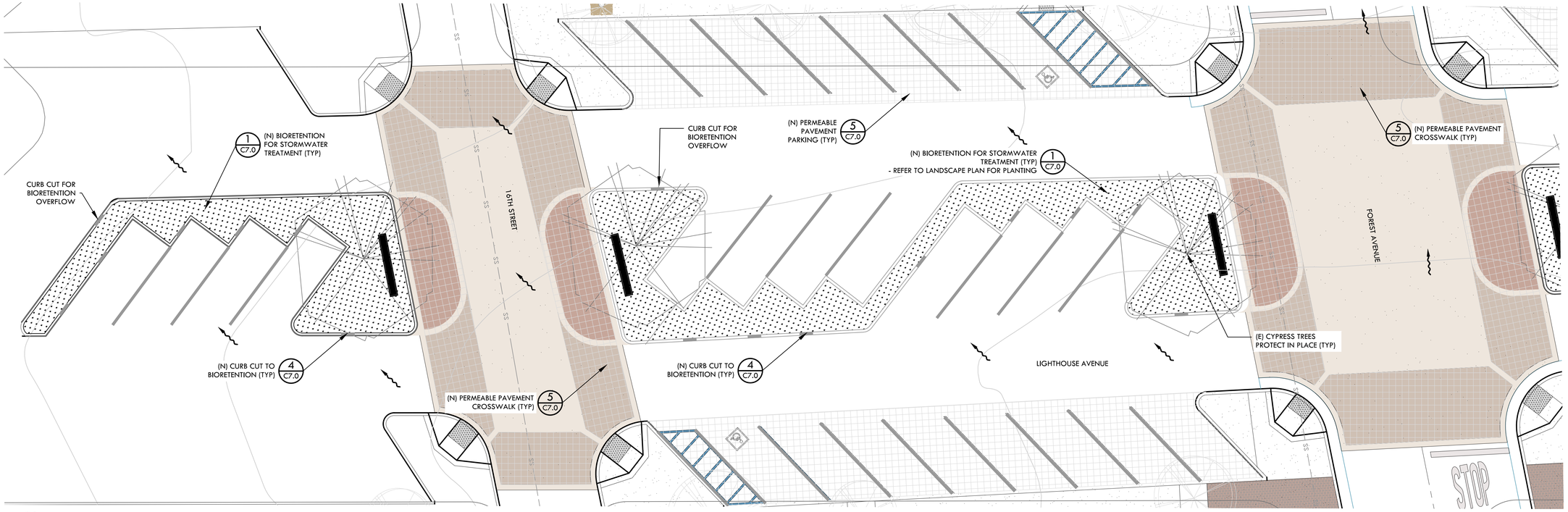
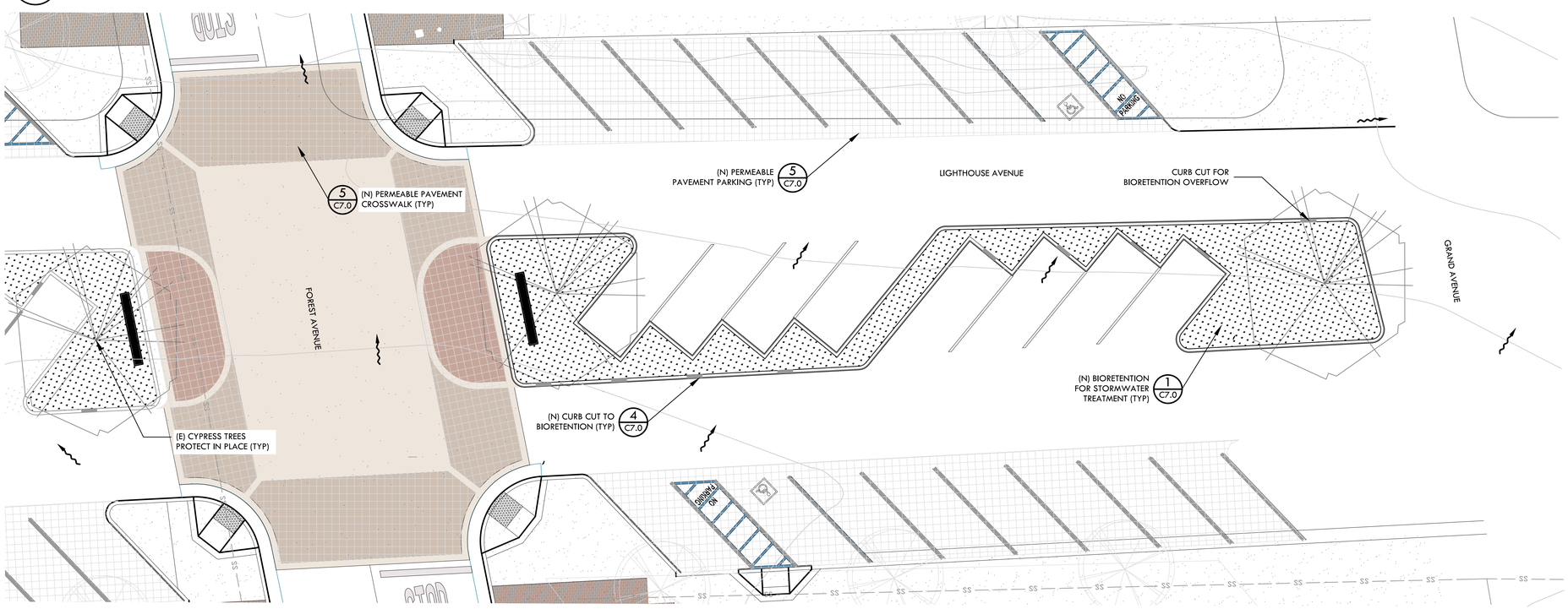
REGISTERED PROFESSIONAL ENGINEER
RALPH L. CORNELL
No. 78568
EXP. 12/31/17
CIVIL
STATE OF CALIFORNIA
SCHEMATIC DESIGN

DRAWN BY:	EMC
CHECKED BY:	RLC
DATE:	DECEMBER 16, 2016
JOB NO:	21613
SCALE:	
SHEET:	C3.0



1 LIGHTHOUSE AVENUE COMPLETE STREET AT 16TH STREET



2 LIGHTHOUSE AVENUE COMPLETE STREET AT FOREST AVENUE

LEGEND:

- (E) CONTOUR
- (E) SANITARY SEWER PIPELINE
- (E) STORM DRAIN PIPELINE
- (E) STREET MARKING
- (E) CONCRETE
- (E) ASPHALT
- (N) BIORETENTION
- (N) PERMEABLE PAVEMENT
- (N) PERMEABLE PAVEMENT - COLORED
- (N) COLORED CONCRETE
- (E) SURFACE FLOW DIRECTION

NORTH

0 10' 20'

SCALE: 1" = 10' @ 24" X 36"

24"x36" SHEET. IF SHEET SIZE IS SMALLER, DRAWING HAS BEEN REDUCED.

PRELIMINARY DRAWINGS NOT FOR CONSTRUCTION

SHEET TITLE:
LIGHTHOUSE AVENUE
COMPLETE STREET CONCEPT
CIVIL SITE PLAN

CLIENT:
CITY OF PACIFIC GROVE
CONTACT: DANIEL GHO
300 FOREST AVENUE
PACIFIC GROVE, CA 93950

PROJECT TITLE:
LID ASSESSMENT
CITY OF PACIFIC GROVE
300 FOREST AVENUE
PACIFIC GROVE, CA 93950

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REGISTERED PROFESSIONAL ENGINEER
ERIC M. COWAN
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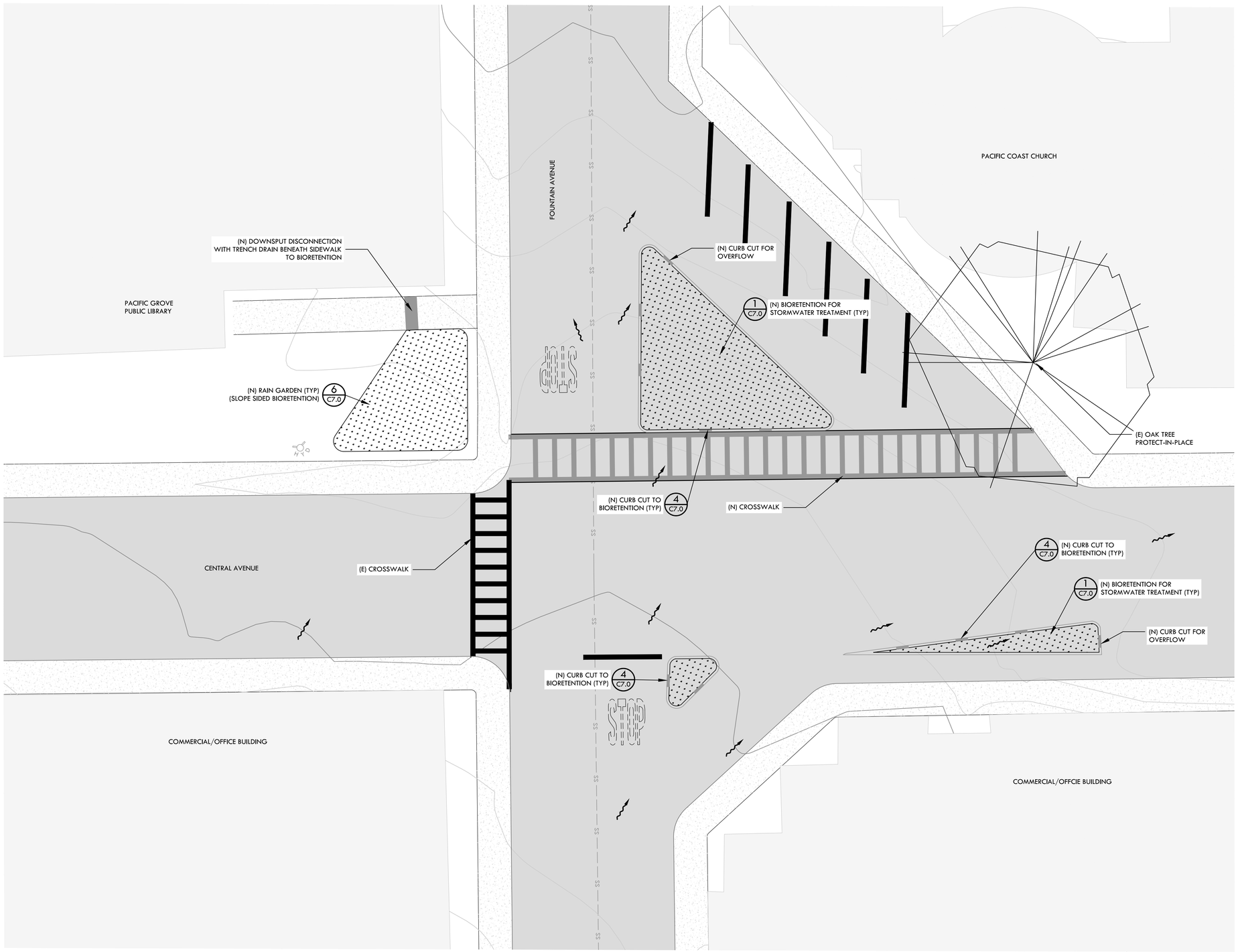
EXP. 6/30/17
CIVIL
STATE OF CALIFORNIA

DRAWN BY:	EMC
CHECKED BY:	RLC
DATE:	DECEMBER 16, 2016
JOB NO:	21613
SCALE:	
SHEET:	C4.0



LEGEND:

- (E) CONTOUR
- (E) SANITARY SEWER PIPELINE
- (E) STORM DRAIN PIPELINE
- (E) STREET MARKING
- (N) STREET MARKING
- (E) CONCRETE
- (E) ASPHALT
- (N) BIORETENTION
- (E) FIRE HYDRANT (APPROXIMATE)
- (E) SURFACE FLOW DIRECTION

NORTH

0 10' 20'

SCALE: 1" = 10' @ 24" X 36"

1 LIBRARY RAIN GARDEN AND BIORETENTION ISLANDS SITE IMPROVEMENTS

24"X36" SHEET. IF SHEET SIZE IS SMALLER, DRAWING HAS BEEN REDUCED.

PRELIMINARY DRAWINGS NOT FOR CONSTRUCTION

SHEET TITLE:
LIBRARY RAIN GARDEN & BIORETENTION ISLANDS CIVIL SITE PLAN

CLIENT:
CITY OF PACIFIC GROVE
CONTACT: DANIEL GHO
300 FOREST AVENUE
PACIFIC GROVE, CA 93950

PROJECT TITLE:
LID ASSESSMENT
CITY OF PACIFIC GROVE
300 FOREST AVENUE
PACIFIC GROVE, CA 93950

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REGISTERED PROFESSIONAL ENGINEER
SCHEMANSKI
NO. 78518
EXP. 12/31/17
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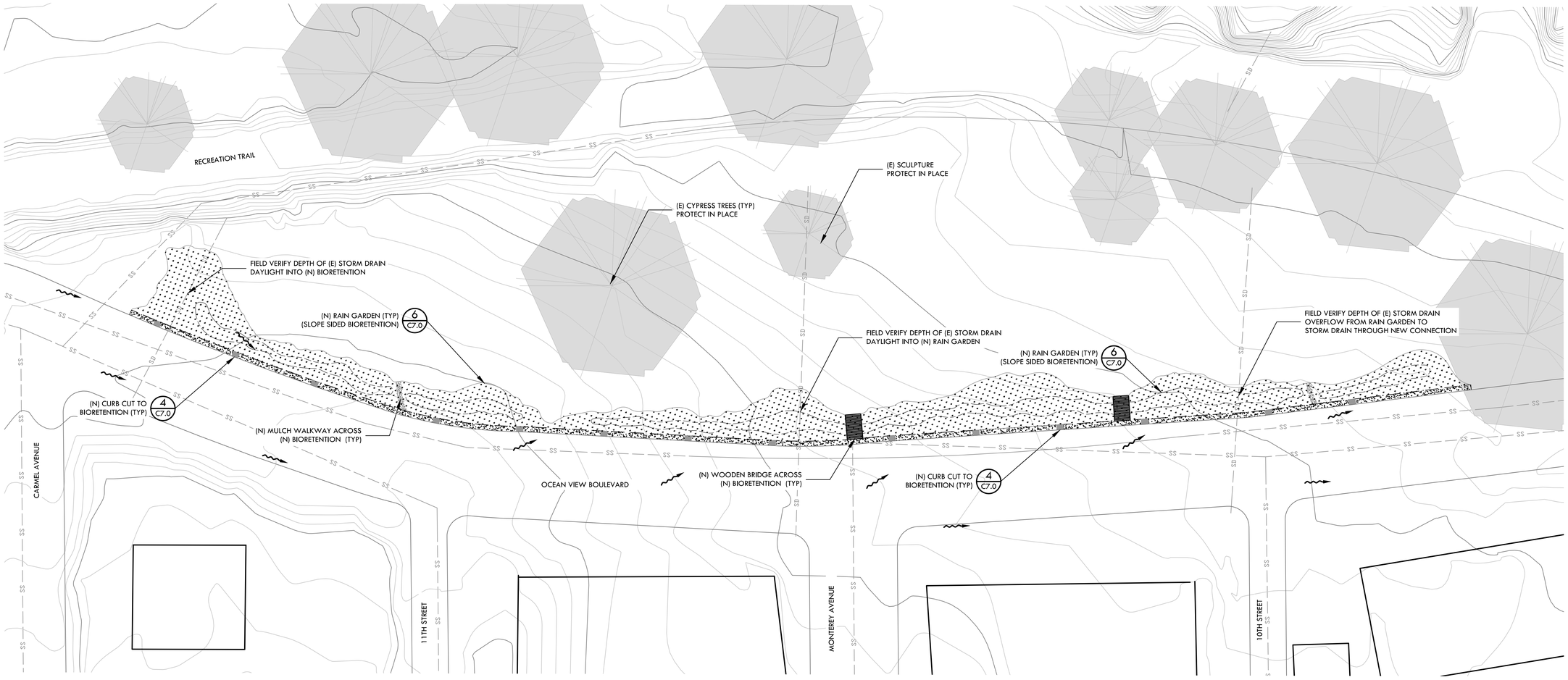
STATE OF CALIFORNIA

DRAWN BY:	EMC
CHECKED BY:	RLC
DATE:	DECEMBER 16, 2016
JOB NO:	21613
SCALE:	
SHEET:	C5.0



1 BERWICK PARK BIORETENTION SITE IMPROVEMENTS

LEGEND:

- (E) CONTOUR
- (E) SANITARY SEWER PIPELINE
- (E) STORM DRAIN PIPELINE
- (E) CONCRETE
- (E) ASPHALT
- (N) BIORETENTION
- (N) 2' WIDE GRAVEL PATH
- (N) PATHS ACROSS BIORETENTION -REFER TO LANDSCAPE PLANS
- (E) SURFACE FLOW DIRECTION

NORTH

0 20' 40'

SCALE: 1" = 20' @ 24" X 36"

PRELIMINARY DRAWINGS NOT FOR CONSTRUCTION

24"x36" SHEET. IF SHEET SIZE IS SMALLER, DRAWING HAS BEEN REDUCED.

SHEET TITLE:
BERWICK PARK BIORETENTION
CIVIL SITE PLAN

CLIENT:
CITY OF PACIFIC GROVE
CONTACT: DANIEL GHO
300 FOREST AVENUE
PACIFIC GROVE, CA 93950

PROJECT TITLE:
LID ASSESSMENT
CITY OF PACIFIC GROVE
300 FOREST AVENUE
PACIFIC GROVE, CA 93950

JOHN L. JANECKI
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REGISTERED PROFESSIONAL ENGINEER
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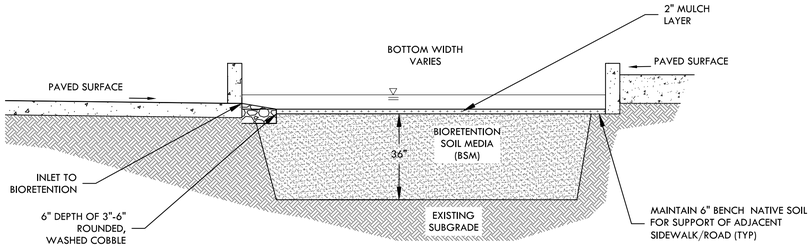
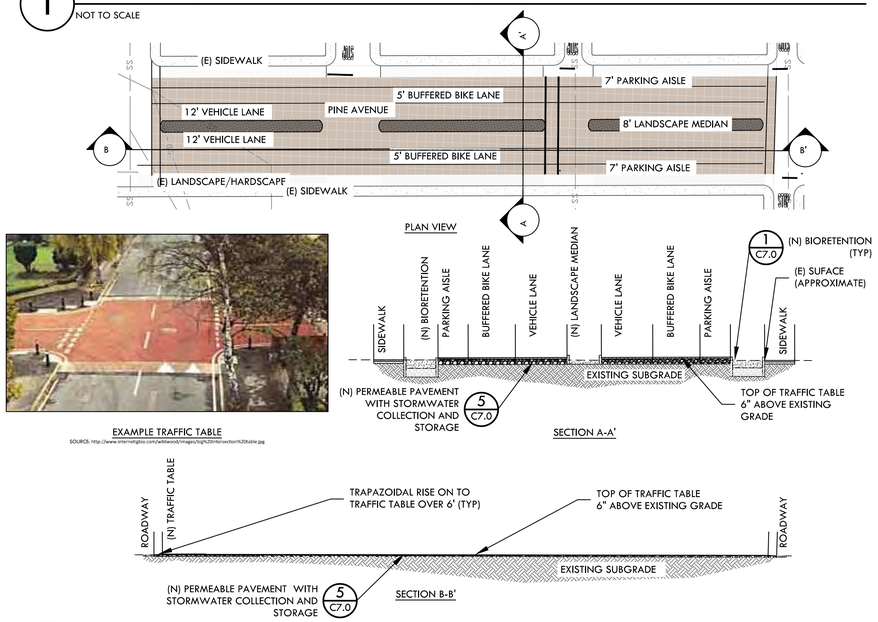
CIVIL
STATE OF CALIFORNIA
SCHUMANN
REVIEW

DRAWN BY:	EMC
CHECKED BY:	RLC
DATE:	DECEMBER 16, 2016
JOB NO:	21613
SCALE:	
SHEET:	C6.0



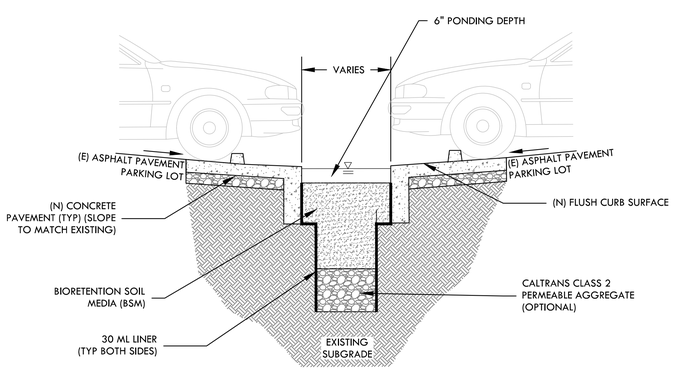
1 TYPICAL BIORETENTION FOR STORMWATER TREATMENT

NOT TO SCALE



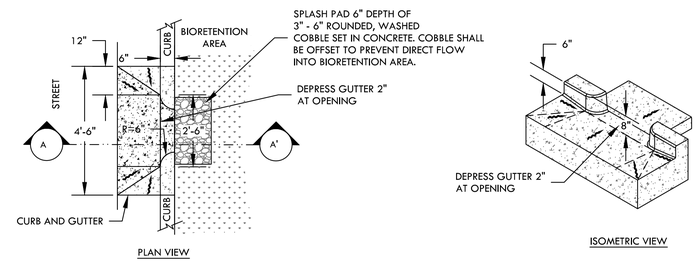
2 TYPICAL SCHOOL SAFETY ZONE TRAFFIC TABLE WITH PERMEABLE PAVEMENT

NOT TO SCALE



3 TYPICAL PARKING LOT/PLANTER STYLE BIORETENTION

NOT TO SCALE

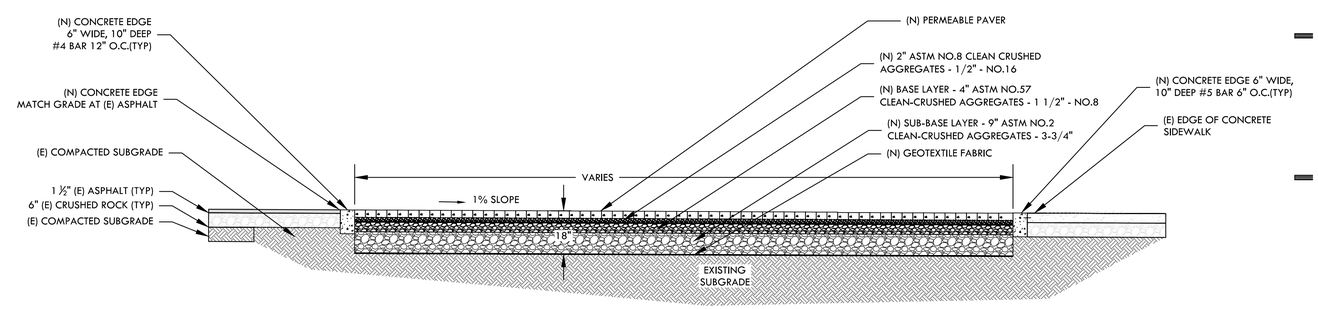


NOTES:

1. EXTEND SPLASH PAD INTO BIORETENTION AREA PER PLAN DIMENSIONS.
2. AFTER CONSTRUCTION PLACE SAND BAGS AT GUTTER OPENINGS TO KEEP STORM FLOWS FROM ENTERING FACILITY UNTIL VEGETATION IS ESTABLISHED.
3. CURB AND GUTTER TO BE INSTALLED CONSISTENT WITH MONTEREY COUNTY STANDARDS.
4. COBBLES IN SPLASH PAD SHALL BE SET IN CONCRETE SUCH THAT HALF OF THE ROCK VOLUME IS PROTRUDING ABOVE THE CONCRETE SURFACE.

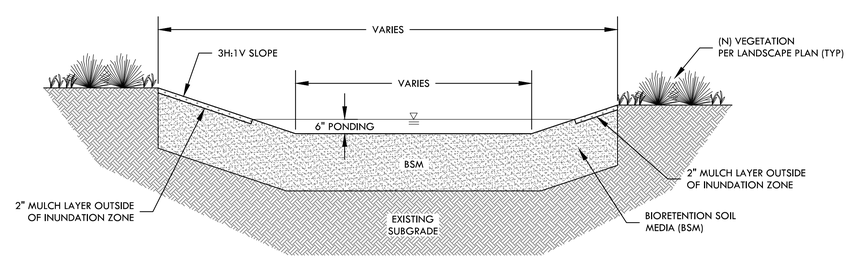
4 TYPICAL CURB CUT INTO BIORETENTION

NOT TO SCALE



5 TYPICAL PERMEABLE PAVEMENT

NOT TO SCALE



BIORETENTION CONSTRUCTION NOTES:

1. EACH BIORETENTION FACILITY SHALL INCLUDE AN INSPECTION RISER.
2. PLANTING DESIGN AND IRRIGATION PER LANDSCAPE PLAN.
3. REFERENCE TECHNICAL SPECIFICATIONS FOR ALL MATERIALS IN LID DETAILS.
4. CONTRACTOR SHALL SCARIFY SUBGRADE TO A DEPTH OF 6" BEFORE INSTALLING BSM IN BIORETENTION AREA.
5. EXCAVATE TO ALLOW FOR SPECIFIED SOIL AND MULCH DEPTHS TO ACHIEVE FINISHED ELEVATIONS.
6. CONTRACTOR SHALL COMPACT EACH 6" LIFT OF BSM WITH LANDSCAPE ROLLER OR BY LIGHTLY WETTING. IF WETTING, ALLOW TO DRY OVERNIGHT BEFORE PLANTING.
7. DO NOT WORK WITHIN BIORETENTION AREA DURING RAIN OR UNDER WET CONDITIONS.
8. CONTRACTOR SHALL KEEP HEAVY MACHINERY OUTSIDE BIORETENTION AREA LIMITS.
9. CONTRACTOR SHALL PERFORM EXCAVATION FROM PERIMETER OF BIORETENTION AREA AND LIMIT MACHINERY TO 2 TONS IN WEIGHT. LARGER MACHINERY MUST BE APPROVED BY PROJECT ENGINEER.
10. BIORETENTION FACILITIES SHALL COMPLY WITH CITY STANDARD STORMWATER DETAILS.

6 TYPICAL RAIN GARDEN/SLOPE SIDED BIORETENTION

NOT TO SCALE

24"x36" SHEET. IF SHEET SIZE IS SMALLER, DRAWING HAS BEEN REDUCED.

PRELIMINARY DRAWINGS NOT FOR CONSTRUCTION

SHEET TITLE:
CIVIL SCHEMATIC DETAILS

CLIENT:
CITY OF PACIFIC GROVE
CONTACT: DANIEL GHO
300 FOREST AVENUE
PACIFIC GROVE, CA 93950

PROJECT TITLE:
LID ASSESSMENT
CITY OF PACIFIC GROVE
300 FOREST AVENUE
PACIFIC GROVE, CA 93950

JONI L. JANECKI ASSOCIATES
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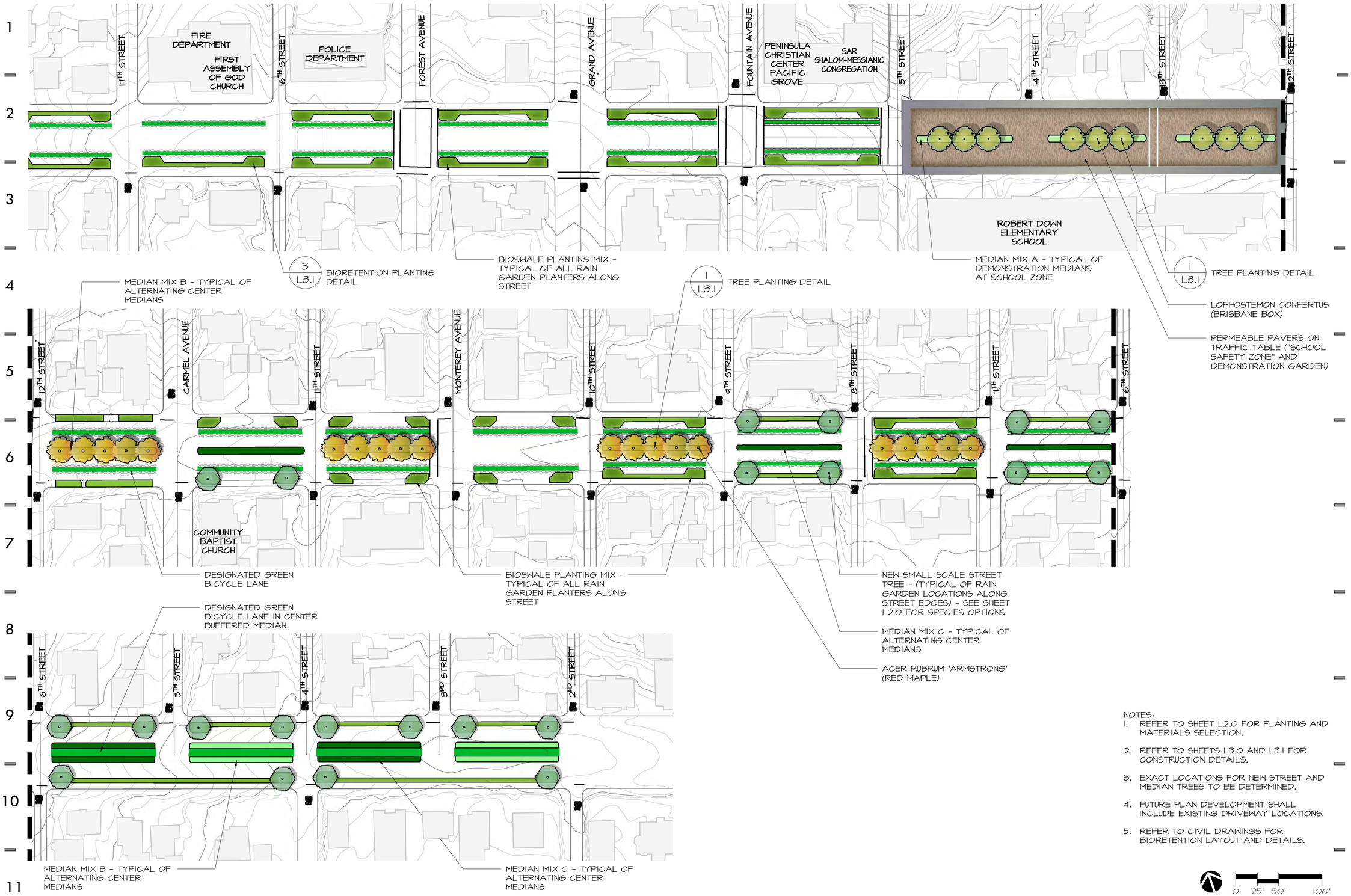
CIVIL
STATE OF CALIFORNIA

DRAWN BY:	EMC
CHECKED BY:	RLC
DATE:	DECEMBER 16, 2016
JOB NO:	21613
SCALE:	
SHEET:	C7.0



NOTES:

1. REFER TO SHEET L2.0 FOR PLANTING AND MATERIALS SELECTION.
2. REFER TO SHEETS L3.0 AND L3.1 FOR CONSTRUCTION DETAILS.
3. EXACT LOCATIONS FOR NEW STREET AND MEDIAN TREES TO BE DETERMINED.
4. FUTURE PLAN DEVELOPMENT SHALL INCLUDE EXISTING DRIVEWAY LOCATIONS.
5. REFER TO CIVIL DRAWINGS FOR BIORETENTION LAYOUT AND DETAILS.

0 25' 50' 100'
SCALE: 1"=50'-0"

ORIGINAL SHEET SIZE: 24" X 36"

PRELIMINARY DRAWINGS NOT FOR CONSTRUCTION

SHEET TITLE:
PINE AVENUE
COMPLETE STREET CORRIDOR
LANDSCAPE SITE PLAN

CLIENT:
CITY OF PACIFIC GROVE
CONTACT: DANIEL GHO
300 FOREST AVENUE
PACIFIC GROVE, CA 93950

PROJECT TITLE:
LID ASSESSMENT
CITY OF PACIFIC GROVE
300 FOREST AVENUE
PACIFIC GROVE, CA 93950

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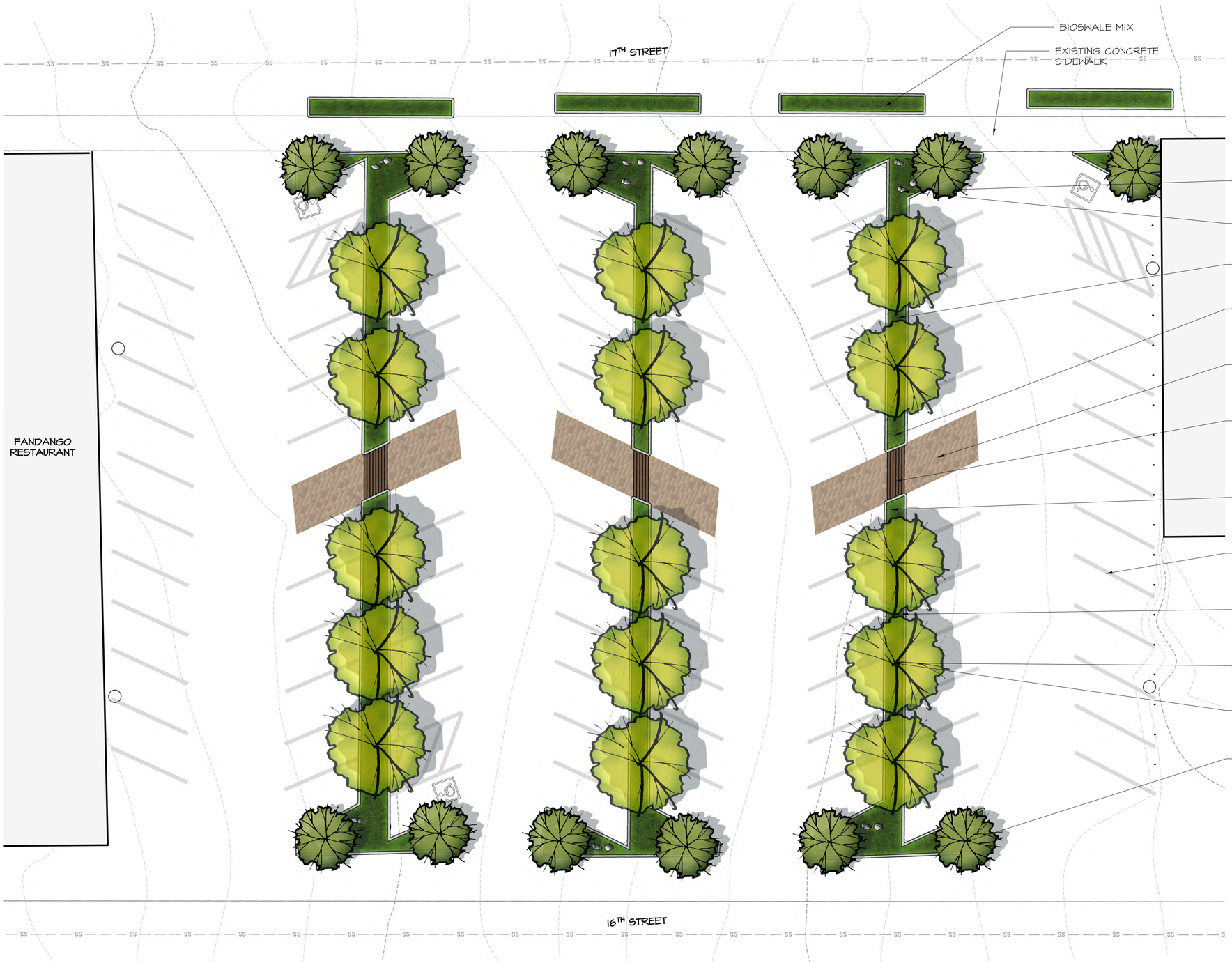
REGISTERED LANDSCAPE ARCHITECT J. L. JANECKI 3763 EXP. 12-31-15 STATE OF CALIFORNIA
SCHEMATIC DESIGN

DRAWN BY:	JH/MO
CHECKED BY:	AW
DATE:	DECEMBER 16, 2016
JOB NO:	21613
SCALE:	1"=50'-0"
SHEET:	L1.0

T:\PROJECTS\16-300.FCE-Pacific Grove LID\Drawings\PG LID LANDSCAPE PINE.dwg, L1.0 PINE, 12/7/2016 11:06:23 AM, DWG To PDF.pc3, ARCH full bleed D (36.00 x 24.00 Inches), 1:1
24"x36" SHEET. IF SHEET SIZE IS SMALLER, DRAWING HAS BEEN REDUCED.

NOTES:
1. REFER TO SHEET L2.1 FOR PLANTING AND MATERIALS SELECTION.
2. REFER TO SHEETS L3.0 AND L3.1 FOR CONSTRUCTION DETAILS.
3. REFER TO CIVIL DRAWINGS FOR BIORETENTION LAYOUT AND DETAILS.



1 L3.0 BOULDER SETTING DETAIL

GRANITE BOULDERS

BIOSWALE MIX

3 L3.1 BIORETENTION PLANTING DETAIL

PERMEABLE PAVERS - REFER TO CIVIL DRAWINGS

FOOT BRIDGE CROSSING OVER BIORETENTION PLANTER

2 L3.1 SHRUB OR GRASS PLANTING DETAIL

NEW PARKING STRIPING - REFER TO CIVIL DRAWINGS

CONCRETE CURB WITH INLETS - REFER TO CIVIL DRAWINGS

1 L3.1 TREE PLANTING DETAIL

PLATANUS X ACERIFOLIA 'YARWOOD' (LONDON PLANE TREE)

ACER RUBRUM 'ARMSTRONG' (RED MAPLE) (AT ENDS OF ISLANDS ONLY)

0 5' 10' 20'
SCALE: 1"=10'-0"

ORIGINAL SHEET SIZE: 24" X 36"

PRELIMINARY DRAWINGS NOT FOR CONSTRUCTION

SHEET TITLE:
(FANDANGO) CITY PARKING LOT LID IMPROVEMENTS LANDSCAPE SITE PLAN

CLIENT:
CITY OF PACIFIC GROVE
CONTACT: DANIEL GHO
300 FOREST AVENUE
PACIFIC GROVE, CA 93950

PROJECT TITLE:
LID ASSESSMENT
CITY OF PACIFIC GROVE
300 FOREST AVENUE
PACIFIC GROVE, CA 93950

JONI L JANECKI & ASSOCIATES
515 SWIFT ST. SANTA CRUZ, CA 95060
PHONE 831.423.6040 I FAX 831.423.6054
EMAIL JL@JLJA.COM I WWW.JLJA.COM
California Landscape Architect License 3163

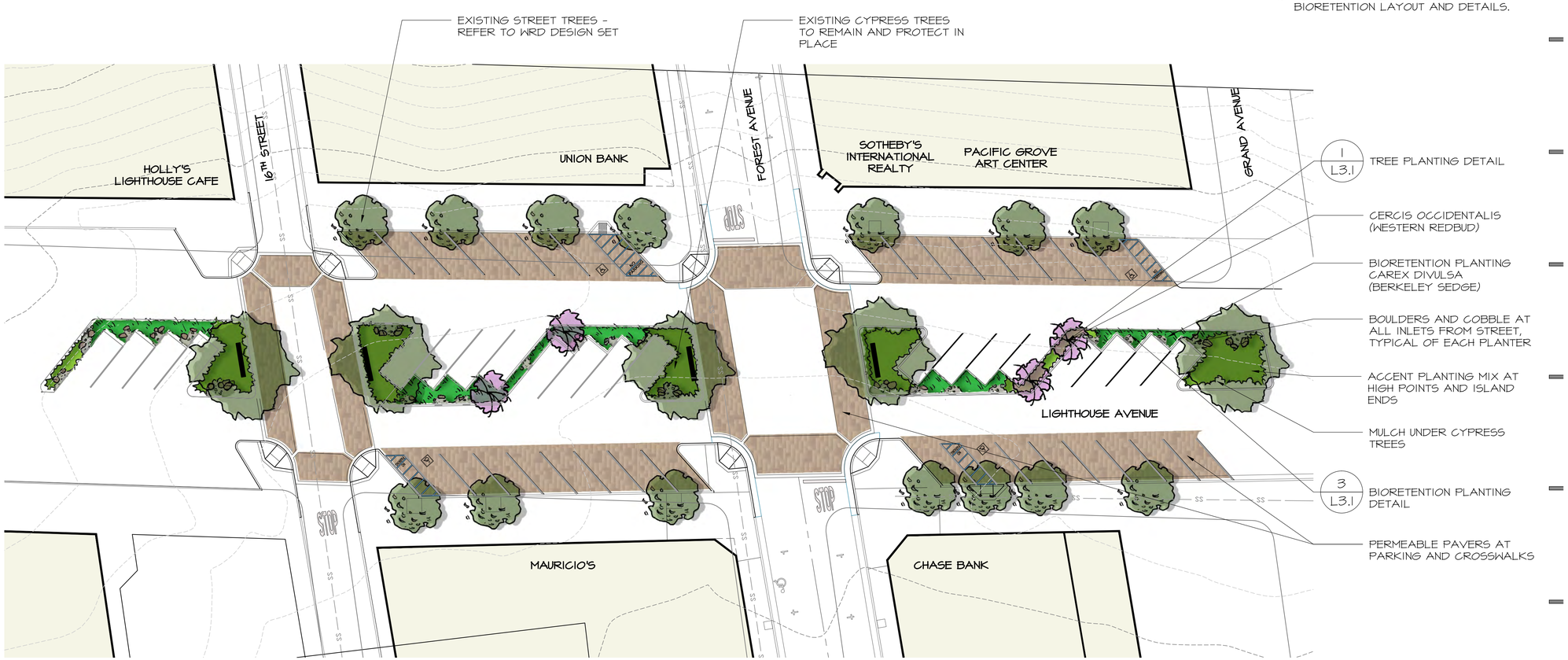
FALL CREEK ENGINEERING, INC.
Consulting Engineers
Civil • Environmental • Water Resources
P.O. BOX 7894, SANTA CRUZ, CA 95061
TEL (831) 426-9054 FAX (831) 426-4932

REGISTERED LANDSCAPE ARCHITECT J.L. JANECKI 3163 Exp. 9/30/16 STATE OF CALIFORNIA
SUPERSEDED

DRAWN BY:	JH/MO
CHECKED BY:	AW
DATE:	DECEMBER 16, 2016
JOB NO:	21613
SCALE:	1"=10'-0"
SHEET:	L1.1

T:\PROJECTS\16-300.FCE-Pacific Grove LID\Drawings\PG LID LANDSCAPE.dwg, L1.1 FANDANGO, 12/7/2016 11:10:48 AM, DWG To PDF.pc3, ARCH full bleed D (36.00 x 24.00 Inches), 1:1
24"x36" SHEET. IF SHEET SIZE IS SMALLER, DRAWING HAS BEEN REDUCED.

NOTES:
1. REFER TO WRD PLANS DATED 1/11/16 FOR ADDITIONAL STREET CONCEPT DEVELOPMENT AND DETAILS.
2. REFER TO SHEET L2.2 FOR PLANTING AND MATERIALS SELECTION.
3. REFER TO SHEETS L3.0 AND L3.1 FOR CONSTRUCTION DETAILS.
4. REFER TO CIVIL DRAWINGS FOR BIORETENTION LAYOUT AND DETAILS.



0 10' 20' 40'
SCALE: 1"=20'-0"

ORIGINAL SHEET SIZE: 24" X 36"

PRELIMINARY DRAWINGS NOT FOR CONSTRUCTION

SHEET TITLE:
LIGHTHOUSE AVENUE
COMPLETE STREET CONCEPT
LANDSCAPE SITE PLAN

CLIENT:
CITY OF PACIFIC GROVE
CONTACT: DANIEL GHO
300 FOREST AVENUE
PACIFIC GROVE, CA 93950

PROJECT TITLE:
LID ASSESSMENT
CITY OF PACIFIC GROVE
300 FOREST AVENUE
PACIFIC GROVE, CA 93950

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REGISTERED LANDSCAPE ARCHITECT J. L. JANECKI 3163 EXP. 9/30/18 STATE OF CALIFORNIA
SUBMITTED FOR ASSESSMENT

DRAWN BY:	JH/MO
CHECKED BY:	AW
DATE:	DECEMBER 16, 2016
JOB NO:	21613
SCALE:	1"=20'-0"
SHEET:	L1.2

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24"x36" SHEET - IF SHEET SIZE IS SMALLER, DRAWING HAS BEEN REDUCED.

NOTES:

1. REFER TO SHEET L2.3 FOR PLANTING AND MATERIALS SELECTION.
2. REFER TO SHEETS L3.0 AND L3.1 FOR CONSTRUCTION DETAILS.
3. REFER TO CIVIL DRAWINGS FOR BIORETENTION LAYOUT AND DETAILS.

0 5' 10' 20'
SCALE: 1"=10'-0"

ORIGINAL SHEET SIZE: 24" X 36"

PRELIMINARY DRAWINGS NOT FOR CONSTRUCTION

SHEET TITLE:
LIBRARY RAIN GARDEN & BIORETENTION ISLANDS LANDSCAPE SITE PLAN

CLIENT:
CITY OF PACIFIC GROVE
CONTACT: DANIEL GHO
300 FOREST AVENUE
PACIFIC GROVE, CA 93950

PROJECT TITLE:
LID ASSESSMENT
CITY OF PACIFIC GROVE
300 FOREST AVENUE
PACIFIC GROVE, CA 93950

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REGISTERED LANDSCAPE ARCHITECT J.L. JANECKI 3163 EXP. 9/30/15 STATE OF CALIFORNIA

SIGNED DRAFT

DRAWN BY:	JH/MO
CHECKED BY:	AW
DATE:	DECEMBER 16, 2016
JOB NO:	21613
SCALE:	1"=10'-0"
SHEET:	L1.3

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24"x36" SHEET. IF SHEET SIZE IS SMALLER, DRAWING HAS BEEN REDUCED.

NOTES:
1. REFER TO SHEET L2.4 FOR PLANTING AND MATERIALS SELECTION.
2. REFER TO SHEETS L3.0 AND L3.1 FOR CONSTRUCTION DETAILS.
3. REFER TO CIVIL DRAWINGS FOR BIORETENTION LAYOUT AND DETAILS.

0 10' 20' 40'
SCALE: 1"=20'-0"

ORIGINAL SHEET SIZE: 24" X 36"

PRELIMINARY DRAWINGS NOT FOR CONSTRUCTION

SHEET TITLE:
BERWICK PARK BIORETENTION LANDSCAPE SITE PLAN

CLIENT:
CITY OF PACIFIC GROVE
CONTACT: DANIEL GHO
300 FOREST AVENUE
PACIFIC GROVE, CA 93950

PROJECT TITLE:
LID ASSESSMENT
CITY OF PACIFIC GROVE
300 FOREST AVENUE
PACIFIC GROVE, CA 93950

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REGISTERED LANDSCAPE ARCHITECT J.L. JANECKI 3163 EXP. 9/30/18 STATE OF CALIFORNIA
SUBMITTED FOR REVIEW

DRAWN BY:	JH/MO
CHECKED BY:	AW
DATE:	DECEMBER 16, 2016
JOB NO:	21613
SCALE:	1"=20'-0"
SHEET:	L1.4

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24"x36" SHEET. IF SHEET SIZE IS SMALLER, DRAWING HAS BEEN REDUCED.

A B C D E F G H I J K L M N O P

MEDIAN MIX A

ARCTOSTAPHYLOS EDMUNDSII
'CARMEL SUR'
(CARMEL SUR MANZANITA)

CEANOTHUS GRISEUS HORIZONTALIS
(CARMEL CREEPER)

MUHLENBERGIA RIGENS
(DEER GRASS)

LOPHOSTEMON CONFERTUS
(BRISBANE BOX)

MEDIAN MIX B

ARCTOSTAPHYLOS 'PACIFIC MIST'
(PACIFIC MIST MANZANITA)

GREVILLEA LANIGERA 'COASTAL GEM'
(WOOLLY GREVILLEA)

ACER RUBRUM
'ARMSTRONG'
(RED MAPLE)

MEDIAN MIX C

CORREA 'DUSKY BELLS'
(AUSTRALIAN FUCHSIA)

MYOPORUM PARVIFOLIUM 'PUTAH CREEK'
(CREEPING MYOPORUM)

BIOSWALE MIX

CAREX BARBARAE
(SANTA BARBARA SEDGE)

JUNCUS PATENS 'ELK BLUE'
(CALIFORNIA BLUE RUSH)

LEYMUS CONDENSATUS
'CANYON PRINCE'
(WILD RYE)

STREET TREE OPTIONS

LIQUIDAMBAR
STYRACIFLUA
(SWEET GUM)

LOPHOSTEMON CONFERTUS
(BRISBANE BOX)

METROSIDEROS EXCELSA
(NEW ZEALAND CHRISTMAS TREE)

MATERIALS PALETTE

GRANITE BOULDERS
COLOR: SALT AND PEPPER GREY AND TAN
SIZE VARIES: 12-INCH TO 36-INCH

PERMEABLE PAVERS AT CROSSWALK AND PARKING

PRELIMINARY DRAWINGS NOT FOR CONSTRUCTION

SHEET TITLE:
PINE AVENUE
COMPLETE STREET CORRIDOR
PLANT AND MATERIALS IMAGES

CLIENT:
CITY OF PACIFIC GROVE
CONTACT: DANIEL GHO
300 FOREST AVENUE
PACIFIC GROVE, CA 93950

PROJECT TITLE:
LID ASSESSMENT
CITY OF PACIFIC GROVE
300 FOREST AVENUE
PACIFIC GROVE, CA 93950

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REGISTERED LANDSCAPE ARCHITECT J. L. JANECKI No. 3163 Exp. 12-31-15 STATE OF CALIFORNIA

SUPERSEDED

DRAWN BY:	JH/MO
CHECKED BY:	AW
DATE:	DECEMBER 16, 2016
JOB NO:	21613
SCALE:	-
SHEET:	L2.0

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24"x36" SHEET. IF SHEET SIZE IS SMALLER, DRAWING HAS BEEN REDUCED.

BIOSWALE MIX

CAREX BARBARAE
(SANTA BARBARA SEDGE)

CAREX DIVULSA
(BERKELEY SEDGE)

JUNCUS PATENS 'ELK BLUE'
(CALIFORNIA BLUE RUSH)

TREE SPECIES

ACER RUBRUM
'ARMSTRONG'
(RED MAPLE)

PLATANUS X ACERIFOLIA
'YARWOOD'
(LONDON PLANE TREE)

MATERIALS PALETTE

GRANITE BOULDERS
COLOR: SALT AND PEPPER GREY AND TAN
SIZE VARIES: 12-INCH TO 36-INCH

FOOT BRIDGE CROSSING AT BIORETENTION PLANTER

PERMEABLE PAVERS AT PARKING LOT CROSSING

CURB CUTS AT BIORETENTION PLANTERS

PRECEDENT IMAGES

PRELIMINARY DRAWINGS NOT FOR CONSTRUCTION

SHEET TITLE:
(FANDANGO) CITY PARKING LOT
LID IMPROVEMENTS
PLANT AND MATERIALS IMAGES

CLIENT:
CITY OF PACIFIC GROVE
CONTACT: DANIEL GHO
300 FOREST AVENUE
PACIFIC GROVE, CA 93950

PROJECT TITLE:
LID ASSESSMENT
CITY OF PACIFIC GROVE
300 FOREST AVENUE
PACIFIC GROVE, CA 93950

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REGISTERED LANDSCAPE ARCHITECT
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EXP. 12-31-18
STATE OF CALIFORNIA

SUPERSEDED

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SCALE:	-
SHEET:	L2.1

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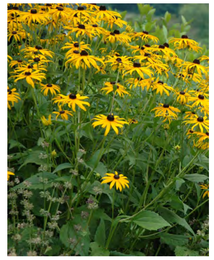
24"x36" SHEET. IF SHEET SIZE IS SMALLER, DRAWING HAS BEEN REDUCED.

ACCENT PLANT MIX

ACHILLEA 'MOONSHINE'
(MOONSHINE YARROW)

CALAMAGROSTIS FOLIOSA
(MENDOCINO REED GRASS)

GREVILLEA LANIGERA
'COASTAL GEM'
(WOOLLY GREVILLEA)



RUDBECKIA FULGIDA
'GOLDSTRUM'
(BLACK-EYED SUSAN)

BIOSWALE PLANTING

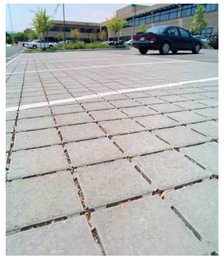
CAREX DIVULSA
(BERKELEY SEDGE)

TREE SPECIES

CERCIS OCCIDENTALIS
(WESTERN REDBUD)

MATERIALS PALETTE

PERMEABLE PAVERS AT CROSSWALK AND PARKING



CURB CUTS AT BIORETENTION PLANTER

GRANITE BOULDERS
COLOR: SALT AND PEPPER GREY AND TAN
SIZE VARIES: 12-INCH TO 36-INCH

RIVER COBBLE
COLOR:TAN AND GREY
SIZE VARIES: 4-INCH TO 6-INCH

PRECEDENT IMAGES

PRELIMINARY DRAWINGS NOT FOR CONSTRUCTION

SHEET TITLE:
LIGHTHOUSE AVENUE
COMPLETE STREET CONCEPT
PLANT AND MATERIALS IMAGES

CLIENT:
CITY OF PACIFIC GROVE
CONTACT: DANIEL GHO
300 FOREST AVENUE
PACIFIC GROVE, CA 93950

PROJECT TITLE:
LID ASSESSMENT
CITY OF PACIFIC GROVE
300 FOREST AVENUE
PACIFIC GROVE, CA 93950

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REGISTERED LANDSCAPE ARCHITECT
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No. 3163
EXP. 12-31-18
STATE OF CALIFORNIA

DRAWN BY:	JH/MO
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JOB NO:	21613
SCALE:	-
SHEET:	L2.2

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24"x36" SHEET. IF SHEET SIZE IS SMALLER, DRAWING HAS BEEN REDUCED.

PLANT PALETTE

ACHILLEA 'MOONSHINE'
(MOONSHINE YARROW)

BACCHARIS PILULARIS
'TWIN PEAKS'
(DWARF COYOTE BRUSH)

CAREX DIVULSA
(BERKELEY SEDGE)

MIMULUS AURANTIACUS
(STICKY MONKEY FLOWER)

MUHLENBERGIA RIGENS
(DEER GRASS)

SALVIA CLEVELANDII
'ALLEN CHICKERING'
(CLEVELAND SAGE)

VERBENA LILACINA
'DE LA MINA'
(CEDROS ISLAND VERBENA)

MATERIALS PALETTE

WATER FEATURE AT DOWNSPOUT
DISCONNECT

GRANITE BOULDERS
COLOR: SALT AND PEPPER GREY AND TAN
SIZE VARIES: 12-INCH TO 36-INCH

RIVER COBBLE
COLOR:TAN AND GREY
SIZE VARIES: 4-INCH TO 6-INCH

DECORATIVE GRAPE STAKE FENCE (MUSEUM BUILDING)

PRECEDENT IMAGES

PRELIMINARY DRAWINGS NOT FOR CONSTRUCTION

SHEET TITLE:
LIBRARY RAIN GARDEN & BIORETENTION ISLANDS
PLANT AND MATERIALS IMAGES

CLIENT:
CITY OF PACIFIC GROVE
CONTACT: DANIEL GHO
300 FOREST AVENUE
PACIFIC GROVE, CA 93950

PROJECT TITLE:
LID ASSESSMENT
CITY OF PACIFIC GROVE
300 FOREST AVENUE
PACIFIC GROVE, CA 93950

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STATE OF CALIFORNIA
SUPERSEDED

DRAWN BY:	JH/MO
CHECKED BY:	AW
DATE:	DECEMBER 16, 2016
JOB NO:	21613
SCALE:	-
SHEET:	L2.3

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24"x36" SHEET. IF SHEET SIZE IS SMALLER, DRAWING HAS BEEN REDUCED.

PLANT PALETTE

ACHILLEA MILLEFOLIUM
'SONOMA COAST'
(SONOMA COAST WHITE YARROW)

BACCHARIS PILULARIS
'TWIN PEAKS'
(DWARF COYOTE BRUSH)

CALAMAGROSTIS NUTKAENSIS
(PACIFIC REED GRASS)

CAREX DIVULSA
(BERKELEY SEDGE)

ERIOPHYLLUM STAECHADIFOLIUM
(LIZARD-TAIL)

MIMULUS AURANTIACUS
(STICKY MONKEY FLOWER)

SALVIA CLEVELANDII
'ALLEN CHICKERING'
(CLEVELAND SAGE)

VERBENA LILACINA
'DE LA MINA'
(CEDROS ISLAND VERBENA)

MATERIALS PALETTE

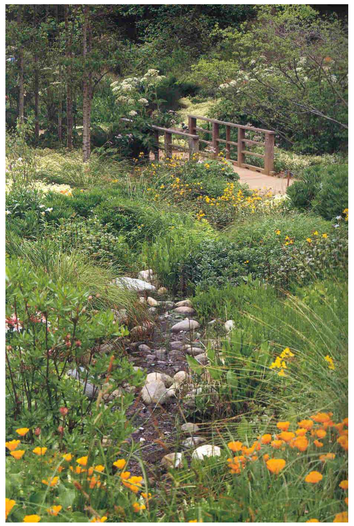
GRANITE BOULDERS
COLOR: SALT AND PEPPER GREY AND TAN
SIZE VARIES: 12-INCH TO 36-INCH

RIVER ROCK
COLOR: MIX OF BROWN, TAN AND GREY
SIZE VARIES: 4-INCH TO 8-INCH

CRUSHED GRANITE
COLOR: GREY
SIZE: 1/2-INCH TO 3/4-INCH

WOOD BRIDGE AT BIOSWALE

PRECEDENT IMAGES



PRELIMINARY DRAWINGS NOT FOR CONSTRUCTION

SHEET TITLE:
BERWICK PARK BIORETENTION
PLANT AND MATERIALS IMAGES

CLIENT:
CITY OF PACIFIC GROVE
CONTACT: DANIEL GHO
300 FOREST AVENUE
PACIFIC GROVE, CA 93950

PROJECT TITLE:
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CITY OF PACIFIC GROVE
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REGISTERED LANDSCAPE ARCHITECT
J. L. JANECKI
No. 3163
EXP. 12-31-18
STATE OF CALIFORNIA
SIGNATURE

DRAWN BY:	JH/MO
CHECKED BY:	AW
DATE:	DECEMBER 16, 2016
JOB NO:	21613
SCALE:	-
SHEET:	L2.4

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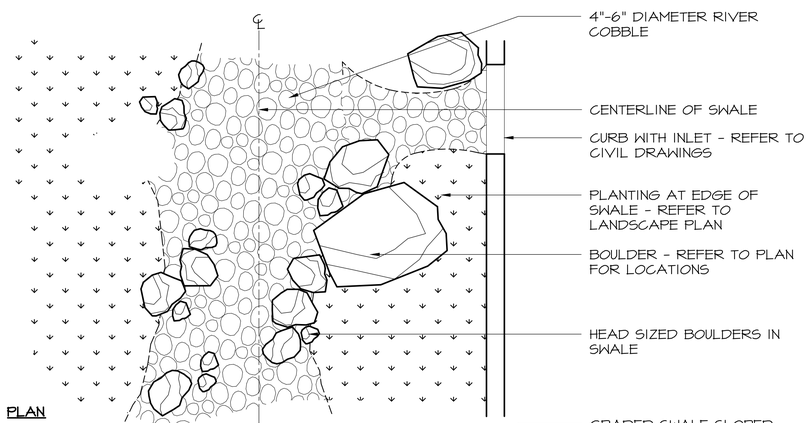
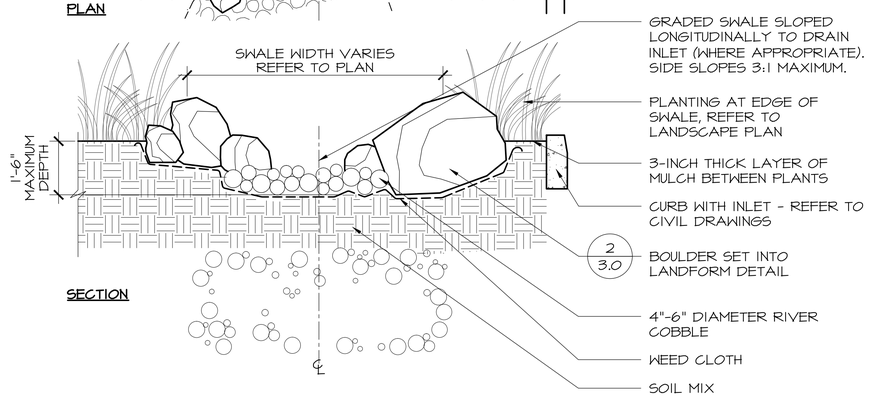
24"x36" SHEET. IF SHEET SIZE IS SMALLER, DRAWING HAS BEEN REDUCED.

NOTES:
1. CONTRACTOR TO COORDINATE SHAPE, DEPTH, AND FORM OF SWALE WITH DRAWINGS AND SITE CONDITIONS. REVIEW SWALE LAYOUT WITH OWNER'S REPRESENTATIVE PRIOR TO INSTALLATION.
2. RETAIN POSITIVE DRAINAGE TO EXISTING DRAIN INLETS AND PLANTER INLETS.
3. CONTRACTOR TO FIELD VERIFY SWALE LAYOUT, SHAPE, DEPTH, AND FORM WITH CIVIL ENGINEER PRIOR TO COMPLETING GRADING.

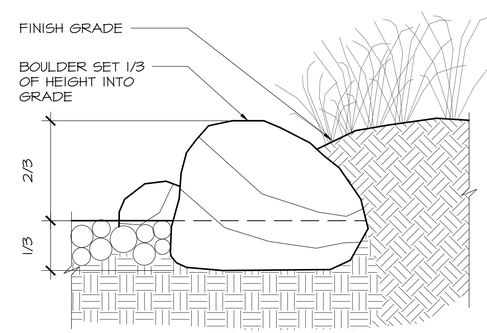


PLAN



SECTION

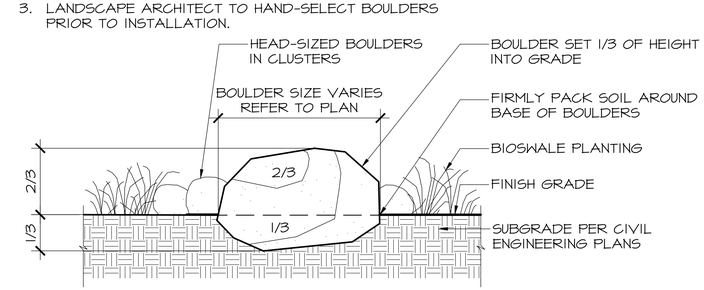
3 RAIN GARDEN/SWALE DETAIL
SCALE: 1/2"=1'-0"



NOTES:
1. AVOID CHIPPING OR SCRATCHING BOULDERS WHILE MOVING OR STORING.
2. REFER TO LANDSCAPE MATERIALS PLANS FOR BOULDER LOCATIONS AND QUANTITIES.

2 BOULDER SET IN LANDFORM DETAIL
SCALE: 3/4"=1'-0"

NOTES:
1. AVOID CHIPPING OR SCRATCHING BOULDER WHILE MOVING OR STORING.
2. SEE PLANT AND MATERIALS IMAGE SHEETS FOR BOULDER TYPE AND SIZING.
3. LANDSCAPE ARCHITECT TO HAND-SELECT BOULDERS PRIOR TO INSTALLATION.



1 BOULDER SETTING DETAIL
SCALE: 3/4"=1'-0"

PRELIMINARY DRAWINGS NOT FOR CONSTRUCTION

SHEET TITLE:
MATERIALS DETAILS

CLIENT:
CITY OF PACIFIC GROVE
CONTACT: DANIEL GHO
300 FOREST AVENUE
PACIFIC GROVE, CA 93950

PROJECT TITLE:
LID ASSESSMENT
CITY OF PACIFIC GROVE
300 FOREST AVENUE
PACIFIC GROVE, CA 93950

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REGISTERED LANDSCAPE ARCHITECT J. L. JANECKI 3163 EXP. 12-31-17 STATE OF CALIFORNIA

SCHEMATIC DESIGN

DRAWN BY:	JH/MO
CHECKED BY:	AW
DATE:	DECEMBER 16, 2016
JOB NO:	21613
SCALE:	AS NOTED
SHEET:	L3.0

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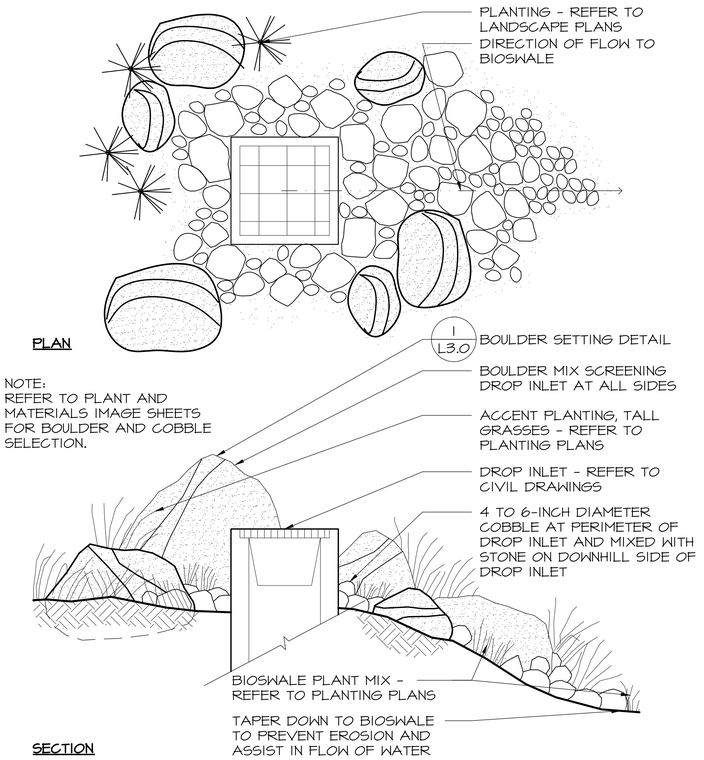
24"x36" SHEET. IF SHEET SIZE IS SMALLER, DRAWING HAS BEEN REDUCED.

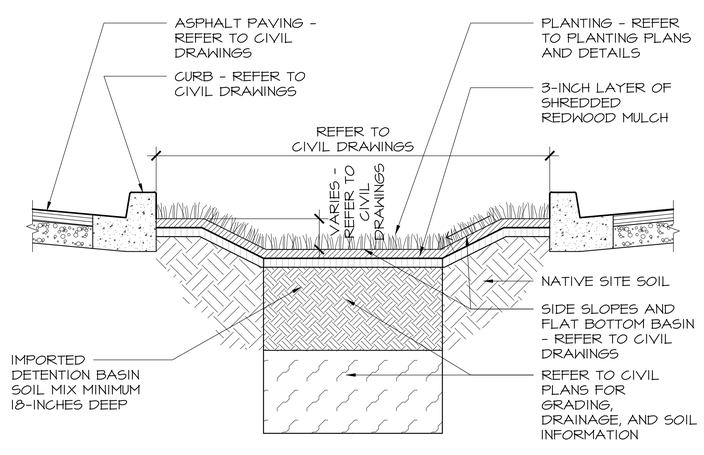
PLANTING NOTES

1. ALL EXISTING TREES SHALL BE PROTECTED IN PLACE UNLESS NOTED OTHERWISE. CONTRACTOR SHALL BE RESPONSIBLE FOR DAMAGE OF ANY KIND TO EXISTING TREES DURING THE COURSE OF CONSTRUCTION.
2. CONTRACTOR SHALL PROCURE PLANT SPECIES WITHIN THIRTY (30) DAYS OF AWARD OF THE CONTRACT. CONTRACTOR SHALL BE RESPONSIBLE FOR PLACING REQUIRED DEPOSITS TO ENSURE TIMELY PROCUREMENT OF THE SPECIFIED PLANTS. CONTRACTOR SHALL PROVIDE OWNER'S REPRESENTATIVE WITH WRITTEN VERIFICATION (RECEIPTS) SHOWING PROCUREMENT TO MEET THE PLANTING REQUIREMENTS. PLANTS MAY NEED TO BE CONTRACT GROWN TO ENSURE PLANT AVAILABILITY.
3. THE CONTRACTOR SHALL NOTIFY THE OWNER'S REPRESENTATIVE A MINIMUM OF FIVE (5) DAYS IN ADVANCE TO SCHEDULE PLANT DELIVERY DATES. THE OWNER'S REPRESENTATIVE SHALL INSPECT PLANTS UPON ARRIVAL, AND RESERVES THE RIGHT TO REJECT PLANTS.
4. THE CONTRACTOR SHALL PLACE PLANTS AS SHOWN ON PLAN AND VERIFY LOCATION WITH OWNER'S REPRESENTATIVE. OWNER'S REPRESENTATIVE MAY REQUEST THAT CONTRACTOR ADJUST OR RELOCATE PLANTS ON-SITE AS NEEDED TO PROPERLY COMPLETE DESIGN.
5. HOLD FINISHED GRADES FOR SHRUB AREAS 1½-INCHES BELOW TOP OF ADJACENT PAVEMENT OR WALLS, UNLESS OTHERWISE NOTED ON THE DRAWINGS.
6. GRADUALLY ROUND OFF TOPS AND TOES OF ALL PLANTED SLOPES TO PRODUCE A SMOOTH AND NATURAL TRANSITION BETWEEN EXISTING PLANTINGS, FINISH GRADES, AND NEW PLANTINGS.
7. SITE SOIL SHALL BE TESTED FOR PLANTING SUITABILITY. AMENDMENTS SHALL BE ADDED AS RECOMMENDED IN SOIL REPORT.
8. ADD COIR EROSION CONTROL MAT FOR ALL SLOPES AND BIORETENTION PLANTING ZONES, INSTALL PER MANUFACTURERS RECOMMENDATIONS.
9. PROVIDE A MINIMUM OF 3 INCHES OF 1"-1½" SIZE COMPOSTED REDWOOD MULCH TO SOIL SURFACE OUTSIDE OF BIORETENTION AREAS AFTER PLANTING. MULCH SHALL NOT BE PLACED IN INUNDATION ZONE OF BIORETENTION AREAS (SEE CIVIL SECTION FOR SOIL PREPARATION) OR WITHIN A 12-INCH DIAMETER OF TREE TRUNKS AND SHOULD BE KEPT FREE FROM THE CROWN OF ALL GRASSES.

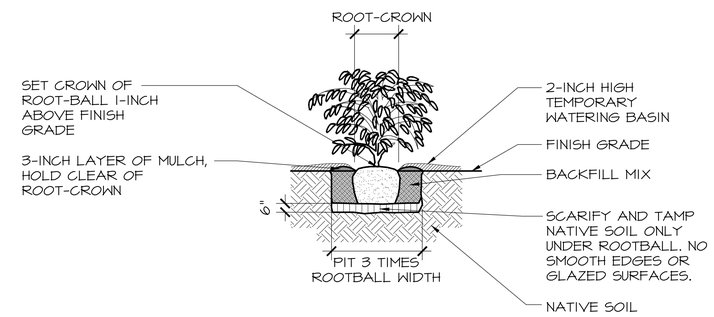


4 STORMWATER DISSIPATOR DETAIL
NOT TO SCALE

NOTES:
1. DO NOT COMPACT SOIL ABOVE "BOOT COMPACTION" (85 - 90%).
2. REFER TO CIVIL DRAWINGS FOR LAYOUT AND DETAILS
3. GRADING FOR BIOSWALES SHALL BE ACCEPTED BY OWNER'S REPRESENTATIVE PRIOR TO PLANTING.

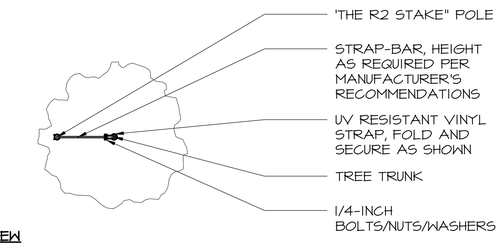


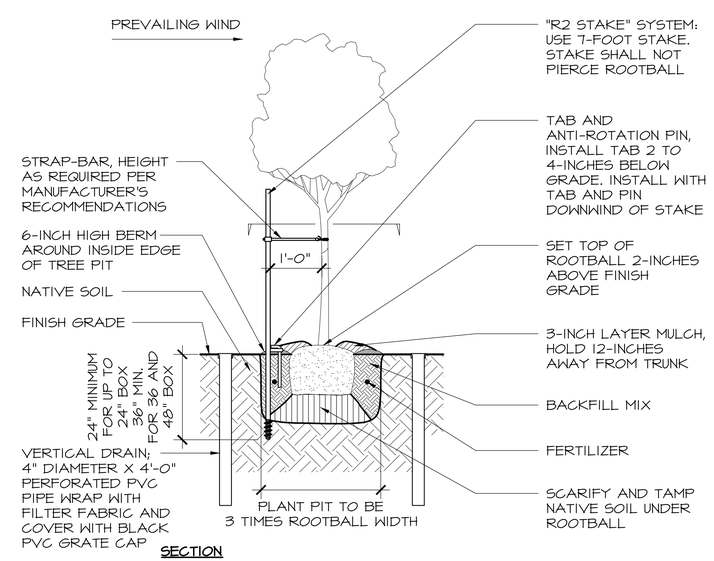
3 BIORETENTION PLANTING DETAIL
NOT TO SCALE



2 SHRUB OR GRASS PLANTING DETAIL
NOT TO SCALE

NOTES:
1. ALL TREES TO BE STAKED ON PREVAILING WIND SIDE WHEN TREE IS IN LEAF.
2. CONTRACTOR SHALL REMOVE NURSERY STAKE(S) AND TAGS FROM TREES UPON COMPLETION OF STAKING.
3. REMOVE TEMPORARY WATERING BASINS ONCE RAINY SEASON HAS COMMENCED.





1 TREE PLANTING DETAIL
NOT TO SCALE

PRELIMINARY DRAWINGS NOT FOR CONSTRUCTION

SHEET TITLE: PLANTING NOTES AND DETAILS

CLIENT: CITY OF PACIFIC GROVE
CONTACT: DANIEL GHO
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PROJECT TITLE: LID ASSESSMENT
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REGISTERED LANDSCAPE ARCHITECT J. L. JANECKI 3163 EXP. 9-30-17 STATE OF CALIFORNIA

DRAWN BY:	JH/MO
CHECKED BY:	AW
DATE:	DECEMBER 16, 2016
JOB NO:	21613
SCALE:	AS NOTED
SHEET:	L3.1

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24"x36" SHEET. IF SHEET SIZE IS SMALLER, DRAWING HAS BEEN REDUCED.

PUBLIC TREE INVENTORY

The following documents were completed as part of the Citywide Public Tree Inventory.

- Public Tree Inventory (2015)
- Urban Forest Resource Analysis (2015), and
- Urban Tree Canopy Assessment (2015).

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Public Tree Inventory Report

July 2015

Prepared for: **City of Pacific Grove**
City Hall
300 Forest Avenue
Pacific Grove, CA 93950

Prepared by: **Davey Resource Group**
A Division of The Davey Tree Expert Company
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800-828-8312

Funding provided by Proposition 84 to Improve the Sustainability and Livability of California's Communities through the Strategic Growth Council's Urban Greening for Sustainable Communities Grant Program.

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Executive Summary

A complete tree inventory is an invaluable tool for urban forest managers. It should be kept current and accessed regularly to develop work assignments and identify strategies for improving and enhancing the urban forest. In April 2015, the City of Pacific Grove contracted with Davey Resource Group (DRG) to collect an inventory of all public street and park trees, recording data about location, species, condition, size, and maintenance needs. Private trees were not included in the inventory.

Managers now have an opportunity to use this data to prioritize work, reduce hazards, and increase the health of the urban forest. During the inventory, maintenance priorities were assigned for each tree, including a description of the work required and the timeframe within which it should be conducted. The inventory data includes additional information that can help urban forest managers determine priorities and anticipate future needs. Information about tree age, disease, defects, nearby utilities, sidewalk displacement, and location can also be used to strategically plan work.

Analysis of the inventory data provides the following information:

- The inventory includes 7,394 trees and 623 vacant sites and stumps, for a stocking level of 92.2%
- The most common species are *Quercus agrifolia* (coast live oak, 30% of the population), *Pinus radiata* (Monterey pine, 25%), and *Cupressus macrocarpa* (Monterey cypress, 21%),
- The most common condition ratings are fair (40%, 3,226 trees) to good (39%, 3,084 trees).
- The most common maintenance recommendation is routine pruning (64%, 5,115 trees).
- Removal is recommended for 8.8% of the inventory, (718 trees).
- Sidewalk repair is required at 258 tree sites.
- Pruning for clearance is recommended for 128 sites.
- Issues with tree stakes were found for 200 trees.

Based on these findings, the following recommendations are provided:

- Prioritize removal of and pruning of 530 **Priority 1** trees.
- Provide clearance pruning for 128 trees, especially for visibility and public safety.
- Develop a 3-5 year pruning cycle for **Priority 2** and **routine pruning** of the remaining trees.
- Repair hardscape damage at 395 tree sites.
- Develop a planting plan to increase stocking level and provide replacements for removals where appropriate. Considering both current vacant sites, and removals anticipated in the next 5-10 years, there will be 1,341 sites available for tree planting in the near future.
- Address issues with tree stakes for 200 trees.

Considering that Pacific Grove has an established public tree population with a large portion of native trees, the urban forest is an important and iconic component of the community. Residents rely on urban forestry staff to manage this resource proactively in order to maintain public safety, enhance and preserve the life expectancy of established trees, and plan for future tree planting. Managers have an opportunity to increase the diversity in the entire population by carefully selecting a diversity of tree species for use in the community tree palette. With appropriate management and replanting, the Pacific Grove urban forest can continue to be a vital community asset for many years to come.

Introduction

This report outlines strategies to help managers sort, interpret, and analyze data collected in the 2015 inventory of Pacific Grove's public trees. To collect this inventory, a team of International Society of Arboriculture (ISA) certified arborists from DRG mapped the location and collected data for street trees using global positioning system technology. In addition to location, the arborists collected information about the species, size, condition, and current maintenance needs of each tree. This inventory was a ground-level visual inspection, and did not include root excavation, or climbing to inspect defects visible from the canopy or scaffold branches.

Pacific Grove's public urban forest is unique, including a large number of native and well-established trees. This population requires a management plan that is responsive to the special details of this particular community. As a coastal community, the common native trees, including *Pinus radiata* (Monterey pine), *Quercus agrifolia* (coast live oak), and *Cupressus macrocarpa* (Monterey Cyprus) are a vital part of the landscape, comprising 76% of the population. These and other large stature trees provide a sense of place, framing breathtaking views, supporting outdoor recreational activities, and providing residents and visitors an unparalleled quality of life. Home to a monarch butterfly habitat, many of the urban trees produce nectar, and provide habitat for butterflies and other wildlife. Furthermore, the 7,394 public trees provide quantifiable environmental and economic benefits, which are described in the Pacific Grove Urban Forest Resource Analysis (2015), a companion to this report.

An urban forest is a dynamic resource, constantly changing and growing in response to environment and care. This Inventory Report focuses on the maintenance needs for the next 5-10 years. With maintenance needs and priority identified, managers can schedule crews appropriately, and request appropriate levels of funding to maintain Pacific Grove's community trees.

Large Stature Trees Create a Sense of Place

Inventory Methods

Inventory arborists are trained to collect accurate, standardized, replicable data. All personnel who collected field data followed consistent methods to ensure uniformity and lack of individual bias in evaluating the trees. The specific definitions below helped maintain this standard, yielding highly reliable, accurate data about the inventoried trees and sites.

Site Data

Site data includes information about the location of the tree that will help managers identify the tree on their next visit. The City also provided a map of 16 areas or neighborhoods, and these were recorded with the tree record. If a tree was in a park, the name was recorded with the tree record. Physical addresses generally corresponded with the information provided by the city, except in some cases where the physical address (numbers posted on a building) were different. In those cases, the physical address was recorded along with a note that the map was inaccurate. Nearby cross streets were also recorded, including the cross street before and after the block on which the tree is located (Figure 1). This method has the particular advantage of supporting tree crew management by blocks and neighborhood.

Figure 1. Street Records Support Block-Side Work

Tree Data includes information to support block-side work assignments for crew efficiency.

In some cases, no address was available, so a block side address was assigned. Generally, the assigned addresses end in 00 or 01, and a note is made in the database that the address is assigned. Trees were collected with the flow of traffic, and median trees were collected with the flow of traffic on the even side of the street. The location of each tree on the property was recorded, including left, right, front and back, and each tree was numbered in sequence with the flow of traffic. Park trees were sequenced based on the path the arborist took to collect the trees and generally was conducted in a clockwise manner. Since parks do not have property sides (left, right, front, and back), N/A was assigned for the side data field. Trees at the edge of parks were considered street trees.

Tree Attributes

The following attributes were collected for each site:

- **Mapping coordinate.** X and Y coordinate locations (latitude and longitude). Additionally, each tree and planting site was located using GIS maps and/or GPS equipment.
- **Descriptive Location (Block side).** DRG documented the location of each street tree and planting site so that they can easily be identified for future work. Street trees and planting sites were located using a street name, side of lot, tree number, and blockside information (on street, from street, and to street).
- **Area 1 & 2.** Tree locations were identified by neighborhood as mapped in the City General Plan. The field Area 2 was used to designate the park name where applicable.
- **Location.** The trees physical location in relation to public ROW and/or public space were recorded.
- **Species.** Trees were identified by genus and species, and by common name.
- **Diameter.** Trunk diameter was recorded to the nearest one-inch.
- **Stems.** The number of stems was recorded. (2 ft. above grade)
- **Condition.** In general, the condition of each tree was recorded in one of the following categories adapted from the rating system established by the International Society of Arboriculture:

Excellent	100%
Very Good	90%
Good	80%
Fair	60%
Poor	40%
Critical	20%
Dead	0%

- **Maintenance need.** The following maintenance categories were collected:

  1. Priority 1 Removal. Trees designated for removal have defects that are not cost-effective or practical to treat. The majority of the trees in this category have a large percentage of dead crown and poses an elevated level of risk for failure. Any hazards that were seen as potential dangers to persons or property and/or seen as potential liabilities to the client are in this category. Large dead and dying trees that are high liability risks are included in this category. These trees are the first ones that should be removed.
  2. Priority 2 Removal. Trees that should be removed but do not pose a liability as great as the first priority will be identified here. This category would need attention as soon as "Priority One" trees are removed.
  3. Priority 1 Prune. Trees that require priority one pruning are recommended for pruning to remove hazardous deadwood, hangers, or broken branches. These trees have broken or hanging limbs, hazardous deadwood, and dead, dying, or diseased limbs or leaders greater than four inches in diameter.
  4. Priority 2 Prune. These trees have dead, dying, diseased, or weakened branches between two and four inches in diameter and are potential safety hazards

5. Large Tree Routine Prune. These trees require routine horticultural pruning to correct structural problems or growth patterns that would eventually obstruct traffic or interfere with utility wires or buildings. Trees in this category are large enough to require bucket truck access or manual climbing.
6. Small Tree Routine Prune. These trees require routine horticultural pruning to correct structural problems or growth patterns that would eventually obstruct traffic or interfere with utility wires or buildings. These trees are small growing, mature trees that can be evaluated and pruned from the ground.
7. Training Prune. Young, large-growing trees that are still small must be pruned to correct or eliminate weak, interfering, or objectionable branches in order to minimize future maintenance requirements. These trees, up to 20 feet in height, can be worked with a pole pruner by a person standing on the ground.
8. Stump Removal. This category indicates a stump that should be removed.

- **Plant Tree.** During the inventory, vacant planting sites were identified by street and address. The size of the site is designated as small, medium, or large (indicating the ultimate size that the tree will attain), depending on the growing space available and the presence of overhead wires.
- **Observations.** General observations referring to a tree's health, structure, and location were made
- **Clearance Required.** Trees which are causing or may cause visibility or clearance difficulties for pedestrians or vehicles will be identified, as well as those trees blocking clear visibility of signs, street lights or traffic signals.
- **Hardscape Damage.** Damage to sidewalks and curbs by tree roots are noted. Notes for potential fixes were recorded.
- **Overhead Utilities.** The inventory indicates whether overhead conductors or other utilities are present at the tree site that could result in conflicts with the tree.
- Grow space. The area within the growing space is categorized as:

T	Tree Lawn
W	Well/Pit
M	Median
P	Raised Planter
O	Open/Unrestricted
I	Island
U	Unmaintained Area

- **Space Size.** The narrowest dimension of the Grow Space, in feet.
- **Notes and Observations.** Additional information regarding mechanical damage, possible disease, codominant stems, previous failures, and insect presence was included in this field.

Quality Control Procedures

Data was collected and verified with the following quality control measures.

- **Training –** Quality control procedures ensure quality data. The first step in DRG's quality control is to provide proper training of qualified individuals. Our field personnel on this project were ISA Certified Arborists with up-to-date credentials.
- **Data Collections Specification –** A clear understanding of the data and the methods for collection and categorization ensure high-quality, standardized collection. DRG worked with the City of Pacific Grove to develop a detailed specification before actual data collection began.
- **Field Quality Check –** At the beginning of the project, 10% of each arborist's information was checked for quality and completeness. All aspects of data collection were reviewed. As the project progressed, the percentage of quality-controlled information may have decrease based on an individual's abilities. DRG's supervisors provided quality control of collected information.
- **Quality Assurance Methods –** Quality assurance was completed electronically so that quality checks are a permanent record of the data collected. Errors were corrected as they were found.
- **Quality Assurance Reporting –** Quality assurance information was tallied by week ending date and is available upon request.
- **Tree Collection Interface (TCI) –** Inventory data was uploaded into DRG's TCI data management system. TCI works concurrently with DRG's ArcPad collection system to run real-time Quality Assurance algorithm checks on the data for an additional element to ensure data accuracy.

Findings

Understanding species composition, condition, maintenance needs, and site issues helps managers to prioritize work based on multiple factors, and schedule work based on available resources. This information allows managers to anticipate funding needs for the coming years. The following findings provide the context for the recommendations provided later in this report.

Species Composition

This inventory Report provides an overview of the species composition. The Pacific Grove Resource Analysis (2015) provides greater detail about the species composition of the entire urban forest, and the benefits provided by individual tree species. The brief summary presented here is included to provide context and an overview for the maintenance recommendations and planting plan suggestions provided in subsequent sections. A full species list is available in the appendices.

As a coastal community, the common native evergreen trees are an iconic part of the landscape, providing shelter, seasonal interest, wildlife habitat and economic and environmental benefits. The three most common species, including *Pinus radiata* (Monterey pine), *Quercus agrifolia* (coast live oak), and *Cupressus macrocarpa* (Monterey cyprus) comprise 76% of community tree population. Pacific Grove's mild coastal climate is an ideal environment for evergreens, including both broadleaf trees and conifers, which together comprise 94% of the overall resource.

An industry-accepted rule is to distribute species composition such that the urban forest is diverse, not relying too heavily on a few species. Diverse urban forests are more resilient to impacts such as weather events, climate, disease, and pest outbreaks. Because the top three species are so prevalent, it will be wise to include a greater diversity of alternative species in the planting palette, so that over time, the species composition will become more diverse and less reliant on these few species.

Table 1. Most Common Species

Species	Number of Trees	% of Total Trees
Quercus agrifolia	2,190	29.62
Pinus radiata	1,866	25.24
Cupressus macrocarpa	1,533	20.73
Eucalyptus globulus	211	2.85
Metrosideros excelsa	147	1.99
Eucalyptus ficifolia	132	1.79
Myoporum laetum	104	1.41
Pinus pinea	97	1.31
Prunus cerasifera	82	1.11
Pittosporum undulatum	75	1.01
Other trees	957	12.94
All Trees	**7,394**	**100%**

Condition and Relative Age Distribution

As trees establish, grow to maturity, and eventually decline, they require different levels of maintenance and inspection, depending on age. Thus, understanding the age distribution of the tree population can help managers anticipate how management needs will change over time. However, it is not feasible to track the exact age of every tree in the community tree resource. Fortunately, because most woody plants increase in stem diameter incrementally each year, the trunk diameter at breast height (DBH) is a reasonable approximation for age, known as the relative age. This distribution, shown in Figure 2, shows the tree population has three features that differ slightly from the ideal distribution of tree age classes.

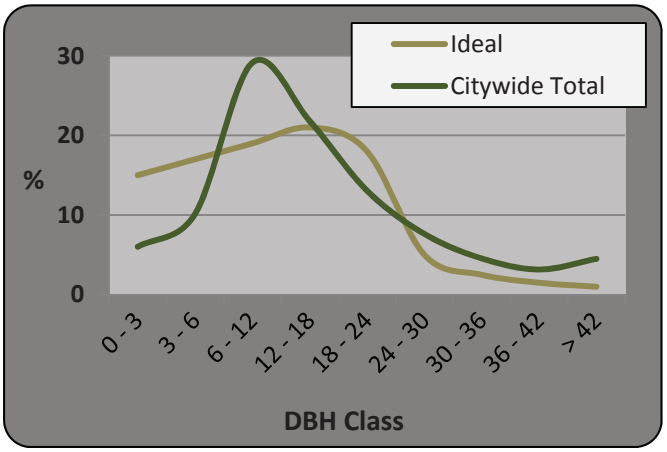

Figure 2. Relative Age Distribution

1. Too few trees in the 0-6" DBH classes
2. A spike in the 6-12" DBH Class
3. A substantial population of trees in the 24" and over DBH classes.

The best way to address the low number of young trees is to develop a tree planting plan. With 623 stumps or vacant sites, and another 304 dead trees, there are ample opportunities to begin establishing new, vigorous trees and shift the age distribution to a younger population. At the same time, tree planting and maintenance of newly planted trees will shift the condition distribution toward good to excellent condition. Furthermore, many fair condition trees may improve to good condition with proper pruning and cultural improvements, such as adding mulch and aeration soil areas to reduce compaction.

Some small statured species stay in the 6-12" DBH class most of their mature lives, but with adequate maintenance, species disposed to attaining larger stature will shift out of this size class into the larger classes. Thus, the best way to address this spike is simply to provide adequate maintenance, allowing the trees to mature. In a coastal environment, this can take several years to occur, and some areas strongly impacted by salt spray and wind may always be somewhat limited.

Considering that the Pacific Grove tree population has a substantial number of mature large-stature trees, the condition distribution understandably has more trees in the poor to dead condition classes than a younger, vigorous urban forest would. This age and condition distribution indicates urban forest managers will need to prioritize removing dead and critical trees in the coming years. Furthermore, the population of established, mature trees will require maintenance so they can preserved in the landscape at their mature large stature.

Table 2. Condition Distribution

Condition	Number of Sites	% of Pop.
Excellent	13	0.16%
Very Good	107	1.33%
Good	3,084	38.47%
Fair	3,226	40.24%
Poor	626	7.81%
Critical	34	0.42%
Dead	304	3.79%
Stump or Vacant	623	7.77%
Total	**8,017**	**100%**

Stocking Level

Pacific Grove's community urban forest currently includes 623 available planting sites, including 351 vacant sites and 272 stumps. Considering the public tree inventory identified a total of 8,017 planting sites with 7,394 existing trees, the current stocking level of the community forest is 92.2%.

Maintenance Priority

Maintenance priorities were assigned based on the most critical or important issue identified for each tree. As maintenance is performed, additional tasks may also be required based on the judgement of the tree pruning technician. Recently, drought has caused rapid decline in many trees, and contracted maintenance activities such as high priority removals have required all available funds, reducing the capacity for proactive maintenance. Based on this tree inventory, maintenance and removal needs are substantial. Addressing this will require increased program resources to provide for public safety as well as regular tree maintenance.

Maintenance domains including Pruning, Removal, and Planting are discussed separately in the following sections.

Pruning

In considering tree maintenance priorities, managers must focus on public safety, and then address tasks of lesser priority intended to improve the health and structure of the urban forest. For this reason, ***Priority 1*** and ***Priority 2*** pruning categories were collected to indicate the trees that should be pruned as soon as resources allow.

The highest priority pruning sites include 356 trees with the majority of those (323) requiring the specific maintenance task of ***Clean*** (Table 3). Deadwood accumulates in trees over time through tree decline, or sometimes as a natural result of higher vigorous branches shading out lower branches. Crown cleaning is a simple pruning strategy to address this situation and reduce the likelihood of deadwood impacting targets below. An additional 876 trees are recommended for ***Priority 2*** pruning, and 803 of those require crown cleaning, followed by 37 requiring end weight reduction, a pruning technique that can reduce major limb failure and storm damage. For more details about specific pruning techniques, see the Methods section.

Routine pruning can be conducted in subsequent years after ***Priority 1*** & ***Priority 2*** concerns are mitigated. Typically, a pruning cycle of 3-5 years is recommended, however, with a mature, established urban forest like Pacific Grove's, regular inspections and cycle adjustments are advisable in order to identify potential problems quickly. This can be accomplished by conducting cursory "windshield" inspections of high-risk areas periodically and following storm events.

Table 3. Pruning Needs by Priority

Pruning Need	Priority 1 Prune	Priority 2 Prune	Large Tree Routine Prune	Small Tree Routine Prune	Training Prune	Grand Total
No Specific Maintenance Need	1	7	1,579	1462	9	3,058
Clean	323	803	1,147	404	1	2,678
Reduce End Weight	13	37	255	12		317
Structural Restoration		2	24	11	6	43
Other - see notes	3	5	21	18	3	50
(Young Tree) Structural Prune		5	13	160	50	228
Thin			2	2		4
Priority Clearance	1	3	1	3		8
Reduce	4	3	1			8
Total	**345**	**865**	**3,043**	**2,072**	**69**	**6,394**

Ground Crew Maintenance

Ground crews, requiring little special equipment, can easily address issues with stakes, hardware, and young tree structural pruning. There are 282 tree sites that can likely be corrected by ground personnel with some basic training (Table 4). For example, 129 trees have established well and no longer require stakes, which can cause injury to bark if ties are left attached to the trees. Furthermore, 63 trees are recommended for root collar exposure, which can also be conducted by ground crews with minimal training. These sites were observed to have a buildup of mulch or shifting soils such that the trees have become buried. Buried root collars can lead to moisture and decay.

Table 4. Ground Crew Tasks

Ground Crew Task	Number of Trees
Remove Hardware	6
Treat Pest/Disease	5
Treat Stem Girdling Root	14
Expose Root Collar	63
Remove Stakes	129
Stake	7
Remove Nursery Stake	58
Total	**282**

Tree Planting Opportunities

Priority 1 removal was recommended for 174 trees and ***Priority 2*** removal was recommended for 544 trees, a combined total of 8.8% of the population. Twenty-three trees that are recommended for removal are also recommended for further inspection. Considering the stumps and vacant sites, there is a grand total of 1,341 tree sites that should be available for tree planting in the next 7 years (16.5% of the population). Consideration should be given to retiring tree sites that are too small, or ill-suited to support a tree, but most sites can support a new tree. In many cases, new, more appropriate species can be chosen, based on site conditions and lessons learned from the previous tree failure.

Table 5. Planting Opportunities

	Year 1-3	Year 4	Year 5-7	Total	% of Pop.
Stump	272			272	3.4%
Vacant site, large	26			26	0.3%
Vacant site, medium	40			40	0.5%
Vacant site, small	285			285	3.6%
Priority 1 Removal		174		174	2.2%
Priority 2 Removal			529	529	6.6%
Other Removal			15		
Grand Total	**623**	**174**	**544**	**1,341**	**16.7%**
Tree Plantings per year	**208**	**174**	**181**		

Among the recommended tree removals, 48% are *Pinus radiata* (Monterey pine), which comprises 25% of the tree population, indicating it is performing relatively poorly. In contrast, *Quercus agrifolia* (coast live oak) represents 25% of the population, so it is in proportion to the population that 23% of removals are of this species, and not an indication of especially poor performance. Another common tree, *Metrosideros excelsa* (New Zealand Christmas tree) represents 2% of the population (147 trees) and just three (3) of them are recommended for removal. Relative performance by species is discussed in more detail in the companion document to this report, the Pacific Grove Resource Analysis (2015).

Table 6. Removals by Species

Species	Priority 1 Removal	Priority 2 Removal	Total Removals	Percent of Removals
Pinus radiata	108	229	337	48%
Quercus agrifolia	16	148	164	23%
Cupressus macrocarpa	36	82	118	17%
Myoporum laetum		25	25	4%
Acacia longifolia	3	3	6	1%
Maytenus boaria	1	4	5	1%
Pinus pinea	1	4	5	1%
Prunus cerasifera	2	3	5	1%
Ulmus americana		4	4	1%
Other trees	7	42	49	5%
Grand Total	**174**	**529**	**718**	**100%**

Hardscape Repairs

Trees provide landscape interest at a human scale that increases community walkability, however, unmitigated hardscape damage can have the opposite effect. Hardscape damage was recorded wherever sidewalks were disrupted by tree roots or trunks by greater than ½". Almost four hundred (395) sites had hardscape damage, 137 of those sites had previous sidewalk repair. Repairing sidewalk disruptions is an important task that increases walkability in neighborhoods, and reduces exposure to liability risk. It also allows for accessibility for wheelchairs, strollers, and recreational use.

Trees Increase Community Walkability

Tree Observations and Notes

Inventory arborists often encounter special circumstances that are not covered by the collection data fields, yet merit recording since they help to provide additional context for maintenance needs of individual trees. These notes and observations become useful for urban forest managers to review and consider as individual trees receive follow-up care. In this inventory, almost 20% of site records had associated notes, and 55% had observations. Observations are collected in a drop-down menu and are thus more standardized, reflecting the most significant concern. Each tree can be assigned only one observation, while notes can be more extensive and unique.

Observations included major structural issues that could affect tree performance over time and may explain the recommendations for removal or pruning. The most common observation was co-dominant stems, occurring at 1,035 sites, 13% of the population. Eight percent of the population had notable cavities or decay (673 trees), and 304 trees (3.8%) had evidence of a previous failure. Table 4 provides a summary of the most common observations identified.

The notes field was used often to indicate when DBH was estimated, or taken at a non-standard height. The following provides a summary of the collected notes. This is not a complete list as many trees had multiple notes associated, creating overlapping groups:

- 186 trees were crowded or shaded by an adjacent larger tree.
- 155 trees had poison oak growing adjacent to them.
- 132 trees showed evidence of bark borers.
- 109 trees had pitch canker (Figure 3).

Figure 3. Pitch Canker Noted in the Observations

(Photo Credit: Cal Poly Pitch Canker Task Force)

Table 7. Observations

Observations	Number of Sites
None	2,034
Other - see notes	1,629
Co-dominants	1,035
Cavity or Decay	673
Poor Structure	499
Thin Canopy	405
Previous failure	304
Deadwood < 4"	269
Signs of Stress	240
Serious Decline	181
Deadwood > 4"	154
Large Limbs/ scaffold defect	129
Leaning-Corrected	127
Mechanical Damage	124
Diseased	72
Improperly Pruned	47
Root Damage	42
Poor Location	31
Pest Problem	22
Total	**8017**

Recommendations

With this inventory, the City has a better understanding about the maintenance needs of its 8,017 public tree sites. The schedule of caring for the City's trees should be a priority-based approach with balanced consideration for public safety and operational efficiency. Over time, with maintenance and normal tree life cycles, the health and condition of trees change. As this occurs, the management framework may need to shift financial and labor resources accordingly. This will allow Pacific Grove's urban forestry program to remain responsive to community needs as they develop.

From the information summarized in this report, DRG provides preliminary and strategies for managing the tree inventory. This includes prioritizing maintenance based on risk, keeping information current in the database, and reporting to administration. Over time, the City can adapt, and budget for urban forestry operations based on new information as it becomes available. As City goals change, the appropriate operational changes should be reviewed and change as well.

Public safety concerns are the first priority, including:

- Prioritize ***Priority 1*** removal of 174 trees and ***Priority 1*** pruning of 356 trees.
- Provide clearance pruning for 128 trees, especially for visibility and public safety.
- Repair hardscape damage at 395 tree sites.

Once priority issues are addressed, consideration should be given to the following:

- Develop a 3-5 year pruning cycle for ***Priority 2*** and routine pruning of the remaining trees.
- Develop a planting plan to increase stocking level and provide replacements for removals where appropriate, including up to 1,341 sites over the next few years.
- Address issues with tree stakes and hardware for 200 trees, and direct ground crews to perform maintenance on 63 trees to minimize root collar decay.

Beyond priority and other critical needs, managers may want to consider the following industry accepted best management practices:

- Maintain current inventory data by updating DBH, condition, and maintenance needs as tree care is performed.
- Track tree removal and planting annually with a goal of planting around 200 trees per year until optimal stocking is reached.
- Conduct a canopy study and set a canopy goal for public and private trees.
- Consider developing a management plan or master plan for the urban forest to increase health, expand canopy, and align management strategies with community values.

Conclusion

With a mature, established urban forest with most trees in fair condition or better, Pacific Grove has a substantial community asset that is worth preserving and maintaining. Addressing maintenance priorities and planting opportunities will require dedicated resources in terms of funds, personnel, and administrative capacity. It will likely take up to 5 years to address all the recommended actions identified by the inventory.

This summary report provides a framework for developing work plans, but the inventory as a whole is also an important resource for understanding the unique circumstances, challenges, and opportunities facing the urban forest in Pacific Grove. Over time, with proactive management, routine maintenance, and prompt attention to emerging issues, the condition, diversity, and health of the urban forest can improve.

Appendices

Supporting Information

The following documents provide additional information about the Pacific Grove tree resource:

Davey Resource Group. Pacific Grove Resource Analysis. 2015.

Davey Resource Group. Pacific Grove Tree Inventory. 2015.

Species Composition

Table 8. Species Composition

Species	Common Name	Number of Trees	% of Pop.
Quercus agrifolia	oak, coast live	2,190	29.62
Pinus radiata	pine, Monterey	1,866	25.24
Cupressus macrocarpa	cypress, Monterey	1,533	20.73
Eucalyptus globulus	eucalyptus, blue gum	211	2.85
Metrosideros excelsa	New Zealand Christmas tree	147	1.99
Eucalyptus ficifolia	gum, redflower	132	1.79
Myoporum laetum	mioporo	104	1.41
Pinus pinea	pine, Italian stone	97	1.31
Prunus cerasifera	plum, cherry	82	1.11
Pittosporum undulatum	box, Victorian	75	1.01
Sequoia sempervirens	redwood, coast	68	0.92
Maytenus boaria	mayten	47	0.64
Liquidambar styraciflua	sweetgum	43	0.58
Phoenix canariensis	palm, Canary Island date	41	0.55
Platanus hybrida	planetree, London	35	0.47
Ulmus americana	elm, American	34	0.46
Eucalyptus sideroxylon	ironbark, red	33	0.45
Olea europaea	olive	30	0.41
Callistemon citrinus	bottlebrush, lemon	29	0.39
Heteromeles arbutifolia	Christmasberry	27	0.37
Acacia longifolia	wattle, Sydney golden	27	0.37
Ilex aquifolium	holly	25	0.34
Acacia melanoxylon	acacia, black	22	0.30
Pinus torreyana	pine, Torrey	22	0.30
Arbutus x marina	strawberry tree, marina	22	0.30
Magnolia grandiflora	magnolia, southern	17	0.23
Pittosporum crassifolium	cheesewood, stiffleaf	14	0.19

Species	Common Name	Number of Trees	% of Pop.
Arbutus unedo	strawberry tree	13	0.18
Syzygium paniculatum	cherry, brush	13	0.18
Washingtonia robusta	palm, Mexican fan	12	0.16
Betula pendula	birch, European white	12	0.16
Pyrus calleryana	pear, callery	12	0.16
Robinia x ambigua	locust, purple robe	12	0.16
Crataegus phaenopyrum	hawthorn, Washington	11	0.15
Cordyline australis	giant dracaena	11	0.15
Prunus X blireana	plum, flowering	10	0.14
Salix species	willow	10	0.14
Ulmus parvifolia	elm, Chinese	10	0.14
Podocarpus gracilior	fern pine	9	0.12
Ilex spp.	holly, spp.	9	0.12
Pinus species	pine	9	0.12
Malus species	apple	8	0.11
Callistemon viminalis	bottlebrush, weeping	7	0.09
Taxus baccata	yew, English	7	0.09
Cedrus atlantica	cedar, atlas	7	0.09
Acacia verticillata	prickly moses	7	0.09
Pinus canariensis	pine, Canary Island	7	0.09
Leptospermum laevigata	coastal teatree	7	0.09
Melaleuca quinquenervia	cajeput	7	0.09
Cedrus deodara	cedar, deodar	6	0.08
Eucalyptus nicholii	gimlet, willow-leaved	6	0.08
Cinnamomum camphora	camphor tree	6	0.08
Umbellularia californica	laurel, California	6	0.08
Prunus ilicifolia lyonii	cherry, Catalina	5	0.07
Acacia spp.	acacia, spp.	5	0.07
Lyonothamnus floribundus asplen	ironwood, Catalina	5	0.07
Acer palmatum	maple, Japanese	5	0.07
Araucaria heterophylla	araucaria	5	0.07
Melaleuca linariifolia	cajeput tree	5	0.07
Prunus serrulata	cherry, Kwanzan	5	0.07
Tristaniopsis laurina	gum, water	4	0.05
Leptospermum scoparium	New Zealand teatree	4	0.05
Pyrus kawakamii	pear, evergreen	4	0.05
Schinus molle	peppertree, California	4	0.05
Ulmus spp.	elm, hybrid	4	0.05
Alnus rhombifolia	alder, white	4	0.05
Betula nigra	birch, river	4	0.05
Trachycarpus fortunei	palm, windmill	4	0.05
Laurus nobilis	sweet bay	4	0.05

Species	Common Name	Number of Trees	% of Pop.
Ceanothus spp.	ceanothus	4	0.05
Eucalyptus species	gum	4	0.05
Arecastrum romanzoffianum	palm, queen	3	0.04
Pseudotsuga menziesii	Douglas fir	3	0.04
Pinus thunbergiana	pine, Japanese black	3	0.04
Schinus terebinthifolius	pepper, Brazilian	3	0.04
Cupressus spp.	cypress, spp.	3	0.04
Acer rubrum	maple, red	3	0.04
Ginkgo biloba	ginkgo	3	0.04
Nyssa sylvatica	tupelo, black	3	0.04
Washingtonia filifera	palm, California fan	3	0.04
Eucalyptus polyanthemos	sliver dollar gum	3	0.04
Other	Other	3	0.04
Eucalyptus conferruminata	bushy yate	3	0.04
Myrtus communis	Myrtle	2	0.03
Dodonaea viscosa	hopbush, Florida	2	0.03
Pyracantha species	firethorn	2	0.03
Robinia pseudoacacia	locust, black	2	0.03
Aesculus californica	buckeye, California	2	0.03
Myrica californica	Pacific wax myrtle	2	0.03
Calocedrus decurrens	cedar, Incense	2	0.03
Pyrus communis	pear	2	0.03
Sequoiadendron giganteum	sequoia, giant	2	0.03
Citrus limon	lemon	2	0.03
Acacia baileyana	acacia, bailey	2	0.03
Fraxinus uhdei	ash, evergreen	2	0.03
Grevillea robusta	silk oak	2	0.03
Pterocarya stenoptera	wingnut, Chinese	2	0.03
Morus alba	mulberry, white	2	0.03
Juglans nigra	walnut, black	2	0.03
Cercis canadensis	redbud, eastern	2	0.03
Eucalyptus citriodora	gum, lemon-scented	2	0.03
Ligustrum lucidum	privet, Chinese	2	0.03
Xylosma congestum	xylosma, shiny	1	0.01
Garrya elliptica	silktassel, wavyleaf	1	0.01
Prunus species	plum	1	0.01
Liriodendron tulipifera	tulip tree	1	0.01
Eucalyptus cinerea	eucalyptus, silver dollar	1	0.01
Salix babylonica	willow, weeping	1	0.01
Eucalyptus viminalis	gum, manna	1	0.01
Ulmus pumila	elm, Siberian	1	0.01
Platanus racemosa	sycamore, California	1	0.01
Albizia julibrissin	mimosa	1	0.01

Species	Common Name	Number of Trees	% of Pop.
Prunus ilicifolia	cherry, hollyleaf	1	0.01
Ficus carica	fig, edible	1	0.01
Ribes sanguineum	flowering currant	1	0.01
Fremontodendron californicum	flannelbush, California	1	0.01
Citrus sinensis	orange	1	0.01
Geijera parviflora	willow, Australian	1	0.01
Pinus sylvestris	pine, Scotch	1	0.01
Ligustrum japonicum	privet	1	0.01
Persea americana	avocado	1	0.01
Cunninghamia lanceolata	Chinese fir	1	0.01
Rhus lancea	sumac, African	1	0.01
Salix matsudana	willow, corkscrew	1	0.01
Abies pinsapo	fir, Spanish	1	0.01
Prunus domestica	plum	1	0.01
Agonis flexuosa	peppermint tree	1	0.01
Quercus species	oak	1	0.01
Prunus subhirtella	cherry, weeping	1	0.01
Cupressocyparis x leylandii	cypress, Leyland	1	0.01
Yucca elephantipes	yucca, giant	1	0.01
Prunus dulcis	almond	1	0.01
Cotinus coggygria	smoke tree	1	0.01
Aesculus species	buckeye	1	0.01
Casuarina cunninghamiana	river-she oak	1	0.01
Eriobotrya japonica	loquat, Japanese	1	0.01
Total	**Total**	**7,394**	**100%**

Urban Forest Resource Analysis
Pacific Grove, California

2015

DAVEY RESOURCE GROUP

A Division of The Davey Tree Expert Company

Urban Forest Resource Analysis
Pacific Grove, California

July 2015

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Executive Summary

Community trees play a critical role in the City of Pacific Grove, California. They provide numerous benefits both tangible and intangible to residents, visitors, and neighboring communities. With a publicly-owned urban forest of 8,017 individual sites, including 7,394 trees and 623 vacant sites, the City's Forestry Department recognizes that community trees are a valued resource, an important component of the urban infrastructure, and part of the City's identity.

In 2015, to support the preservation and management of community trees, the City commissioned an inventory of public trees within the city right-of-way (ROW) on streets and in parks (only trees greater than 6 inches in diameter and within 50 feet of the street were collected). The inventory produced a GIS layer that includes vital information about each tree including species, size, condition, and geographic location. Davey Resource Group (DRG) used this data in conjunction with i-Tree *Streets* benefit-cost modeling software to develop a detailed and quantified analysis of the current structure, function, and value of the community urban forest. This report details the results of that analysis.

Pacific Grove's community urban forest provides nearly $2.3 million in annual benefits ($80 per capita). These benefits include air quality improvements, energy savings, stormwater runoff reduction, atmospheric CO_2 reduction, and aesthetic contributions to the social and economic health of the community. The annual investment (cost) to maintain the 7,394 public trees is approximately $299,571. **For every $1 invested in the community urban forest, Pacific Grove receives $4.11 in benefits.**

The community urban forest is reducing annual electric energy consumption by 996 MWh and annual natural gas consumption by 20,329 therms, for a combined value of $176,195. Tree canopy from public trees reduces annual stormwater runoff by more than 14.2 million gallons and protects local water resources by reducing sediment and pollution loading. To date, public trees have sequestered 15,442 tons of carbon (CO_2). They continue to sequester an additional 910 tons of CO_2 each year for an annual net benefit valued at $17,704. Each year public trees are removing 1.9 tons of pollutants from the air, including ozone (O_3), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), and particulates (PM_{10}). Biogenic organic compounds (BVOCs) that are produced by the trees offsets annual air quality benefits by -$66,401. However, the overall environmental benefits from this resource more than compensates for the annual air quality deficit.

The community urban forest in Pacific Grove is well established and in overall fair to good condition. The resource has a predominance of established young trees, with nearly 30% of trees 6"-12" diameter at breast height (DBH). With proper management, and planning, the environmental and economic benefits from this resource will continue to increase over time. Regular inspection and proactive maintenance will ensure the preservation of existing benefits, support individual tree longevity, and help manage risk.

Trees are a part of the City's infrastructure and character. Unlike most other public assets, with proper maintenance, trees have the potential to increase in value over time. With an established population in fair to good condition, a high percentage of young trees, and more than 136 different species, the community urban forest in Pacific Grove will continue to be a vital asset to the City and neighboring communities.

Introduction

Pacific Grove is a coastal city located 45 miles south of Santa Cruz. It shares boarders with the Monterey Bay, City of Monterey, the Pacific Ocean, and the Del Monte Forest. Nicknamed "America's Last Hometown," attractions include Victorian homes and an award-winning natural history museum. Local public schools are ranked highest among all public schools on the Monterey Peninsula and the community has the lowest crime rate of any city in Monterey County. Natural resources include a monarch butterfly habitat sanctuary, sandy beaches, and the oldest continuously-operating lighthouse on the west coast. It is home to over 15 thousand residents in just over 4 square miles. Residents enjoy average summer temperatures of 71° F, dropping during the winter months to about 50° F. Although the community generally receives around 10 – 12 inches of rainfall during the winter months, relatively dry summers (<1 of rainfall per month) can pose an extra challenge to managing the water needs of a diverse urban forest. All trees play a role in supporting a positive and healthy environment. This analysis provides a snapshot of the community urban forest (publicly-owned trees) and benchmarks the current structure and benefits of this resource.

Individual trees and a healthy urban forest play an important role in the quality of life and the sustainability of every community. Research demonstrates that healthy urban trees can improve the local environment and diminish the impact resulting from urbanization and industry (Center for Urban Forest Research). Trees improve air quality by manufacturing oxygen and absorbing carbon dioxide (CO_2), as well as filtering and reducing airborne particulate matter such as smoke and dust. Urban trees reduce energy consumption by shading structures from solar energy and reducing the overall rise in temperature created through urban heat island effects (EPA). Trees slow and reduce stormwater runoff, helping to protect critical waterways from excess pollutants and particulates. In addition, urban trees provide critical habitat for wildlife and promote a connection to the natural world for city residents.

In addition to these direct improvements, healthy urban trees increase the overall attractiveness of a community and the value of local real estate by 7% to 10%. Trees promote shopping, retail sales, and tourism (Wolf, 2007). Trees support a more livable community, fostering psychological health, and providing residents with a greater sense of place (Ulrich, 1986; Kaplan, 1989). Community trees, both public and private, soften the urban hardscape by providing a green sanctuary, making Pacific Grove a more enjoyable place to live, work, and play. The City's community trees play a prominent role in the overall urban forest benefits afforded to the community. The Forestry Department has the responsibility to maintain a portion of the urban forest along with safeguarding the trees from unauthorized pruning or removal. The department oversees 7,394 trees on streets and in parks. Residents rely on the department to protect and maintain this vital resource.

To support the management of the community urban forest, an inventory of public trees was collected in 2015. The inventory collected the species, size, condition, and geographic location of each tree in an electronic, GIS format. An urban forest is a dynamic resource, constantly changing and growing in response to environment and care. Maintaining and updating this information will be critical for ongoing management.

The tree inventory data was analyzed with i-Tree's *Streets*, a STRATUM Analysis Tool (*Streets* v5.1.5; i-Tree v6.0.9), to develop a resource analysis and report of the existing condition of this urban forest. This report, unique to Pacific Grove, quantifies the value of the community's trees with

regard to actual benefits derived from the tree resource. In addition, the report provides baseline values that can be used to develop and update an urban forest management plan. Management plans help communities determine where to focus available resources and set benchmarks for measuring progress.

This analysis describes the structure, function, and value of Pacific Grove's community trees. With this information, managers and citizens can make informed decisions about tree management strategies. This report provides the following information:

- A description of the current structure of Pacific Grove's community tree resource and an established benchmark for future management decisions.
- The economic value of the benefits from the urban forest, illustrating the relevance and relationship of trees to local quality of life issues such as air quality, environmental health, economic development, and psychological health.
- Data that may be used by resource managers in the pursuit of alternative funding sources and collaborative relationships with utility purveyors, non-governmental organizations, air quality districts, federal and state agencies, legislative initiatives, or local assessment fees.
- Benchmark data for developing a long-term urban forest management plan.

Figure 1. Monarch Grove Sanctuary, with conifer and eucalyptus species that provide crucial habitat for the Monarch Butterfly.

Summary

Structure

Pacific Grove's community urban forest includes 7,394 public trees and 623 available planting sites on streets and in parks. A structural analysis is the first step towards understanding the benefits provided by these trees as well as their management needs. Considering species composition, diversity, age distribution, condition, canopy coverage, and replacement value, DRG determined that the following information characterizes this urban forest resource:

- More than 136 unique tree species were identified in the inventory. The predominant tree species are coast live oak (Quercus agrifolia, 30%), Monterey pine (Pinus radiata, 25%), and Monterey cypress (Cupressus macrocarpa, 21%). These native trees comprise 76% of the total population.
- Over half of the trees are between 6" – 18" DBH and a fifth are over 24", indicating a mix of young, established populations along with a mature population providing maximum benefits.
- 42% of trees are in good condition.
- Community trees are providing 134 acres of canopy cover, about 5% of the overall land area in Pacific Grove.
- To date, Community trees have sequestered 15,442 tons of carbon dioxide (CO_2), valued at $231,624.
- The current stocking level for the community urban forest is 92.2%, based on a total 8,017 suitable planting sites, including 7,394 trees and 623 vacant sites and stumps.
- Replacement of Pacific Grove's 7,394 community trees with trees of similar size, species, and condition would cost nearly $26.3 million.

Benefits

Annually, Pacific Grove's community trees provide cumulative benefits to the community at an average value of $166 per tree, for a total gross value of nearly $1.3 million per year (Appendix A). These benefits include:

- Community trees reduce electricity and natural gas use through shading and climate effects for an overall benefit of $176,195, an average of $23.83 per tree.
- Each year, community trees sequester a gross 910 tons of atmospheric CO2 for a net value of $17,704 and a net average of $2.39 per tree.
- Each year community trees remove 1.9 tons of air pollutants with a gross value of $39,085.
- Pacific Grove's community trees intercept over 14.2 million gallons of stormwater annually for a total value of almost $57,000, an average of $7.70 per tree.
- The benefits from Pacific Grove's community trees to property value, health, aesthetics, and socioeconomics is nearly $1.1 million, an average of $141.38 per tree.

- When the annual investment of $299,571 for the management of the community urban forest is considered, the annual net benefit (benefits minus investment) for the community is nearly $1.3 million, an average of $166 per tree. In other words, for every $1 invested in public trees, the community receives $4.11 in benefits.

Management

Pacific Grove's community urban forest is a dynamic resource that requires continued investment to maintain and realize its full benefit potential. Trees are one of the few community assets that have the potential to increase in value with time and proper management. Appropriate and timely tree care can substantially increase lifespan. When trees live longer, they provide greater benefits. As individual trees continue to mature and aging trees are replaced, the overall value of the community forest and the amount of benefits provided grow as well. This vital, living resource is, however, vulnerable to a host of stressors and requires ecologically sound and sustainable best management practices to ensure a continued flow of benefits for future generations.

The urban forest in Pacific Grove is an establishing resource in overall fair to good condition. With continued new tree planting, proactive management, and planning, the benefits from this resource will continue to increase as young trees mature. Young tree training, a regular pruning cycle, and regular inspection to identify structural and age-related defects is recommended to manage risk and reduce the likelihood of tree and branch failure. Additional maintenance recommendations, based on the 2015 inventory are provided in the Pacific Grove Inventory Summary, a companion document to this one. Based on this resource analysis, DRG recommends the following:

- Increase species diversity by insuring that new tree plantings include a variety of suitable species and don't unduly increase reliance on prevalent species.
- Increase the stocking level by using all available planting sites to improve diversity and increase benefits. Install large-stature species wherever space allows.
- Provide structural pruning for young trees and a regular pruning cycle for all trees.
- Protect existing trees, especially mature native species, and manage risk with regular inspection to identify and mitigate structural and age-related defects.
- Continue to maintain and update the inventory database, including tracking tree growth and condition during regular pruning cycles.
- For greater air quality benefits, new planting should include trees that emit less biogenetic organic compounds (BVOCs).

With adequate protection and planning, the value of the community urban forest resource in Pacific Grove will increase over time. Proactive management and a tree replacement plan are critical to ensuring that residents continue to receive a high return on their investment. Along with new tree installation and replacement planting, funding for tree maintenance and inspection is vital to preserving benefits, prolonging tree life, and managing risk. Existing mature trees should be maintained and protected whenever possible since the greatest benefits accrue from the continued growth and longevity of the existing canopy. Managers can take pride in knowing that community trees support the quality of life for residents and neighboring communities.

Pacific Grove's Urban Forest Resource

An urban forest is more thoroughly understood through examination of composition and species richness (diversity). Consideration of stocking level (trees per total available space), canopy cover, age distribution, condition, and performance provide a foundation for planning and management strategies. Inferences based on this data can help managers understand the importance of individual tree species to the overall forest as it exists today and provide a basis to project the future potential of the resource.

Population Composition

Conifer species are a staple species in Pacific Grove's coastal community urban forest, comprising 49% of the total inventory. Not only do conifers capture large amounts of stormwater during the winter months when it typically rains, but they help create a sense of place for the community.

Broadleaf evergreen species make up 45% of the tree population, including 33% large-stature, 8% medium-stature, and 4% small-stature trees. Broadleaf deciduous trees comprise 5% of the population, including 1% large-stature, 1% medium-stature, and 2% small-stature species. Conifers species make up more than 49% of the population, including 49% large-stature, 0.27% medium-stature, and 0.09% small-stature species. Palms comprise 1% of the total population.

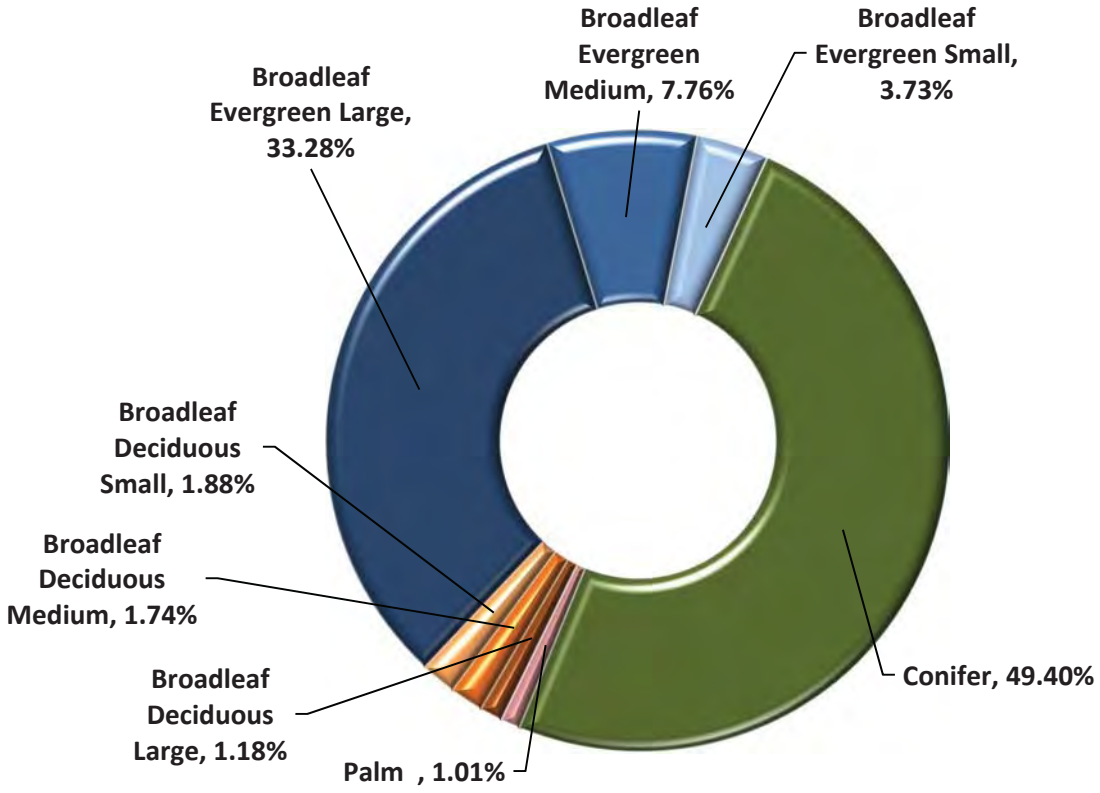


Figure 2. Composition of Tree Type and Stature in Pacific Grove's Community Urban Forest

Species Richness and Composition

The community tree resource in Pacific Grove is composed of a wide variety of more than 136 unique species (Table 1 and Appendix C). That's much greater than the mean of 53 species reported by McPherson and Rowntree (1989) in their nationwide survey of street tree populations in 22 U.S. cities.

The top 3 species in Pacific Grove represent over 75% of the overall population (Figure 3). The predominant tree species are coast live oak (*Quercus agrifolia*, 30%), Monterey pine (*Pinus radiata*, 25%), and Monterey cypress (*Cupressus macrocarpa*, 21%). There is a widely accepted rule that no single species should represent greater than 10% of the total population, and no single genus more than 20% (Clark Et al, 1997). Even though these species far exceed that rule, they are native to the region and reinforce the special character that is unique to the City.

Maintaining diversity in an urban forest is important. Dominance of any single species or genus can have detrimental consequences in the event of storms, drought, disease, pests, or other stressors that can severely affect an urban forest and the flow of benefits and costs over time. Catastrophic pathogens, such as Dutch Elm Disease (*Ophiostoma ulmi*), Emerald Ash Borer (*Agrilus planipennis*), Asian Longhorned Beetle (*Anoplophora glabripennis*), and Sudden Oak Death (SOD) (*Phytophthora ramorum*) are some examples of unexpected, devastating, and costly pests and pathogens that highlight the importance of diversity and the balanced distribution of species and genera.

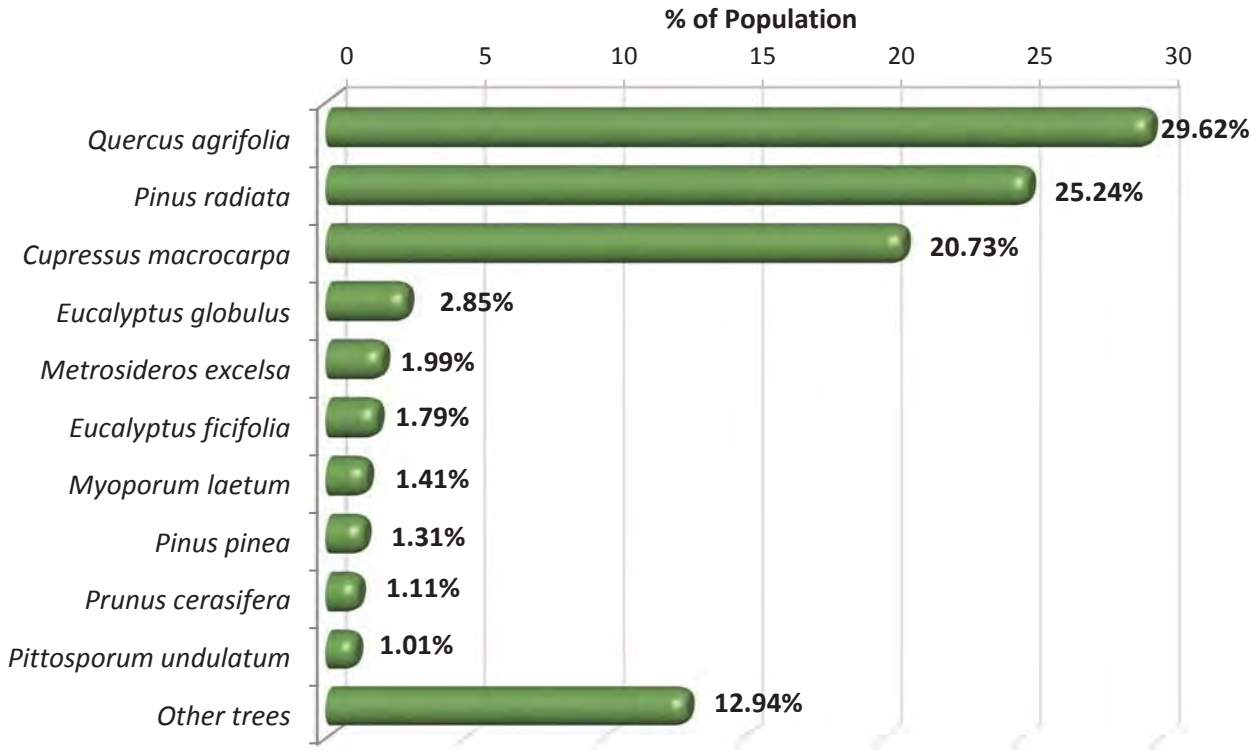


Figure 3. Ten Most Prevalent Species in Pacific Grove's Community Urban Forest

Table 1. Population Summary of Pacific Grove's Community Urban Forest (Species representing >1%)

Species	DBH Class (in)										%of Pop
	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	> 42	Total	
Broadleaf Deciduous Small (BDS)											
Prunus cerasifera	31	34	17	0	0	0	0	0	0	**82**	**1.11**
Other BDS Trees	30	16	9	1	1	0	0	0	0	**57**	**0.77**
BDS Total	**61**	**50**	**26**	**1**	**1**	**0**	**0**	**0**	**0**	**139**	**1.88%**
Broadleaf Evergreen Large (BEL)											
Quercus agrifolia	37	168	925	681	237	82	34	15	11	**2,190**	**29.62**
Eucalyptus globulus	0	5	48	25	20	16	13	21	63	**211**	**2.85**
Other BEL Trees	6	3	7	6	20	11	5	2	0	**60**	**0.81**
BEL Total	**43**	**176**	**980**	**712**	**277**	**109**	**52**	**38**	**74**	**2,461**	**33.28%**
Broadleaf Evergreen Medium (BEM)											
Metrosideros excelsa	6	27	45	39	20	10	0	0	0	**147**	**1.99**
Eucalyptus ficifolia	0	1	11	25	46	21	19	6	3	**132**	**1.79**
Pittosporum undulatum	6	25	37	6	1	0	0	0	0	**75**	**1.01**
Other BEM Trees	30	64	85	26	6	2	6	1	0	**220**	**2.97**
BEM Total	**42**	**117**	**178**	**96**	**73**	**33**	**25**	**7**	**3**	**574**	**7.76%**
Broadleaf Evergreen Small (BES)											
Myoporum laetum	1	22	67	13	1	0	0	0	0	**104**	**1.41**
Other BES Trees	17	45	84	20	5	1	0	0	0	**172**	**2.32**
BES Total	**18**	**67**	**151**	**33**	**6**	**1**	**0**	**0**	**0**	**276**	**3.73%**
Conifer Evergreen Large (CEL)											
Pinus radiata	159	112	373	393	342	245	127	74	41	**1,866**	**25.24**
Cupressus macrocarpa	60	114	291	280	216	155	112	96	209	**1,533**	**20.73**
Pinus pinea	7	15	33	33	8	1	0	0	0	**97**	**1.31**
Other CEL Trees	20	32	32	17	16	3	6	2	2	**130**	**1.76**
CEL Total	**246**	**273**	**729**	**723**	**582**	**404**	**245**	**172**	**252**	**3,626**	**49.04%**
Grand Total	**445**	**750**	**2,154**	**1,612**	**965**	**564**	**337**	**234**	**333**	**7,394**	**100%**

Species Importance

To quantify the significance of any one particular species in Pacific Grove's community tree inventory an importance value is derived for each of the most common species. Importance values are particularly meaningful to urban forest managers because they indicate a reliance on the functional capacity of a particular species. i-Tree *Streets* calculates importance value based on the mean of three values: percentage of total population, percentage of total leaf area, and percentage of total canopy cover. Importance value goes beyond tree numbers alone to suggest reliance on specific species based on the benefits they provide. The importance value can range from zero (which implies no reliance) to 100 (suggesting total reliance).

No single species should dominate the composition of an urban forest population. Since the importance value goes beyond population numbers alone, it can help managers to better comprehend the resulting loss of benefits from a catastrophic loss of any one species. When importance values are comparatively equal among the 10 most abundant species, the risk of major reductions to benefits is significantly reduced. Of course, suitability of the dominant species is another important consideration. Planting short-lived or poorly adapted species can result in shorter lifespans and increased long-term management investments.

The 10 most abundant species (>1% of the population) represent 87% of the overall population, 93% of the total leaf area, and 92% of the total canopy cover for a combined importance value of 90.69 (Table 2). Of these Pacific Grove relies most on coast live oak (*Quercus agrifolia*, IV=26.85), Monterey pine (*Pinus radiata*, IV=26.03) and Monterey cypress (*Cupressus macrocarpa*, IV=25.74).

These three native species dominate the landscape. The two large-stature conifers have both a young and established population. The coast live oak (*Quercus agrifolia*) has a high population of young trees. These species should be carefully maintained as to not lose the character they give the City and to maintain their high importance values.

Due to their large stature and high leaf surface area, some species provide more impact than their population numbers alone would suggest. For example, blue gum (*Eucalyptus globulus*) represents 3% of the population but 6% of canopy cover. These are mature populations of large-stature trees with substantial numbers of established trees.

The low importance value of some species is a function of tree type. Immature and small-stature populations tend to have lower importance values than their percentage in the overall population might suggest. This is due to their relatively small leaf area and canopy coverage. For instance, myoporum (*Myoporum laetum*) represents 2% of the population but the importance value of the species is 0.92%. In contrast, Italian stone pine (*Pinus pinea*), which represent 1% of the population and an importance value of 0.93% is a large-stature stature species with 91% of the population less than 18 inches in diameter (DBH). The importance value of this species will increase as trees mature.

Table 2. Importance Value of Pacific Grove's Most Prevalent Community Tree Species (representing >1%)

Species	Number of Trees	% of Pop	Leaf Area (ft2)	% of Total Leaf Area	Canopy Cover (ft2)	% of Total Canopy Cover	Importance Value
Quercus agrifolia	2,190	29.62	5,337,707	25.80	1,466,293	25.13	**26.85**
Pinus radiata	1,866	25.24	5,647,538	27.29	1,491,411	25.56	**26.03**
Cupressus macrocarpa	1,533	20.73	5,741,270	27.75	1,677,091	28.74	**25.74**
Eucalyptus globulus	211	2.85	1,349,090	6.52	367,153	6.29	**5.22**
Metrosideros excelsa	147	1.99	171,248	0.83	84,965	1.46	**1.42**
Eucalyptus ficifolia	132	1.79	635,412	3.07	167,016	2.86	**2.57**
Myoporum laetum	104	1.41	120,739	0.58	45,073	0.77	**0.92**
Pinus pinea	97	1.31	172,052	0.83	38,162	0.65	**0.93**
Prunus cerasifera	82	1.11	29,652	0.14	11,528	0.20	**0.48**
Pittosporum undulatum	75	1.01	41,393	0.20	19,030	0.33	**0.51**
Other Trees	957	12.94	1,445,087	6.98	467,299	8.01	**9.31**
All Trees	**7,394**	**100%**	**20,691,187**	**100%**	**5,835,020**	**100%**	**100**

Canopy Cover

The amount and distribution of leaf surface area is the driving force behind the urban forest's ability to produce benefits for the community (Clark, 1997). As canopy cover increases, so do the benefits afforded by leaf area. The City of Pacific Grove encompasses an area of 2,560 acres. Overall, community trees provide approximately 134 acres of canopy cover, or 5% of the City's total area.

Stocking Level

Pacific Grove's community urban forest currently includes 623 available planting sites, including 351 vacant sites and 272 stumps. Considering the public tree inventory identified a total of 8,017 planting sites with 7,394 existing trees, the current stocking level of the community forest is 92.2%. However, the inventory identified 174 trees that are recommended for Priority 1 removal and 544 trees that are recommended for Priority 2 removal over the next few years. A tree planting strategy to increase the stocking level, maximize the use of available planting sites, and maintain the benefit stream the urban forest is providing is outlined in the Inventory Summary Report (2015).

Relative Age Distribution

Age distribution can be approximated by considering the DBH range of the overall population and of individual species. Trees with smaller diameters tend to be younger. It is important to note that palms do not increase in DBH over time, so they are not considered in this analysis. In palms, height more accurately correlates to age.

The distribution of individual tree ages within a tree population influences present and future costs as well as the flow of benefits. An ideally-aged population allows managers to allocate annual maintenance costs uniformly over many years and assures continuity in overall tree canopy coverage and associated benefits. A desirable distribution has a high proportion of young trees to offset establishment and age related mortality as the percentage of older trees declines over time (Richards, 1982/83). This ideal, albeit uneven, distribution suggests a large fraction of trees (~40%) should be young, with diameters (DBH) less than eight inches, while only 10% should be in the large diameter classes (>24 inches DBH).

The age distribution of Pacific Grove's community urban forest is nearly ideal, with 37% of trees 8 inches or less in diameter (DBH) and 20% of trees larger than 24 inches in diameter (Figure 4). With ongoing proactive management this resource will continue to produce a stable benefit stream, supporting the quality of life and health of the community and the environment. The City has a fairly large population of established trees (6" to 12" inch DBH. With regular inspection and proactive management, these trees have the potential to increase in the benefits they provide over time.

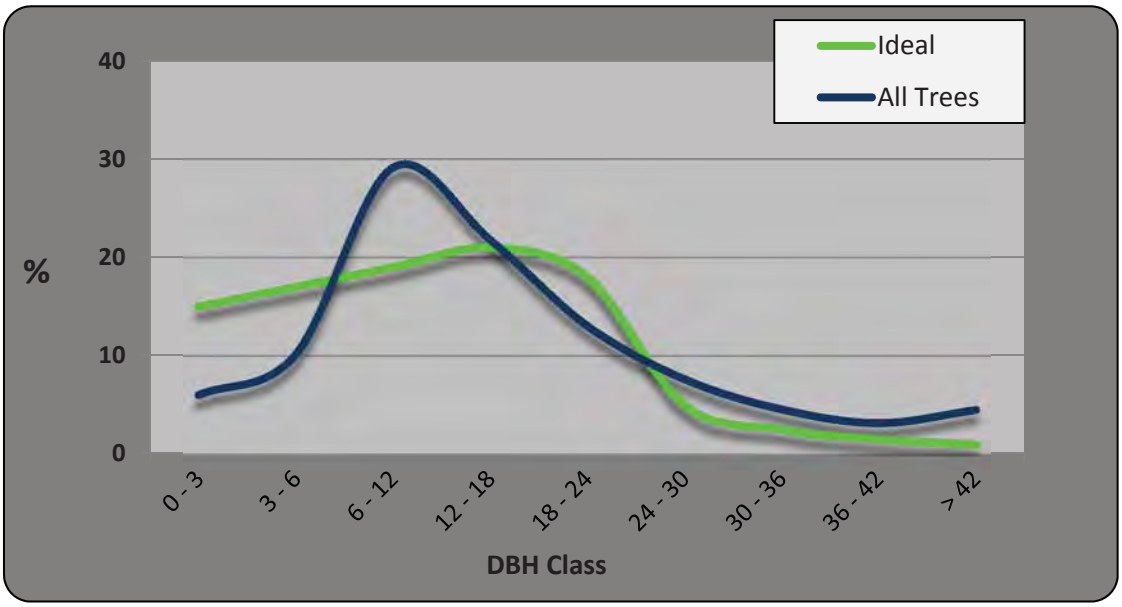
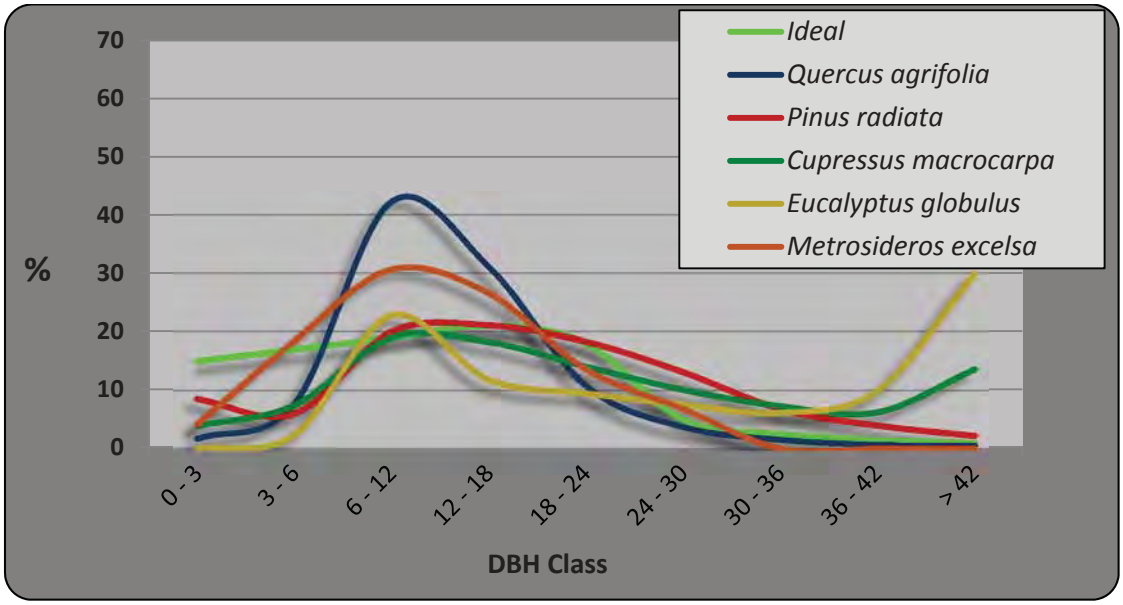


Figure 4. Age Distribution of Pacific Grove's Community Urban Forest

Of the ten most common species in Pacific Grove's community urban forest, the youngest population is purple leaf plum (*Prunus cerasifera*). Nearly 38% of these trees are 3 inches or less in diameter. This suggests that recent tree plantings have increased the prevalence of this species. Blue gum (*Eucalyptus globulus*), Monterey cypress (Cupressus macrocarpa), and red flowering gum (*Eucalyptus ficifolia*) are the most mature populations with the greatest representation of trees greater than 24 inches in diameter.

Italian stone pine (*Pinus pinea*), New Zealand Christmas tree (*Metrosideros excelsa*), myoporum (*Myoporum laetum*), purple leaf plum (*Prunus cerasifera*), and Victorian box (*Pittosporum undulatum*) are also well established species. Of these, only Victorian box and purple leaf plum have significant representation in the smaller class sizes, with 41% of Victorian box and 79% of purple leaf plum between 1 and 6 inches diameter.



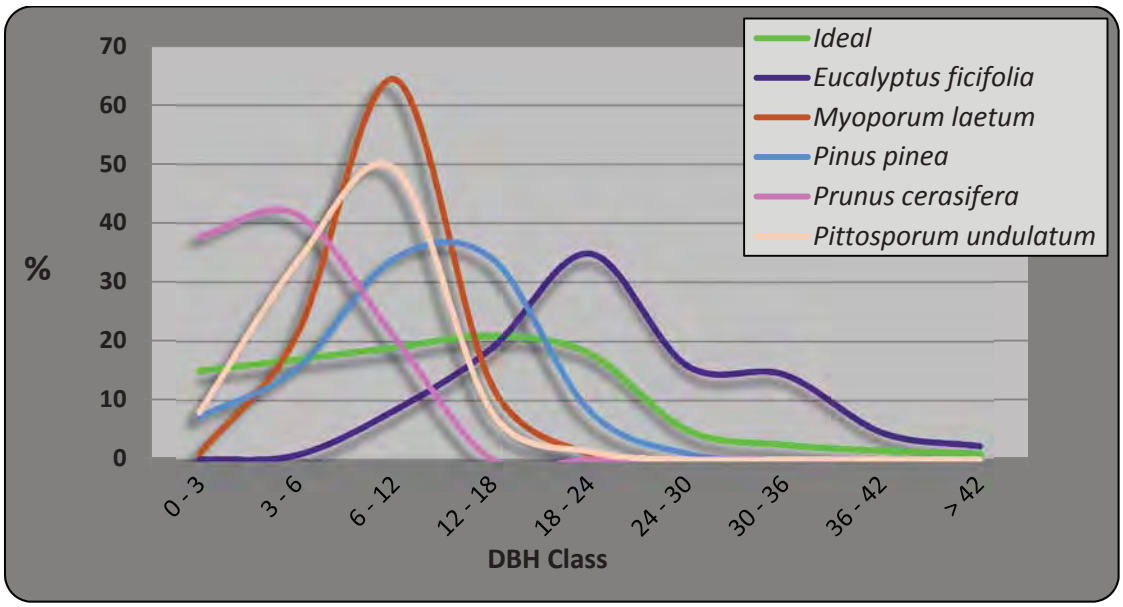


Figure 5. Age Distribution of the Top 10 Tree Species

Urban Forest Condition

Tree condition is an indication of how well trees are managed and how well they are performing in a given site-specific environment (e.g., street, median, parking lot, etc.). Condition ratings can help urban forest managers anticipate maintenance and funding needs. In addition, tree condition is an important factor for the calculation of urban forest benefits. A condition rating of good assumes that a tree has no major structural problems, no significant mechanical damage, and may have only minor aesthetic, insect, disease, or structural problems, and is in good health.

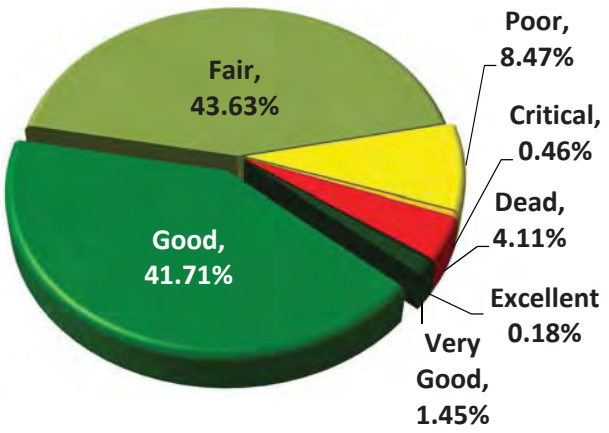


Figure 6. Condition of Pacific Grove's Community Urban Forest

Pacific Grove's community forest is overall relatively young and in fair to good condition with 42% good and 44% fair trees (Figure 6). About 13% of Pacific Grove's community trees are poor, dead, or in critical condition

The *relative performance index* (RPI) is one way to further analyze the condition and suitability of specific tree species. The RPI provides an urban forest manager with a detailed perspective on how different species perform compared to each other. The index compares the condition ratings of each tree species with the condition ratings of every other tree species within the population. An RPI of 1.0 or better indicates that the species is performing as well or better than average. An RPI value below 1.0 indicates that the species is not performing as well in comparison to the rest of the population.

Among the 10 most common species included in this inventory, 8 have an RPI of 1.0 or greater (Table 3). Of these, New Zealand Christmas tree (*Metrosideros excelsa*) and blue gum (*Eucalyptus globulus*) have the highest RPI with 1.12, while Monterey pine (*Pinus radiata* RPI=0.91) and myoporum (*Myoporum laetum,* RPI=0.90) have the lowest.

The RPI can be a useful tool for urban forest managers. For example, if a community has been planting two or more new species, the RPI can be used to compare their relative performance. If the RPI indicates that one is performing relatively poorly, managers may decide to reduce or even stop planting that species and subsequently save money on both planting stock and replacement costs. The RPI enables managers to look at the performance of long-standing species as well. Established species with an RPI of 1.00 or greater have performed well when compared to the population as a whole. These top performers should be retained, and planted, as a healthy proportion of the overall population. It is important to keep in mind that, because RPI is based on condition at the time of the inventory, it may not reflect cosmetic or nuisance issues, especially seasonal issues that are not threatening the health or structure of the trees.

An RPI value less than 1.00 may be indicative of a species that is not well adapted to local conditions. Poorly adapted species are more likely to present increased safety and maintenance issues. Species with an RPI less than 1.00 should receive careful consideration before being selected for future planting choices. However, prior to selecting or deselecting trees based on RPI alone, managers should consider the age distribution of the species, among other factors. A species that

has an RPI of less than 1.00, but has a significant number of trees in larger DBH classes, may simply be exhibiting signs of population senescence. A complete table, with RPI values for all species, is included in Appendix C.

Table 3. Relative Performance Index for Pacific Grove's Most Prevalent Species (representing>1%)

Species	Dead or Dying (%)	Poor (%)	Fair (%)	Good (%)	Very Good (%)	N/A (%)	RPI	# of Trees	% of Pop
Quercus agrifolia	0.78	10.64	49.95	38.36	0.09	0.18	**1.00**	2,190	29.62
Pinus radiata	11.36	10.50	40.89	32.48	3.91	0.86	**0.91**	1,866	25.24
Cupressus macrocarpa	3.65	5.81	40.51	47.49	1.17	1.37	**1.03**	1,533	20.73
Eucalyptus globulus	0.47	1.90	36.49	61.14	0.00	0.00	**1.12**	211	2.85
Metrosideros excelsa	0.00	1.36	39.46	57.14	1.36	0.68	**1.12**	147	1.99
Eucalyptus ficifolia	0.00	5.30	62.88	31.82	0.00	0.00	**1.00**	132	1.79
Myoporum laetum	5.77	21.15	38.46	33.65	0.00	0.96	**0.90**	104	1.41
Pinus pinea	3.09	4.12	31.96	60.82	0.00	0.00	**1.10**	97	1.31
Prunus cerasifera	0.00	12.20	32.93	54.88	0.00	0.00	**1.07**	82	1.11
Pittosporum undulatum	0.00	2.67	46.67	49.33	1.33	0.00	**1.09**	75	1.01
Other Trees	0.94	5.96	41.48	50.05	1.15	0.42	**1.05**	957	12.94
Total	**4.11%**	**8.47%**	**43.63%**	**41.71%**	**1.45%**	**0.64%**	**1.00**	**7,394**	**100%**

The RPI value can also help to identify underused species that are demonstrating good performance. Trees with an RPI value greater than 1.00 and an established age distribution may be indicating their suitability in the local environment and should receive consideration for additional planting (Table 4).

Although there are only 6 California bay trees (*Umbellularia californica*) in the inventory, they are native to the region and would naturally thrive. This species may be appropriate for additional planting. Sweetgum (*Liquidambar styraciflua*), is sometimes considered a nuisance because of its spiked fruit. However, the cultivar, *Liquidambar styraciflua* 'Rotundiloba' is fruitless and can be a suitable substitute. Coast redwood (*Sequoia sempervirens*) is another native species, and performs very well in coastal environments. However, these trees need ample growing space when planted.

When considering new species based on RPI, it is important to base the decision on established populations. The greater number of trees of a particular species, the more relevant the RPI becomes. The following species appear to be performing well and should be considered for future tree plantings:

Table 4. Species That May Be Underused (based on RPI and age distribution)

Species	RPI	# of Trees	% of Pop
Broadleaf Deciduous Large			
Platanus hybrida	**1.06**	35	0.47
Broadleaf Deciduous Medium			
Liquidambar styraciflua	**1.11**	43	0.58
Betula pendula	**1.06**	12	0.16
Robinia x ambigua	**1.06**	12	0.16
Broadleaf Evergreen Large			
Podocarpus gracilior	**1.28**	9	0.12
Umbellularia californica	**1.16**	6	0.08
Broadleaf Evergreen Medium			
Maytenus boaria	**1.03**	47	0.64
Conifer Evergreen Large			
Sequoia sempervirens	**1.07**	68	0.92
Pinus torreyana	**1.25**	22	0.30

Replacement Value

The current value of the community urban forest in Pacific Grove is over $26.2 million (Table 5). The replacement value accounts for the historical investment in trees over their lifetime. The replacement value is also a way of describing the value of a tree population (and/or average value per tree) at a given time. The replacement value reflects current population numbers, stature, placement, and condition. There are several methods available for obtaining a fair and reasonable perception of a tree's value (CTLA, 1992; Watson, 2002). The cost approach, trunk formula method used in this analysis assumes the value of a tree is equal to the cost of replacing the tree in its current state (Cullen, 2002).

To replace Pacific Grove's 7,394 community trees with trees of similar size, species, and condition would cost over $26.2 million. The average replacement value per tree is $3,546. Monterey cypress (*Cupressus macrocarpa*) and coast live oak (*Quercus agrifolia*) are the most valuable populations representing $19.1 million, 73% of the overall replacement value and 55% of the overall urban forest resource.

Pacific Grove's community trees represent a vital component of the City's infrastructure and a public asset valued at over $26.2 million—an asset that, with proper care and maintenance, will continue to increase in value over time. Distinguishing the replacement value from the value of annual benefits produced by this urban forest resource is very important.

Figure 7. Replacement of the entire Monterey cypress population in Pacific Grove's public inventory would cost nearly 12.2 million.

Table 5. Summary of Replacement Value for Pacific Grove's Community Urban Forest Resource

	DBH Class (in)											
Species	**0-3**	**3-6**	**6-12**	**12-18**	**18-24**	**24-30**	**30-36**	**36-42**	**> 42**	**Total $**	**% of Total**	**% of Pop**
Quercus agrifolia	4,975	72,914	1,230,507	2,289,327	1,503,928	825,716	508,650	235,464	225,767	**6,897,250**	26.30	29.62
Pinus radiata	26,524	24,285	157,031	353,381	559,926	663,295	486,112	356,021	238,850	**2,865,426**	10.93	25.24
Cupressus macrocarpa	10,960	49,438	400,793	966,100	1,400,879	1,619,070	1,547,144	1,880,159	4,309,268	**12,183,810**	46.46	20.73
Eucalyptus globulus	0	945	14,217	13,250	16,114	20,413	20,137	47,504	159,759	**292,339**	1.11	2.85
Metrosideros excelsa	1,114	20,648	114,782	258,614	259,417	214,631	0	0	0	**869,206**	3.31	1.99
Eucalyptus ficifolia	0	366.16	14,416	74,195	300,854	235,859	281,463	115,531	60,354	**1,083,038**	4.13	1.79
Myoporum laetum	45	3,684	34,064	17,127	2,985	0	0	0	0	**57,907**	0.22	1.41
Pinus pinea	839	4,736	30,717	79,499	41,449	8,804	0	0	0	**166,046**	0.63	1.31
Prunus cerasifera	5,351	11,757	11,978	0	0	0	0	0	0	**29,086**	0.11	1.11
Pittosporum undulatum	894	14,845	71,754	35,542	8,527.77	0	0	0	0	**131,564**	0.50	1.01
Other Trees	23,375	95,244	352,272	342,562	267,612	152,183	205,934	147,224	60,119	**1,646,527**	6.28	12.94
All Trees	**$74,077**	**$298,862**	**$2,432,531**	**$4,429,597**	**$4,361,692**	**$3,739,971**	**$3,049,440**	**$2,781,903**	**$5,054,117**	**$26,222,199**	**100%**	**100%**

Benefits from Pacific Grove's Community Urban Forest

Trees are important to Pacific Grove. Environmentally, they help conserve and reduce energy use, reduce global carbon dioxide (CO_2) levels, improve air quality, and mitigate stormwater runoff. Additionally, trees provide a wealth of well-documented psychological, social, and economic benefits related primarily to their aesthetic effects. Environmentally, trees make good sense, providing benefits back to the community. However, the question remains, are the collective benefits worth the cost of management? In other words, are community trees a good investment for Pacific Grove? To answer this question, the benefits must be quantified in financial terms.

The i-Tree *Streets* analysis model allows benefits to be quantified based on regional reference cities and local community attributes, such as median home values and local energy prices. This analysis provides a snapshot of the annual benefits (along with the value of those benefits) produced by Pacific Grove's community urban forest. While the annual benefits produced by the urban forest can be substantial, it is important to recognize that the greatest benefits are derived from the benefit stream that results over time, from a mature forest where trees are well managed, healthy, and long-lived.

This analysis used current inventory data for Pacific Grove's community trees and i-Tree's *Streets* software to assess and quantify the beneficial functions of this resource and to place a dollar value on the annual environmental benefits these trees provide. The benefits calculated by i-Tree *Streets* are estimations based on the best available and current scientific research with an accepted degree of uncertainty. The data returned from i-Tree *Streets* can provide a platform from which informed management decisions can be made (Maco and McPherson, 2003). A discussion on the methods used to calculate and assign a monetary value to these benefits is included in Appendix A.

Energy Savings

Trees modify climate and conserve energy in three principal ways:

- Shading reduces the amount of radiant energy absorbed and stored by hardscape surfaces, thereby reducing the heat island effect.
- Transpiration converts moisture to water vapor, thereby cooling the air by using solar energy that would otherwise result in heating of the air.
- Reduction of wind speed and the movement of outside air into interior spaces and conductive heat loss where thermal conductivity is relatively high (e.g., glass windows) (Simpson, 1998).

The *heat island effect* describes the increase in urban temperatures in relation to surrounding suburban and rural areas. Heat islands are associated with an increase in hardscape and impervious surfaces. Trees and other vegetation within an urbanized environment help reduce the heat island effect by lowering air temperatures 5°F (3°C) compared with outside the green space (Chandler, 1965). On a larger citywide scale, temperature differences of more than 9°F (5°C) have been observed between city centers without adequate canopy coverage and more vegetated suburban areas (Akbari and others, 1992). The relative importance of these effects depends upon the size

and configuration of trees and other landscape elements (McPherson, 1993). Tree spacing, crown spread, and vertical distribution of leaf area each influence the transport of warm air and pollutants along streets and out of urban canyons. Trees reduce conductive heat loss from buildings by reducing air movement into buildings and against conductive surfaces (e.g., glass, metal siding). Trees can reduce wind speed and the resulting air infiltration by up to 50%, translating into potential annual heating savings of 25% (Heisler, 1986).

Electricity and Natural Gas Reduction

Electricity and natural gas saved annually in Pacific Grove from both the shading and climate effects of community trees is equal to 996 MWh (valued at $149,410) and 20,329 therms ($26,785), for a total retail savings of approximately $176,195 and an average of $23.83 per tree (Table 6). The species that contribute most to energy benefits on a per-tree basis are large-stature broadleaf evergreens including blue gum (*Eucalyptus globulus*), with an average value of $41.49 and red flowering gum (*Eucalyptus ficifolia*) with an average value of $39.06 per tree.

Small-canopy trees are less able to provide electricity and natural gas reduction benefits. On a per-tree basis, purple leaf plum (*Prunus cerasifera)* provides $4.17 in average benefits and it is providing just 0.19% of the energy benefits. This is a small-statured tree with 79% of its population less than 6 inches DBH. Victorian box (*Pittosporum undulatum*) provides only $6.03 in average benefits while providing 0.26% of the energy benefits. This is a medium-stature tree with 91% of its population less than 12 inches DBH. However, these energy benefits should increase over time as this younger medium-stature population matures.

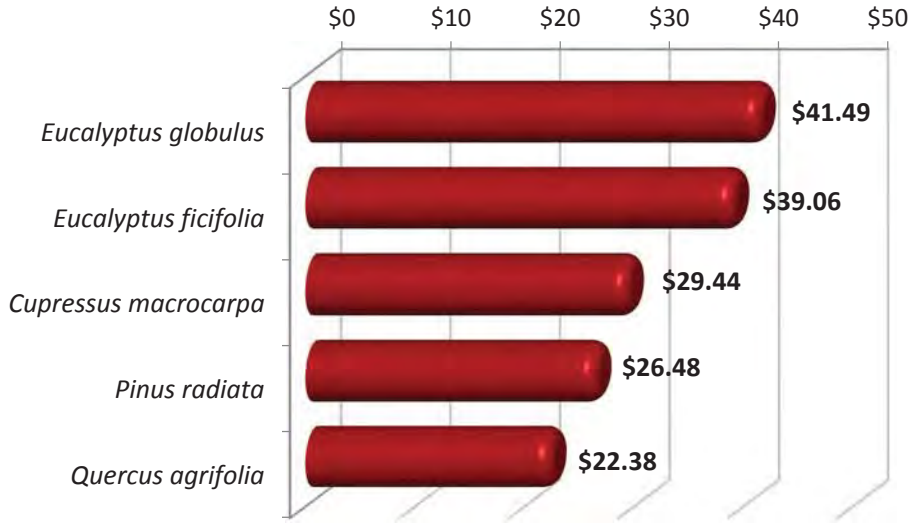


Figure 8. Top Five Species for Per-Tree Annual Electricity and Natural Gas Benefits

Figure 9. Public Trees provide $176,195 in total annual energy savings in Pacific Grove.

Table 6. Annual Electric and Natural Gas Benefits from Pacific Grove's Community Urban Forest

Species	Total Electricity (MWh)	Electricity ($)	Total Natural Gas (Therms)	Natural Gas ($)	Total ($)	% of Pop	% of Total $	Avg. $/tree
Quercus agrifolia	275.68	41,352	5,814	7,660	**49,012**	29.62	27.82	**22.38**
Pinus radiata	278.12	41,718	5,841	7,696	**49,414**	25.24	28.04	**26.48**
Cupressus macrocarpa	257.63	38,645	4,923	6,487	**45,132**	20.73	25.61	**29.44**
Eucalyptus globulus	50.19	7,528	930	1,226	**8,754**	2.85	4.97	**41.49**
Metrosideros excelsa	9.49	1,423	152	199	**1,623**	1.99	0.92	**11.04**
Eucalyptus ficifolia	28.59	4,289	658	867	**5,156**	1.79	2.93	**39.06**
Myoporum laetum	7.20	1,080	148	194	**1,275**	1.41	0.72	**12.26**
Pinus pinea	9.69	1,453	215	283	**1,736**	1.31	0.99	**17.90**
Prunus cerasifera	1.93	289	39	52	**341**	1.11	0.19	**4.17**
Pittosporum undulatum	2.65	398	41	54	**452**	1.01	0.26	**6.03**
Other Trees	74.89	11,233	1,567	2,065	**13,298**	12.94	7.55	**13.90**
All Trees	**996.06**	**$149,408**	**20,328**	**$26,783**	**$176,193**	**100%**	**100%**	**$23.83**

Atmospheric Carbon Dioxide Reduction

As environmental awareness continues to increase, governments are paying particular attention to global warming and the effects of greenhouse gas (GHG) emissions. As energy from the sun (sunlight) strikes the Earth's surface it is reflected back into space as infrared radiation (heat). Greenhouse gases absorb some of this infrared radiation and trap heat in the atmosphere, modifying the temperature of the Earth's surface. Many chemical compounds in the Earth's atmosphere act as GHGs, including methane (CH_4), nitrous oxide (N_2O), carbon dioxide (CO_2), water vapor, and human-made (gases/aerosols). As GHGs increase, the amount of energy radiated back into space is reduced, and more heat is trapped in the atmosphere. An increase in the average temperature of the earth may result in changes in weather, sea levels, and land-use patterns, commonly referred to as "climate change." In the last 150 years, since large-scale industrialization began, the levels of some GHGs, including CO_2, have increased by 25 percent (U.S. Energy Information Administration).

California's Global Warming Solutions Act (AB 32), passed in 2006, set the 2020 GHG emissions reduction goal into law. In December 2007, the California Air Resources Board (ARB) approved the 2020 emission limit of 427 million metric tons of carbon dioxide equivalent (CO_2). As of 2007, regulations require that the largest industrial sources of GHG must report and verify their emissions. In 2011, the ARB adopted the cap-and-trade regulation. Under a cap-and-trade system, an upper limit (or cap) is placed on GHG emissions. This cap can be applied to any source, industry, region, or other jurisdictional level (e.g., state, national, global). Regulated entities are required to either reduce emissions to required limits or purchase (trade) emissions offsets in order to meet the cap. In 2011, the ARB approved four offset protocols for issuing carbon credits under cap-and-trade including the Forest Offset Protocol (ARB, 2011). This Protocol recognizes the important role forests play in fighting climate change.

The Center for Urban Forest Research (CUFR) recently led the development of Urban Forest Project Reporting Protocol. The protocol, which incorporates methods of the Kyoto Protocol and Voluntary Carbon Standard (VCS), establishes methods for calculating reductions, provides guidance for accounting and reporting, and guides urban forest managers in developing tree planting and stewardship projects that could be registered for GHG reduction credits (offsets). The protocol can be applied to urban tree planting projects within municipalities, campuses, and utility service areas anywhere in the United States.

While the urban forest in Pacific Grove may or may not qualify for carbon-offset credits or be traded in the open market, the City's trees are nonetheless providing a significant reduction in atmospheric carbon dioxide (CO_2) for a positive environmental and financial benefit to the community.

Urban trees reduce atmospheric CO_2 in two ways:

- Directly, through growth and the sequestration of CO_2 in wood, foliar biomass, and soil.
- Indirectly, by lowering the demand for heating and air conditioning, thereby reducing the emissions associated with electric power generation and natural gas consumption.

At the same time, vehicles and other combustion engines used to plant and care for trees release CO_2 during operation. Additionally, when a tree dies, most of the CO_2 that accumulated as woody biomass is released back into the atmosphere during decomposition, except in cases where the

wood is recycled. Each of these factors must be considered when calculating the net CO_2 benefits of trees.

Sequestered Carbon Dioxide

To date, community trees in Pacific Grove have sequestered a total of 15,442 tons of carbon dioxide (CO_2), valued at $231,624 [1]. Annually, all community trees directly sequester an additional 910 tons of CO_2, valued at $13,655, into woody and foliar biomass. Accounting for estimated CO_2 emissions from tree decomposition (-148 tons), tree related maintenance activity (-0.43 tons), and avoided CO_2 (419 tons), Pacific Grove's community trees provide an annual net reduction in atmospheric CO_2 of 1,180 tons, valued at $17,704, with an average value of $2.39 per tree (Table 7).

Of prevalent species (representing >1% of the overall resource) blue gum (*Eucalyptus globulus*, $7.90/tree) and red flowering gum (*Eucalyptus ficifolia* $7.31/tree) currently provide the highest annual per tree benefit (Figure 10). The population of coast live oak (*Quercus agrifolia*) provide the highest amount of annual carbon benefits, valued at $5,278, 30% of the total benefit.

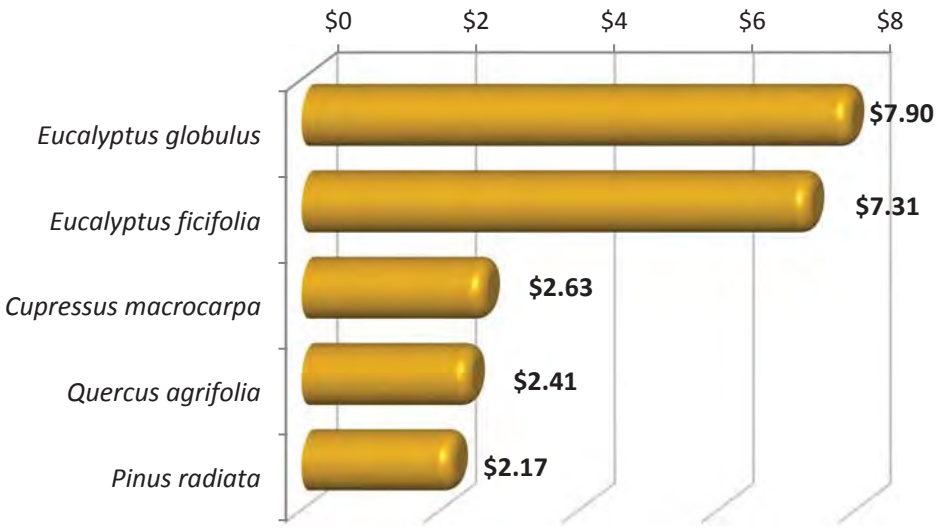


Figure 10. Top 5 Species for Per-Tree Annual Carbon Benefits

[1] Based on i-Tree *Streets* default value of $0.0075. Market value may vary.

Table 7. Summary of Annual Carbon Benefits from Pacific Grove's Community Tree Resource

Species	Sequestered (lb.)	Sequestered ($)	Decomposition Release (lb.)	Maintenance Release (lb.)	Total Release ($)	Avoided (lb.)	Avoided ($)	Net Total (lb.)	Total ($)	% of Pop	% of Total $	Avg. $/tree
Quercus agrifolia	542,973	4,072	- 70,663	- 257.53	- 531.91	231,735	1,738	703,787	**5,278**	29.62	29.81	**2.41**
Pinus radiata	359,711	2,698	- 54,543	- 219.43	- 410.72	233,784	1,753	538,733	**4,040**	25.24	22.82	**2.17**
Cupressus macrocarpa	397,704	2,983	- 77,535	- 180.27	- 582.87	216,564	1,624	536,552	**4,024**	20.73	22.73	**2.63**
Eucalyptus globulus	233,980	1,755	- 54,005	- 24.81	- 405.23	42,187	316	222,137	**1,666**	2.85	9.41	**7.90**
Metrosideros excelsa	14,086	106	- 2,677	- 17.29	- 20.21	7,974	60	19,366	**145**	1.99	0.82	**0.99**
Eucalyptus ficifolia	122,135	916	- 17,532	- 15.52	- 131.60	24,033	180	128,621	**965**	1.79	5.45	**7.31**
Myoporum laetum	5,036	38	- 419	- 12.23	- 3.24	6,054	45	10,658	**80**	1.41	0.45	**0.77**
Pinus pinea	8,491	64	- 694	- 11.41	- 5.29	8,143	61	15,929	**119**	1.31	0.67	**1.23**
Prunus cerasifera	3,516	26	- 235	- 9.64	- 1.83	1,624	12	4,895	**37**	1.11	0.21	**0.45**
Pittosporum undulatum	3,662	27	- 386	- 8.82	- 2.96	2,231	17	5,498	**41**	1.01	0.23	**0.55**
Other Trees	129,332	970	- 17,789	- 112.54	- 134.26	62,950	472	174,380	**1,308**	12.94	7.39	**1.37**
All Trees	**1,820,627**	**$13,655**	**- 296,479**	**- 869.49**	**-$2,230**	**837,278**	**$6,280**	**2,360,557**	**$17,704**	**100%**	**100%**	**$2.39**

Air Quality Improvement

Urban trees improve air quality in five fundamental ways:

- Absorption of gaseous pollutants such as ozone (O3), sulfur dioxide (SO2), and nitrogen dioxide (NO2) through leaf surfaces
- Interception of particulate matter (PM10), such as dust, ash, dirt, pollen, and smoke
- Reduction of emissions from power generation by reducing energy consumption
- Increase of oxygen levels through photosynthesis
- Transpiration of water and shade provision, resulting in lower local air temperatures, thereby reducing ozone (O3) levels

PM_{10} is particulate matter in the air that measures less than 10 micrometers, smaller than the width of a single human hair. These small particles or liquid droplets include smoke, soot, dust, and secondary reactions from gaseous pollutants. PM_{10} pollution is detrimental to health and can cause respiratory problems for local residents.

Ozone (O_3) is another air pollutant that is harmful to human health. Ozone forms when nitrogen oxide from fuel combustion and volatile organic gases from evaporated petroleum products react in the presence of sunshine.

In the absence of cooling effects provided by trees, higher temperatures contribute to ozone (O_3) formation. Additionally, short-term increases in ozone concentrations are statistically associated with increased tree mortality for 95 large US cities (Bell and others, 2004).

However, it should be noted that while trees do a great deal to absorb air pollutants (especially ozone and particulate matter); they also negatively contribute to air pollution. Trees emit various biogenic volatile organic compounds (BVOCs), such as isoprene's and monoterpenes, which also contribute to ozone formation. i-Tree *Streets* analysis accounts for these BVOC emissions in the air quality net benefit.

Deposition and Interception

Each year, 1.9 tons of nitrogen dioxide (NO_2), sulfur dioxide (SO_2), small particulate matter (PM_{10}), and ozone (O_3) are intercepted or absorbed by community trees in Pacific Grove, for a value of $39,085 (Table 8). As a population, Monterey cypress (*Cupressus macrocarpa*) is the greatest contributor to pollutant deposition and interception, accounting for 38% of these benefits.

Avoided Pollutants

The energy savings provided by trees have the additional indirect benefit of reducing air pollutant emissions (NO_2, PM_{10}, SO_2, and VOCs) that result from energy production. Altogether, 1,042 pounds of pollutants, valued at $8,825, are avoided annually through the shading effects of Pacific Grove's community trees.

BVOC Emissions

Biogenic volatile organic compound (BVOC) emissions from trees, which negatively affect air quality, must also be considered along with the benefits. Approximately 7.9 tons of BVOCs are emitted annually from community trees, offsetting the total air quality impact by -$114,312. Of the prevalent species, the heaviest emitters by population are coast live oak (*Quercus agrifolia*) emitting 40% of BVOCs, and blue gum (*Eucalyptus globulus*, 30%). Red flowering gum (*Eucalyptus ficifolia*) is also a significant contributor BVOC emissions (2,244 lbs) and it is only 2% of the population. Monterey cypress (*Cupressus macrocarpa*, 607 lbs) and Monterey pine (*Pinus radiata*, 598 lbs) both contribute to the overall loss in air quality benefits, but at a lower rate. These trees make up 46% of the population and although they are high emitters of BVOCs, they also intercept air pollutants (NO2, PM10, SO2, and VOCs) valued in excess of their BVOC emissions for net positive air quality benefit of $4.08/tree (*Pinus radiata*) and $8.21/tree (*Cupressus macrocarpa).*

Net Air Quality Improvement

The net value of air pollutants removed by community trees in Pacific Grove is -$66,401 annually. This is mainly due to the high populations of trees that emit high level of BVOCs. The overall average net air quality impact per tree is -$8.98. As trees that emit high levels of BVOCs mature and decline, future tree planting should emphasize planting large-canopied trees with large leaf surface areas that are typically not high emitters of BVOCs. Monterey cypress (*Cupressus* macrocarpa, $8.21) and Monterey pine (*Pinus radiata* $4.08) currently produce the greatest per tree net air quality benefits (Figure 11).

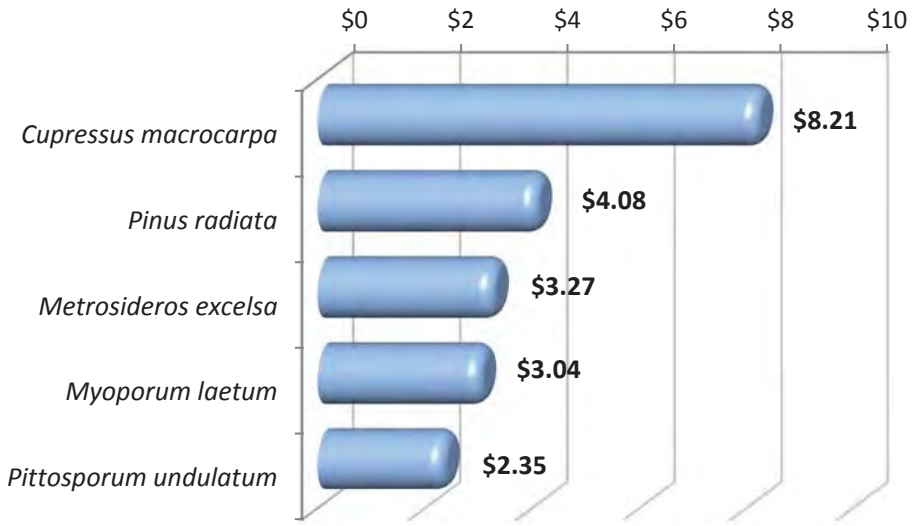


Figure 11. Top 5 Species for Per-Tree Annual Air Quality Benefits

Table 8. Summary of Annual Air Quality Benefits from Pacific Grove's Community Tree Resource

Species	Deposition O_3 (lb.)	Deposition NO_2 (lb.)	Deposition PM_{10} (lb.)	Deposition SO_2 (lb.)	Total Deposition ($)	Avoided NO_2 (lb.)	Avoided PM_{10} (lb.)	Avoided VOC (lb.)	Avoided SO_2 (lb.)	Total Avoided ($)	BVOC Emissions (lb.)	BVOC Emissions ($)	Total (lb.)	Total ($)	% of Pop	Avg. $/tree
Quercus agrifolia	265	116.54	180	22.71	**6,141**	152.84	38.33	19.72	80.28	**2,465**	- 6,369	**- 45,987**	- 5,494	**- 37,381**	29.62	**- 17.07**
Pinus radiata	420	184.90	262	36.05	**9,454**	153.59	38.31	19.73	80.08	**2,472**	- 598	**- 4,314**	597	**7,611**	25.24	**4.08**
Cupressus macrocarpa	665	292.79	394	57.10	**14,724**	139.00	35.07	18.02	73.64	**2,247**	- 607	**- 4,386**	1,067	**12,586**	20.73	**8.21**
Eucalyptus globulus	179	78.62	103	15.33	**3,924**	26.96	6.73	3.46	14.06	**434**	- 4,765	**- 34,405**	- 4,338	**- 30,047**	2.85	**- 142.40**
Metrosideros excelsa	17	7.62	12	1.49	**398**	5.01	1.32	0.67	2.82	**83**	0	**0**	48	**481**	1.99	**3.27**
Eucalyptus ficifolia	51	22.46	31	4.38	**1,144**	16.19	3.92	2.03	8.09	**257**	- 2,244	**- 16,205**	- 2,105	**- 14,803**	1.79	**- 112.15**
Myoporum laetum	11	4.86	7	0.95	**251**	4.01	1.02	0.52	2.14	**65**	0	**0**	32	**316**	1.41	**3.04**
Pinus pinea	4	1.94	3	0.38	**107**	5.42	1.36	0.70	2.84	**87**	- 18	**- 131**	2	**63**	1.31	**0.65**
Prunus cerasifera	2	0.63	1	0.12	**36**	1.08	0.28	0.14	0.58	**18**	0	**0**	5	**53**	1.11	**0.65**
Pittosporum undulatum	7	3.04	4	0.59	**153**	1.41	0.38	0.19	0.81	**23**	0	**0**	17	**177**	1.01	**2.35**
Other Trees	125	52.81	75	10.38	**2,753**	41.86	10.48	5.39	21.95	**675**	- 1,230	**- 8,884**	- 888	**- 5,456**	12.94	**- 5.70**
All Trees	**1,745**	**766.20**	**1,072**	**149.46**	**$39,085**	**547.37**	**137.18**	**70.58**	**287.29**	**$8,825**	**- 15,833**	**-$114,312**	**- 11,057**	**-$66,401**	**100%**	**-$ 8.98**

Stormwater Runoff Reductions

Rainfall interception by trees reduces the amount of stormwater that enters collection and treatment facilities during large storm events. Trees intercept rainfall in their canopy, acting as mini-reservoirs, controlling runoff at the source. Healthy urban trees reduce the amount of runoff and pollutant loading in receiving waters in three primary ways:

- Leaves and branch surfaces intercept and store rainfall, thereby reducing runoff volumes and delaying the onset of peak flows.
- Root growth and decomposition increase the capacity and rate of soil infiltration by rainfall and reduce overland flow.
- Tree canopies reduce soil erosion and surface flows by diminishing the impact of raindrops on bare soil.

Community trees in Pacific Grove intercept more than 14.2 million gallons of stormwater annually for an average of 1,926 gallons per tree (Table 9).The total value of this benefit to the City is $56,949, an average of $7.70 per tree. The City recognizes that trees and vegetation help mitigate stormwater. As of 2014, residents building or replacing between 2,500 to 15,000 square feet or more of impervious surface, must prepare a landscape plan for the property. This regulation shows that City Planners understand that landscaping can help mitigate stormwater runoff.

Overall, among prevalent species, blue gum (*Eucalyptus globulus)* currently provides the greatest per tree benefit of $17.56, followed by red flowering gum (*Eucalyptus ficifolia*) $13.03 (Figure 12). The population of Monterey cypress (*Cupressus macrocarpa*) provides the largest portion of stormwater benefit at 29%, but this value is aligned with their prevalence in the population as they represent 21% of all trees.

As trees grow, their benefits tend to increase, but some species will ultimately realize more substantial benefits than others will. Some tree species currently demonstrating lower benefits, including purple leaf plum (*Prunus cerasifera*, $0.68/tree), are small canopy broadleaf deciduous trees. As such, their benefits will not increase much over time. However, medium-stature evergreen trees such as Victorian box (*Pittosporum undulatum*, $1.88/tree), which have a high percentage of immature trees in the current population should see increased benefits as these younger individuals mature.

Figure 12. Top 5 Species for Annual Stormwater Benefits

Table 9. Summary of Annual Stormwater Runoff Reduction Benefits from Pacific Grove's Community Tree Resource

Species	Total Rainfall Interception (Gal)	Total ($)	% of Pop	% of Total $	Avg. $/tree
Quercus agrifolia	3,647,735	**14,591**	29.62	25.62	**6.66**
Pinus radiata	3,842,658	**15,371**	25.24	26.99	**8.24**
Cupressus macrocarpa	4,069,542	**16,278**	20.73	28.58	**10.62**
Eucalyptus globulus	926,116	**3,704**	2.85	6.50	**17.56**
Metrosideros excelsa	151,162	**605**	1.99	1.06	**4.11**
Eucalyptus ficifolia	429,940	**1,720**	1.79	3.02	**13.03**
Myoporum laetum	94,919	**380**	1.41	0.67	**3.65**
Pinus pinea	109,441	**438**	1.31	0.77	**4.51**
Prunus cerasifera	13,939	**56**	1.11	0.10	**0.68**
Pittosporum undulatum	35,261	**141**	1.01	0.25	**1.88**
All Trees	**916,508**	**3,666**	**12.94**	**6.44**	**3.83**

Aesthetic, Property Value, and Socioeconomic Benefits

Trees provide beauty in the urban landscape, privacy to homeowners, improved human health, a sense of comfort and place, and habitat for urban wildlife. Research shows that trees promote better business by stimulating more frequent and extended shopping and a willingness to pay more for goods and parking (Wolf, 1999). Some of these benefits are captured as a percentage of the value of the property on which a tree stands. To determine the value of these less tangible benefits, i-Tree *Streets* uses research that compares differences in sales prices of homes to estimate the contribution associated with trees. Differences in housing prices in relation to the presence (or lack) of a street tree help define the aesthetic value of street trees in the urban environment.

The calculation of annual aesthetic and other benefits corresponds with a tree's annual increase in leaf area. When a tree is actively growing, leaf area may increase dramatically. Once a tree is mature, there may be little or no net increase in leaf area from one year to the next; thus, there is little or no incremental annual aesthetic benefit for that year, although the cumulative benefit over the course of the entire life of the tree may be large. Since this report represents a one-year sample snapshot of the inventoried tree population, **aesthetic benefits reflect the increase in leaf area for each species population over the course of a single year.**

The total annual benefit from Pacific Grove's community trees associated with property value increases and other less tangible benefits is nearly $1.1 million, an average of $141 per tree (Table 10). Overall, among prevalent species, red flowering gum (*Eucalyptus ficifolia*, $240) and blue gum (*Eucalyptus globulus*, $238) provide the greatest per-tree aesthetic value annually.

Figure 13. Urban trees promote retail shopping by stimulating more frequent visits and a willingness to pay more for goods and services (Wolf 1999).

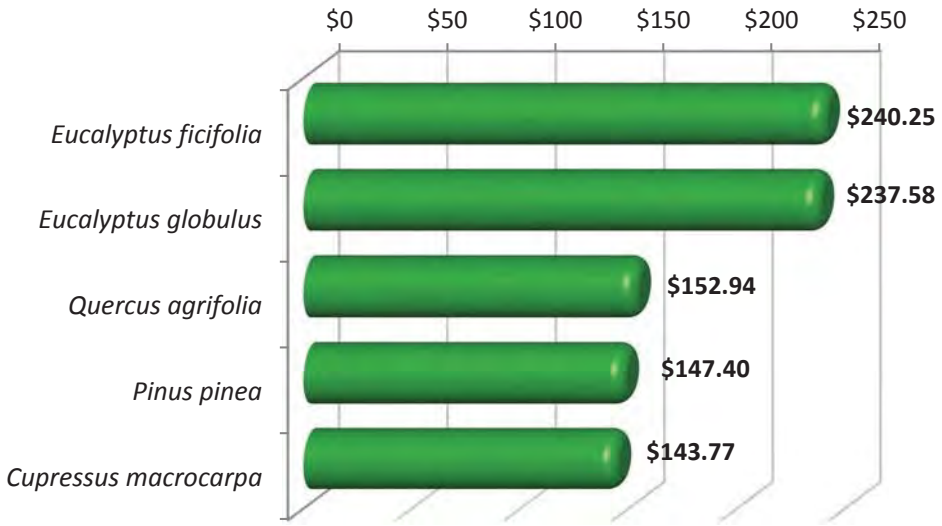


Figure 14. Top 5 Species for Annual Aesthetic Benefits

Table 10. Summary of Annual Aesthetic, Property Value, and Socioeconomic Benefits from Pacific Grove's Community Tree Resource

Species	Total ($)	% of Pop	% of Total $	Avg. $/tree
Quercus agrifolia	**334,928**	29.62	32.04	**152.94**
Pinus radiata	**267,644**	25.24	25.60	**143.43**
Cupressus macrocarpa	**220,404**	20.73	21.08	**143.77**
Eucalyptus globulus	**50,128**	2.85	4.80	**237.58**
Metrosideros excelsa	**8,029**	1.99	0.77	**54.62**
Eucalyptus ficifolia	**31,713**	1.79	3.03	**240.25**
Myoporum laetum	**8,936**	1.41	0.85	**85.92**
Pinus pinea	**14,298**	1.31	1.37	**147.40**
Prunus cerasifera	**3,548**	1.11	0.34	**43.27**
Pittosporum undulatum	**4,018**	1.01	0.38	**53.58**
Other Trees	**101,709**	12.94	9.73	**106.28**
All Trees	**$1,045,356**	**100%**	**100%**	**$141.38**

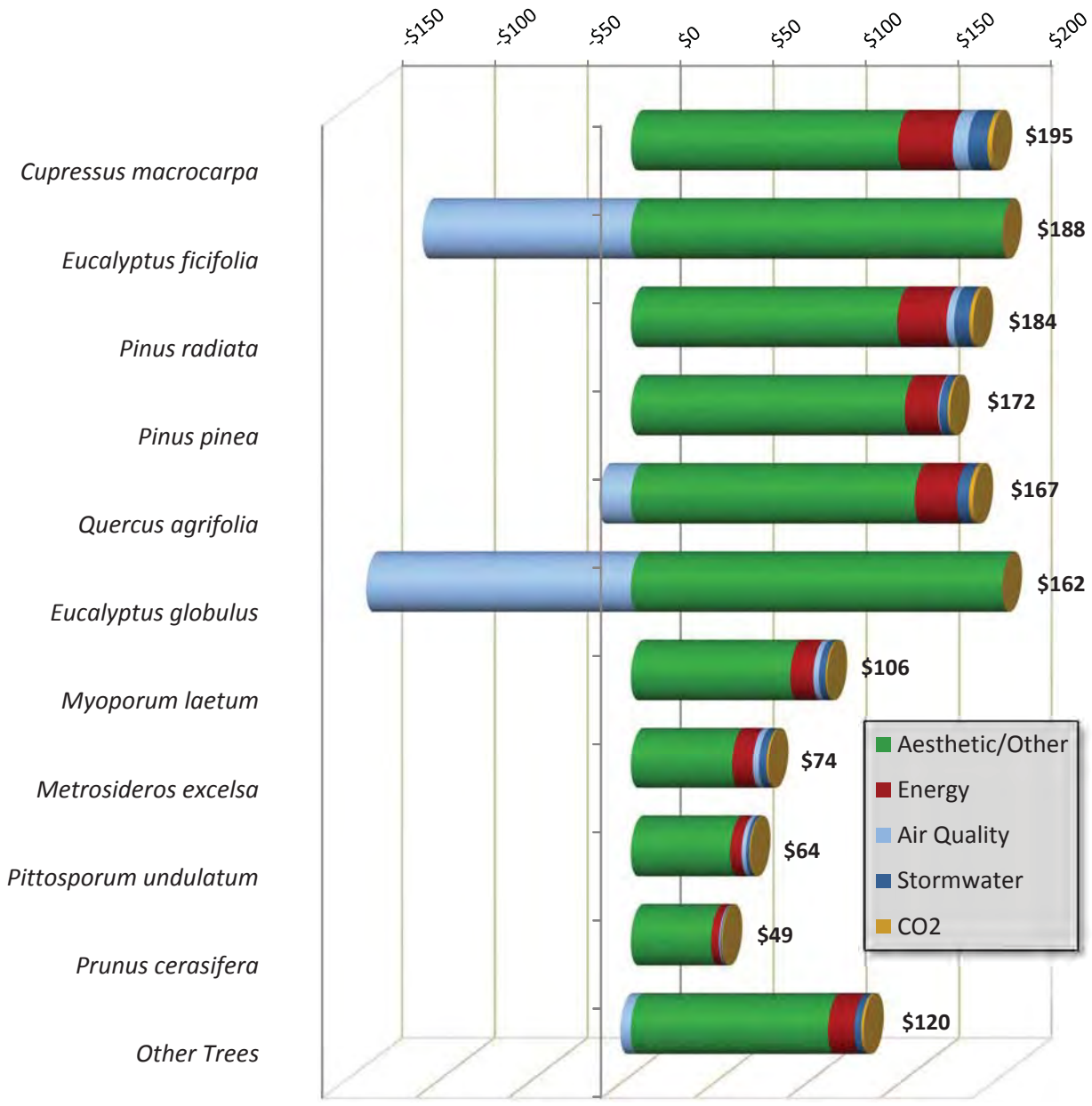


Figure 15. Summary of Annual Per-Tree Benefits from Predominant Species (representing>1%)

Table 11. Summary of Annual per Tree Benefits from Species Representing > 1%

Species	Energy	CO2	Air Quality	Stormwater	Aesthetic/Other	Total
Quercus agrifolia	22.38	2.41	- 17.07	6.66	152.94	**167.32**
Pinus radiata	26.48	2.17	4.08	8.24	143.43	**184.39**
Cupressus macrocarpa	29.44	2.63	8.21	10.62	143.77	**194.67**
Eucalyptus globulus	41.49	7.90	- 142.40	17.56	237.58	**162.11**
Metrosideros excelsa	11.04	0.99	3.27	4.11	54.62	**74.03**
Eucalyptus ficifolia	39.06	7.31	- 112.15	13.03	240.25	**187.50**
Myoporum laetum	12.26	0.77	3.04	3.65	85.92	**105.64**
Pinus pinea	17.90	1.23	0.65	4.51	147.40	**171.70**
Prunus cerasifera	4.17	0.45	0.65	0.68	43.27	**49.22**
Pittosporum undulatum	6.03	0.55	2.35	1.88	53.58	**64.40**
Other Trees	13.90	1.37	- 5.70	3.83	106.28	**119.67**
All Trees	**$23.83**	**$2.39**	**-$8.98**	**$7.70**	**$141.38**	**$166.32**

Net Benefits and Benefit versus Investment Ratio (BIR)

Pacific Grove receives substantial benefits from their community urban forest; however, the City must also consider their investments in maintaining this resource. Applying a *benefit-investment ratio* (BIR) is a useful way to evaluate the public investment in a community tree resource. A BIR is an indicator used to summarize the overall value compared to the investments of a given resource. Specifically, in this analysis, BIR is the ratio of the total value of benefits provided by all the City's community trees compared to the cost (investment) associated with their management.

Pacific Grove's community urban forest has beneficial effects on the environment. Approximately $184,447 of the total annual benefits (over $1.2 million) quantified in this study are environmental services (Table 12). Energy savings, valued at $176,195, account for the greatest environmental benefits, followed by stormwater benefits ($56,949), and carbon reduction ($17,704). Annual increases to property value, socioeconomic, and other aesthetic benefits are substantial, accounting $1.1 million of all benefits.

The total estimated benefits provided by Pacific Grove's city-maintained community urban forest is nearly $1.2 million, a value of $166.32 per tree and $79.32 per capita. These benefits are realized on an annual basis. It is important to acknowledge that this is not a full accounting of the benefits provided by this resource, as some benefits are intangible and/or difficult to quantify, such as impacts on psychological health, crime, and violence. Empirical evidence of these benefits does exist (Wolf, 2007; Kaplan, 1989; Ulrich, 1986), but there is limited knowledge about the physical processes at work and the complex nature of interactions make quantification imprecise. Tree growth and mortality rates are highly variable. A true and full accounting of benefits and investments must consider variability among sites (e.g., tree species, growing conditions, maintenance practices) throughout the City, as well as variability in tree growth. In other words, **trees are worth far more than what one can ever quantify!**

When the City's annual estimated expenditure (or investment) of $299,571 in this resource is considered, the net annual benefit (benefits minus investment) to the City is $930,232. The average net benefit for an individual community tree in Pacific Grove is $125.81 and the per capita net benefit is $60.00. **Pacific Grove is currently receiving $4.11 in benefits for every $1 invested in community trees.**

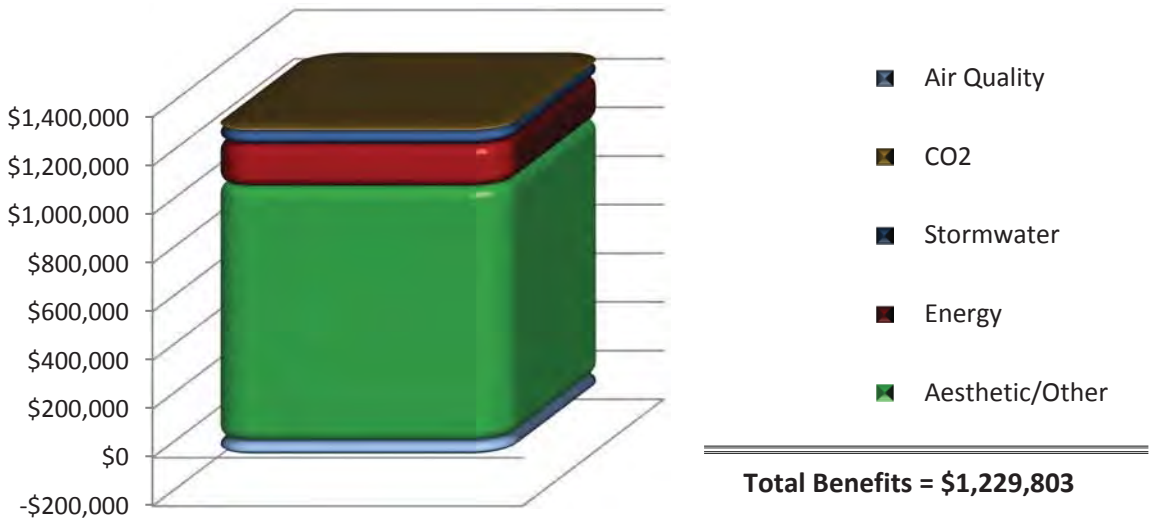


Figure 16. Total Annual Benefits from Community Trees in Pacific Grove

Total Annual Benefits: $1.2 million

Average Annual per Tree Benefit: $166.32

Annual Value of Benefits per Capita: $79.32

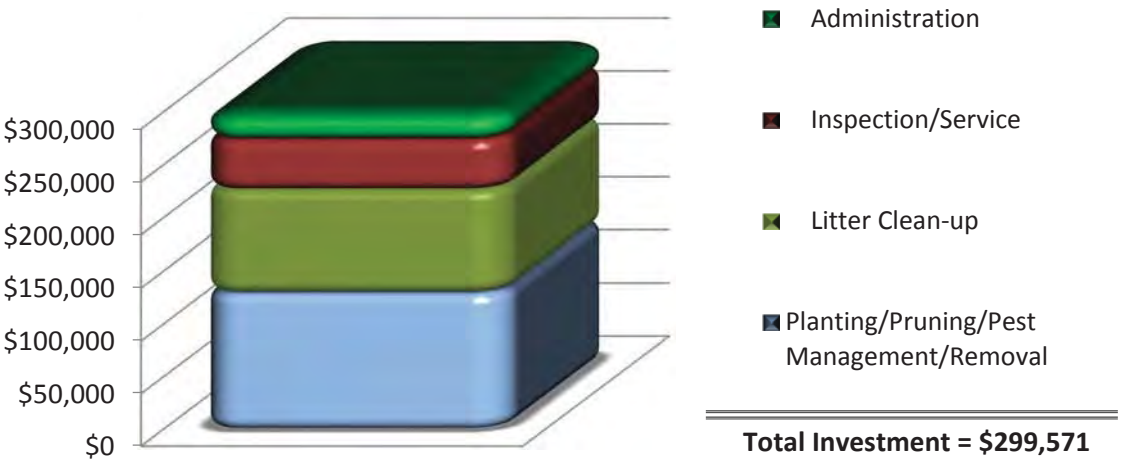


Figure 17. Total Annual Investment to Publicly Maintain Trees in Pacific Grove

Total Annual Investment: $299,571

Average Annual per Tree Investment: $40.52

Annual Investment per Capita: $19.32

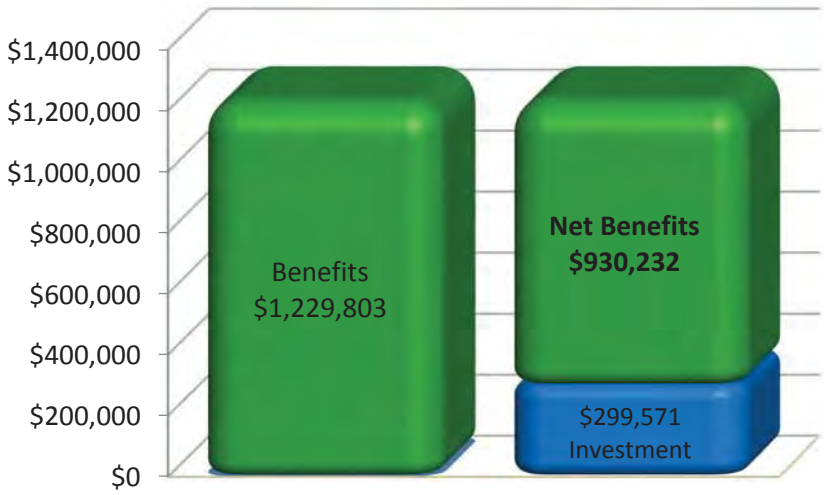


Figure 18. Benefit versus Investment Ratio

Annual Net Benefit of Publicly Maintained Trees in Pacific Grove: $930,232

For EVERY $1 invested in publicly maintained trees, Pacific Grove receives: $4.11 in benefits

Table 12. Annual Benefit versus Investment Summary for all Community Trees

Benefits	Total ($)	$/tree	$/capita
Energy	176,195	23.83	11.36
CO2	17,704	2.39	1.14
Air Quality	- 66,401	- 8.98	- 4.28
Stormwater	56,949	7.70	3.67
Aesthetic/Other	1,045,356	141.38	67.42
Total Benefits	**$1,229,803**	**$166.32**	**$79.32**

Investment			
Planting/Pruning/Pest Management/Removal	129,651	17.53	8.36
Administration	25,000	3.38	1.61
Inspection/Service	48,000	6.49	3.10
Litter Clean-up	96,920	13.11	6.25
Total Investment	**$299,571**	**$40.52**	**$19.32**

Net Benefit	**$930,232**	**$125.81**	**$60.00**

Benefit Investment Ratio	**$4.11**

Conclusion

This analysis describes the current structural characteristics of Pacific Grove's community urban forest resource, using established tree sampling, numerical modeling, and statistical methods to provide a general accounting of the benefits. The analysis provides a "snapshot" of this resource at its current population, structure, and condition. Rather than examining each individual tree, as an inventory does, the resource analysis examines trends and performance measures over the entire urban forest and each of the major species populations within.

Community trees are providing quantifiable impacts on air quality, reduction in atmospheric CO_2, stormwater runoff, and aesthetic benefits. The City's 7,394 trees are providing over $1.2 million in annual gross benefits. That is an average of $166.32 per tree and $79.32 per capita.

The community urban forest in Pacific Grove has a nearly ideal age distribution of young to established trees in fair to good condition. The resource has a healthy diversity with more than 136 different species. The City can increase the benefits from this resource by using all available planting sites to increase the stocking level (currently 92.2%) as well as replacing mature trees that are in decline and recommended for removal (8%).The City should continue to focus resources on preserving existing and mature trees to promote health, strong structure, tree longevity, and manage risk. Structural and training pruning for young trees will maximize the value of this resource, reduce long-term maintenance costs, and ensure that as trees mature they provide the greatest possible benefits over time. Davey Resource Group recommends the following:

- Increase species diversity by insuring that new tree plantings include a variety of suitable species and don't unduly increase reliance on prevalent species.
- Increase stocking level by using all available planting sites to improve diversity and increase benefits. Install large-stature species wherever space allows.
- Provide structural pruning for young trees and a regular pruning cycle for all trees.
- Protect existing trees and manage risk with regular inspection to identify and mitigate structural and age-related defects.
- Continue to maintain and update the inventory database, including tracking tree growth and condition during regular pruning cycles.
- For greater air quality benefits, new planting should include trees that emit less biogenetic organic compounds (BVOCs).

Urban forest managers can better anticipate future trends with an understanding of the current status of the City's tree population. Managers can also anticipate challenges and devise plans to increase the current level of benefits. Performance data from the analysis can be used to make determinations regarding species selection, distribution, and maintenance policies. Documenting current structure is necessary for establishing goals and performance objectives and can serve as a benchmark for measuring future success. Information from the urban forest resource analysis can be referenced in development of an urban forest management or master plan. An urban forest master plan is a critical tool for successful urban forest management, inspiring commitment and providing vision for communication with key decision-makers both inside and outside the organization.

Pacific Grove's community trees are of vital importance to the environmental, social, and economic well-being of the community. The City has demonstrated that public trees are a valued community

resource, a vital component of the urban infrastructure, and an important part of the City's history and identity. The inventory data can be used to plan a proactive and forward-looking approach to the future care of community trees. Updates should continue to be incorporated into the inventory a regular maintenance is performed, including updating the DBH and condition of existing trees. Current and complete inventory data will help staff to more efficiently track maintenance activities and tree health and will provide a strong basis for making informed management decisions. A continued commitment to planting, maintaining, and preserving these trees, will support the health and welfare of the City and the surrounding region.

Figure 19. Trees are an important part of the city's history and identity.

Appendix A: Methodology

In 2015, Certified Arborists collected an inventory of the community trees in Pacific Grove, including details about each tree's species, size, and condition. The inventory data was formatted for use in i-Tree's public tree population assessment tool, i-Tree *Streets*, a STRATUM Analysis Tool (Streets v 5.1.5; i-Tree v 6.0.9). i-Tree *Streets* assesses tree population structure and the function of those trees, such as their role in building energy use, air pollution removal, stormwater interception, carbon dioxide removal, and property value increases. To analyze the economic benefits of Pacific Grove's community trees, i-Tree *Streets* calculates the dollar value of annual resource functionality. This analysis combines the results of the City's tree inventory with benefit modeling data to produce information regarding resource structure, function, and value for use in determining management recommendations. i-Tree *Streets* regionalizes the calculations of its output by incorporating detailed reference City project information for 17 climate zones across the United States (Pacific Grove is located in the Northern California Coast Climate Zone).

An annual resource unit was determined on a per tree basis for each of the modeled benefits. Resource units are measured as MWh of electricity saved per tree; MBtu of natural gas conserved per tree; pounds of atmospheric CO_2 reduced per tree; pounds of NO_2,SO_2, O_3, PM_{10}, and VOCs reduced per tree; cubic feet of stormwater runoff reduced per tree; and square feet of leaf area added per tree to increase property values.

Price values assigned to each resource unit (tree) were generated based on economic indicators of society's willingness to pay for the environmental benefits trees provide. The City provided the estimated investment costs for contracted and in-house tree services, pest management, administration, and inspections.

Estimates of benefits are initial approximations as some benefits are difficult to quantify (e.g. impacts on psychological health, crime, and violence). In addition, limited knowledge about the physical processes at work and their interactions makes estimates imprecise (e.g., fate of air pollutants trapped by trees and then washed to the ground by rainfall). Therefore, this method of quantification provides first-order approximations based on current research. It is intended to be a general accounting of the benefits produced by urban trees.

Table 13. Pacific Grove Benefit Prices Used In This Analysis

Benefits	Price	Unit	Source
Electricity	0.15	$/Kwh	Pacific Gas and Electric
Natural Gas	1.32	$/Therm	Pacific Gas and Electric
CO_2	0.0075	$/lb.	Streets default – Northern California Coast
PM_{10}	11.79	$/lb.	Streets default – Northern California Coast
NO_2	10.31	$/lb.	Streets default – Northern California Coast
SO_2	3.72	$/lb.	Streets default – Northern California Coast
VOC	7.22	$/lb.	Streets default – Northern California Coast
Stormwater Interception	0.004	$/gallon	Streets default – Northern California Coast
Median Home Value	731,000	$	City of Pacific Grove

i-Tree *Streets* default values (Table 13) from the Northern California Coast Climate Zone were used for all benefit prices except for the median home value, and electrical and natural gas rates. Using these rates, the magnitude of the benefits provided by the inventoried tree resource was calculated using i-Tree *Streets***.** Median home value, electrical and gas rates, and program investment costs were supplied by the City of Pacific Grove.

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Appendix C: Tables

Table 14. Complete Population Summary of Tree Species in Pacific Grove's Community Urban Forest

Species	DBH Class (in)									Total	%of Pop
	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	> 42		
Broadleaf Deciduous Large (BDL)											
Platanus hybrida	0	12	12	10	1	0	0	0	0	35	0.47
Ulmus americana	0	0	2	9	11	6	1	4	1	34	0.46
Ulmus parvifolia	2	0	4	2	1	0	1	0	0	10	0.14
Fraxinus uhdei	0	1	1	0	0	0	0	0	0	2	0.03
Juglans nigra	0	0	0	0	1	0	0	0	1	2	0.03
Ulmus pumila	0	0	0	0	1	0	0	0	0	1	0.01
Platanus racemosa	0	0	1	0	0	0	0	0	0	1	0.01
Liriodendron tulipifera	0	0	0	0	0	1	0	0	0	1	0.01
Quercus species	0	1	0	0	0	0	0	0	0	1	0.01
BDL Total	**2**	**14**	**20**	**21**	**15**	**7**	**2**	**4**	**2**	**87**	**1.18%**
Broadleaf Deciduous Medium (BDM)											
Liquidambar styraciflua	9	14	15	5	0	0	0	0	0	43	0.58
Robinia x ambigua	10	1	1	0	0	0	0	0	0	12	0.16
Betula pendula	0	7	3	2	0	0	0	0	0	12	0.16
Pyrus calleryana	2	8	1	1	0	0	0	0	0	12	0.16
Salix species	0	0	5	3	1	1	0	0	0	10	0.14
Acacia spp.	0	0	5	0	0	0	0	0	0	5	0.07
Alnus rhombifolia	0	0	3	1	0	0	0	0	0	4	0.05
Ulmus spp.	0	0	3	0	1	0	0	0	0	4	0.05
Betula nigra	0	4	0	0	0	0	0	0	0	4	0.05
Nyssa sylvatica	0	3	0	0	0	0	0	0	0	3	0.04
Ginkgo biloba	3	0	0	0	0	0	0	0	0	3	0.04
Acer rubrum	0	2	1	0	0	0	0	0	0	3	0.04
Robinia pseudoacacia	0	0	0	2	0	0	0	0	0	2	0.03
Morus alba	0	0	1	1	0	0	0	0	0	2	0.03
Pterocarya stenoptera	2	0	0	0	0	0	0	0	0	2	0.03
Albizia julibrissin	0	0	0	1	0	0	0	0	0	1	0.01
Salix babylonica	0	0	0	0	0	0	0	1	0	1	0.01
Prunus subhirtella	0	1	0	0	0	0	0	0	0	1	0.01
Salix matsudana	0	0	1	0	0	0	0	0	0	1	0.01
Aesculus species	0	1	0	0	0	0	0	0	0	1	0.01

Species	DBH Class (in)									Total	%of Pop
	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	> 42		
BDM Total	**26**	**41**	**42**	**16**	**2**	**1**	**0**	**1**	**0**	**129**	**1.74%**
Broadleaf Deciduous Small (BDS)											
Prunus cerasifera	31	34	17	0	0	0	0	0	0	82	1.11
Crataegus phaenopyrum	11	0	0	0	0	0	0	0	0	11	0.15
Prunus X blireana	2	6	2	0	0	0	0	0	0	10	0.14
Malus species	5	3	0	0	0	0	0	0	0	8	0.11
Prunus ilicifolia lyonii	0	3	2	0	0	0	0	0	0	5	0.07
Acer palmatum	3	1	1	0	0	0	0	0	0	5	0.07
Prunus serrulata	3	1	1	0	0	0	0	0	0	5	0.07
Aesculus californica	0	0	0	1	1	0	0	0	0	2	0.03
Pyrus communis	2	0	0	0	0	0	0	0	0	2	0.03
Cercis canadensis	2	0	0	0	0	0	0	0	0	2	0.03
Ribes sanguineum	1	0	0	0	0	0	0	0	0	1	0.01
Ficus carica	0	1	0	0	0	0	0	0	0	1	0.01
Prunus ilicifolia	0	0	1	0	0	0	0	0	0	1	0.01
Prunus dulcis	0	1	0	0	0	0	0	0	0	1	0.01
Prunus domestica	0	0	1	0	0	0	0	0	0	1	0.01
Prunus species	0	0	1	0	0	0	0	0	0	1	0.01
Cotinus coggygria	1	0	0	0	0	0	0	0	0	1	0.01
BDS Total	**61**	**50**	**26**	**1**	**1**	**0**	**0**	**0**	**0**	**139**	**1.88%**
Broadleaf Evergreen Large (BEL)											
Quercus agrifolia	37	168	925	681	237	82	34	15	11	2190	29.62
Eucalyptus globulus	0	5	48	25	20	16	13	21	63	211	2.85
Eucalyptus sideroxylon	0	0	3	1	15	8	5	1	0	33	0.45
Podocarpus gracilior	6	3	0	0	0	0	0	0	0	9	0.12
Umbellularia californica	0	0	1	2	2	1	0	0	0	6	0.08
Eucalyptus species	0	0	2	1	1	0	0	0	0	4	0.05
Eucalyptus polyanthemos	0	0	0	0	1	2	0	0	0	3	0.04
Eucalyptus citriodora	0	0	1	0	0	0	0	1	0	2	0.03
Grevillea robusta	0	0	0	2	0	0	0	0	0	2	0.03
Eucalyptus viminalis	0	0	0	0	1	0	0	0	0	1	0.01
BEL Total	**43**	**176**	**980**	**712**	**277**	**109**	**52**	**38**	**74**	**2461**	**33.28%**
Broadleaf Evergreen Medium (BEM)											
Metrosideros excelsa	6	27	45	39	20	10	0	0	0	147	1.99
Eucalyptus ficifolia	0	1	11	25	46	21	19	6	3	132	1.79
Pittosporum undulatum	6	25	37	6	1	0	0	0	0	75	1.01

Species	DBH Class (in)									Total	%of Pop
	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	> 42		
Maytenus boaria	11	11	17	8	0	0	0	0	0	47	0.64
Olea europaea	14	12	4	0	0	0	0	0	0	30	0.41
Acacia longifolia	0	3	20	3	0	1	0	0	0	27	0.37
Ilex aquifolium	0	12	8	4	1	0	0	0	0	25	0.34
Acacia melanoxylon	1	1	10	5	2	1	2	0	0	22	0.30
Magnolia grandiflora	3	8	5	0	0	0	1	0	0	17	0.23
Syzygium paniculatum	0	3	5	5	0	0	0	0	0	13	0.18
Melaleuca quinquenervia	0	1	6	0	0	0	0	0	0	7	0.09
Cinnamomum camphora	0	6	0	0	0	0	0	0	0	6	0.08
Eucalyptus nicholii	0	0	0	0	2	0	3	1	0	6	0.08
Lyonothamnus floribundus asplen	0	1	4	0	0	0	0	0	0	5	0.07
Schinus molle	0	1	3	0	0	0	0	0	0	4	0.05
Laurus nobilis	1	2	0	0	1	0	0	0	0	4	0.05
Ligustrum lucidum	0	2	0	0	0	0	0	0	0	2	0.03
Acacia baileyana	0	1	1	0	0	0	0	0	0	2	0.03
Persea americana	0	0	1	0	0	0	0	0	0	1	0.01
Eucalyptus cinerea	0	0	0	1	0	0	0	0	0	1	0.01
Geijera parviflora	0	0	1	0	0	0	0	0	0	1	0.01
BEM Total	**42**	**117**	**178**	**96**	**73**	**33**	**25**	**7**	**3**	**574**	**7.76%**

Broadleaf Evergreen Small (BES)											
Myoporum laetum	1	22	67	13	1	0	0	0	0	104	1.41
Callistemon citrinus	4	4	16	5	0	0	0	0	0	29	0.39
Heteromeles arbutifolia	1	7	18	0	1	0	0	0	0	27	0.37
Arbutus x marina	2	6	12	2	0	0	0	0	0	22	0.30
Pittosporum crassifolium	0	4	7	3	0	0	0	0	0	14	0.19
Arbutus unedo	3	6	3	1	0	0	0	0	0	13	0.18
Ilex spp.	0	2	5	1	1	0	0	0	0	9	0.12
Acacia verticillata	0	5	2	0	0	0	0	0	0	7	0.09
Callistemon viminalis	0	4	2	1	0	0	0	0	0	7	0.09
Leptospermum laevigata	0	0	4	2	1	0	0	0	0	7	0.09
Melaleuca linariifolia	0	0	2	2	1	0	0	0	0	5	0.07
Leptospermum scoparium	1	1	2	0	0	0	0	0	0	4	0.05
Pyrus kawakamii	0	2	2	0	0	0	0	0	0	4	0.05
Tristaniopsis laurina	4	0	0	0	0	0	0	0	0	4	0.05
Eucalyptus conferruminata	0	0	1	1	0	1	0	0	0	3	0.04
Schinus terebinthifolius	0	0	0	2	1	0	0	0	0	3	0.04
Pyracantha species	0	0	2	0	0	0	0	0	0	2	0.03
Dodonaea viscosa	0	0	2	0	0	0	0	0	0	2	0.03
Citrus limon	0	1	1	0	0	0	0	0	0	2	0.03

Species	DBH Class (in)									Total	%of Pop
	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	> 42		
Xylosma congestum	0	1	0	0	0	0	0	0	0	1	0.01
Garrya elliptica	0	0	1	0	0	0	0	0	0	1	0.01
Fremontodendron californicum	0	1	0	0	0	0	0	0	0	1	0.01
Citrus sinensis	0	1	0	0	0	0	0	0	0	1	0.01
Ligustrum japonicum	0	0	1	0	0	0	0	0	0	1	0.01
Eriobotrya japonica	1	0	0	0	0	0	0	0	0	1	0.01
Rhus lancea	0	0	1	0	0	0	0	0	0	1	0.01
Agonis flexuosa	1	0	0	0	0	0	0	0	0	1	0.01
BES Total	**18**	**67**	**151**	**33**	**6**	**1**	**0**	**0**	**0**	**276**	**3.73%**
Conifer Evergreen Large (CEL)											
Pinus radiata	159	112	373	393	342	245	127	74	41	1,866	25.24
Cupressus macrocarpa	60	114	291	280	216	155	112	96	209	1,533	20.73
Pinus pinea	7	15	33	33	8	1	0	0	0	97	1.31
Sequoia sempervirens	11	25	21	2	3	0	2	2	2	68	0.92
Pinus torreyana	1	1	6	5	5	1	3	0	0	22	0.30
Pinus canariensis	5	1	1	0	0	0	0	0	0	7	0.09
Cedrus atlantica	0	0	1	5	1	0	0	0	0	7	0.09
Cedrus deodara	2	0	1	1	2	0	0	0	0	6	0.08
Araucaria heterophylla	1	2	0	1	0	0	1	0	0	5	0.07
Pseudotsuga menziesii	0	0	0	0	2	1	0	0	0	3	0.04
Cupressus spp.	0	1	0	2	0	0	0	0	0	3	0.04
Pinus thunbergiana	0	2	1	0	0	0	0	0	0	3	0.04
Calocedrus decurrens	0	0	1	0	1	0	0	0	0	2	0.03
Sequoiadendron giganteum	0	0	0	0	1	1	0	0	0	2	0.03
Casuarina cunninghamiana	0	0	0	0	1	0	0	0	0	1	0.01
Abies pinsapo	0	0	0	1	0	0	0	0	0	1	0.01
CEL Total	**246**	**273**	**729**	**723**	**582**	**404**	**245**	**172**	**252**	**3,626**	**49.04%**
Conifer Evergreen Medium (CEM)											
Pinus species	2	3	2	2	0	0	0	0	0	9	0.12
Ceanothus spp.	0	0	4	0	0	0	0	0	0	4	0.05
Myrica californica	0	2	0	0	0	0	0	0	0	2	0.03
Myrtus communis	0	0	2	0	0	0	0	0	0	2	0.03
Pinus sylvestris	0	0	1	0	0	0	0	0	0	1	0.01
Cupressocyparis x leylandii	0	0	0	0	1	0	0	0	0	1	0.01
Cunninghamia lanceolata	0	1	0	0	0	0	0	0	0	1	0.01
CEM Total	**2**	**6**	**9**	**2**	**1**	**0**	**0**	**0**	**0**	**20**	**0.27%**

Species	DBH Class (in)									Total	%of Pop
	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	> 42		
Conifer Evergreen Small (CES)											
Taxus baccata	2	1	2	1	1	0	0	0	0	7	0.09
CES Total	**2**	**1**	**2**	**1**	**1**	**0**	**0**	**0**	**0**	**7**	**0.09%**
Palm Evergreen Large (PEL)											
Phoenix canariensis	0	0	3	2	1	8	13	12	2	41	0.55
PEL Total	**0**	**0**	**3**	**2**	**1**	**8**	**13**	**12**	**2**	**41**	**0.55%**
Palm Evergreen Small (PES)											
Washingtonia robusta	0	0	4	2	6	0	0	0	0	12	0.16
Cordyline australis	1	4	5	1	0	0	0	0	0	11	0.15
Trachycarpus fortunei	0	0	4	0	0	0	0	0	0	4	0.05
Arecastrum romanzoffianum	2	1	0	0	0	0	0	0	0	3	0.04
Washingtonia filifera	0	0	1	1	0	1	0	0	0	3	0.04
Yucca elephantipes	0	0	0	1	0	0	0	0	0	1	0.01
PES Total	**3**	**5**	**14**	**5**	**6**	**1**	**0**	**0**	**0**	**34**	**0.46%**
Grand Total	**445**	**750**	**2,154**	**1,612**	**965**	**564**	**337**	**234**	**333**	**7,394**	**100%**

Table 15. Relative Performance of All Species

Species	Dead or Dying	Poor	Fair	Good	N/A	Very Good	RPI	# of Trees	% of Pop
Quercus agrifolia	0.78	10.64	49.95	38.36	0.18	0.09	**1.00**	2,190	29.62
Pinus radiata	11.36	10.50	40.89	32.48	0.86	3.91	**0.91**	1,866	25.24
Cupressus macrocarpa	3.65	5.81	40.51	47.49	1.37	1.17	**1.03**	1,533	20.73
Eucalyptus globulus	0.47	1.90	36.49	61.14	0.00	0.00	**1.12**	211	2.85
Metrosideros excelsa	0.00	1.36	39.46	57.14	0.68	1.36	**1.12**	147	1.99
Eucalyptus ficifolia	0.00	5.30	62.88	31.82	0.00	0.00	**1.00**	132	1.79
Myoporum laetum	5.77	21.15	38.46	33.65	0.96	0.00	**0.90**	104	1.41
Pinus pinea	3.09	4.12	31.96	60.82	0.00	0.00	**1.10**	97	1.31
Prunus cerasifera	0.00	12.20	32.93	54.88	0.00	0.00	**1.07**	82	1.11
Pittosporum undulatum	0.00	2.67	46.67	49.33	0.00	1.33	**1.09**	75	1.01
Sequoia sempervirens	0.00	5.88	45.59	47.06	0.00	1.47	**1.07**	68	0.92
Maytenus boaria	6.38	4.26	31.91	55.32	2.13	0.00	**1.03**	47	0.64
Liquidambar styraciflua	0.00	4.65	37.21	58.14	0.00	0.00	**1.11**	43	0.58
Phoenix canariensis	0.00	0.00	17.07	80.49	0.00	2.44	**1.22**	41	0.55
Platanus hybrida	2.86	2.86	45.71	48.57	0.00	0.00	**1.06**	35	0.47
Ulmus americana	0.00	14.71	47.06	38.24	0.00	0.00	**0.99**	34	0.46
Eucalyptus sideroxylon	0.00	12.12	75.76	12.12	0.00	0.00	**0.90**	33	0.45
Olea europaea	0.00	0.00	43.33	56.67	0.00	0.00	**1.12**	30	0.41
Callistemon citrinus	0.00	0.00	31.03	68.97	0.00	0.00	**1.16**	29	0.39
Acacia longifolia	3.70	18.52	62.96	14.81	0.00	0.00	**0.86**	27	0.37
Heteromeles arbutifolia	0.00	3.70	40.74	55.56	0.00	0.00	**1.10**	27	0.37
Ilex aquifolium	0.00	4.00	44.00	52.00	0.00	0.00	**1.09**	25	0.34
Acacia melanoxylon	4.55	9.09	59.09	27.27	0.00	0.00	**0.94**	22	0.30
Arbutus x marina	0.00	9.09	22.73	68.18	0.00	0.00	**1.13**	22	0.30
Pinus torreyana	0.00	0.00	9.09	81.82	0.00	9.09	**1.25**	22	0.30
Magnolia grandiflora	0.00	5.88	76.47	11.76	0.00	5.88	**0.95**	17	0.23
Pittosporum crassifolium	0.00	14.29	50.00	35.71	0.00	0.00	**0.99**	14	0.19
Syzygium paniculatum	0.00	0.00	92.31	7.69	0.00	0.00	**0.93**	13	0.18
Arbutus unedo	0.00	0.00	15.38	84.62	0.00	0.00	**1.22**	13	0.18
Pyrus calleryana	0.00	0.00	50.00	50.00	0.00	0.00	**1.09**	12	0.16
Betula pendula	0.00	8.33	41.67	50.00	0.00	0.00	**1.06**	12	0.16
Robinia x ambigua	0.00	16.67	25.00	58.33	0.00	0.00	**1.06**	12	0.16
Washingtonia robusta	0.00	0.00	0.00	66.67	0.00	33.33	**1.31**	12	0.16
Crataegus phaenopyrum	0.00	0.00	0.00	100.00	0.00	0.00	**1.28**	11	0.15
Cordyline australis	0.00	0.00	36.36	63.64	0.00	0.00	**1.14**	11	0.15
Ulmus parvifolia	0.00	30.00	50.00	20.00	0.00	0.00	**0.87**	10	0.14
Salix species	0.00	10.00	70.00	10.00	10.00	0.00	**0.81**	10	0.14
Prunus X blireana	0.00	10.00	50.00	40.00	0.00	0.00	**1.02**	10	0.14
Pinus species	0.00	22.22	44.44	33.33	0.00	0.00	**0.95**	9	0.12
Podocarpus gracilior	0.00	0.00	0.00	100.00	0.00	0.00	**1.28**	9	0.12

Species	Dead or Dying	Poor	Fair	Good	N/A	Very Good	RPI	# of Trees	% of Pop
Ilex spp.	0.00	0.00	33.33	66.67	0.00	0.00	**1.16**	9	0.12
Malus species	0.00	25.00	37.50	37.50	0.00	0.00	**0.95**	8	0.11
Pinus canariensis	0.00	0.00	0.00	85.71	0.00	14.29	**1.29**	7	0.09
Taxus baccata	0.00	0.00	28.57	71.43	0.00	0.00	**1.17**	7	0.09
Callistemon viminalis	0.00	0.00	14.29	85.71	0.00	0.00	**1.23**	7	0.09
Leptospermum laevigata	0.00	0.00	71.43	28.57	0.00	0.00	**1.01**	7	0.09
Melaleuca quinquenervia	0.00	0.00	14.29	85.71	0.00	0.00	**1.23**	7	0.09
Acacia verticillata	0.00	28.57	42.86	28.57	0.00	0.00	**0.90**	7	0.09
Cedrus atlantica	0.00	0.00	0.00	85.71	0.00	14.29	**1.29**	7	0.09
Eucalyptus nicholii	0.00	0.00	100.00	0.00	0.00	0.00	**0.90**	6	0.08
Umbellularia californica	0.00	0.00	33.33	66.67	0.00	0.00	**1.16**	6	0.08
Cedrus deodara	0.00	0.00	50.00	50.00	0.00	0.00	**1.09**	6	0.08
Cinnamomum camphora	0.00	0.00	0.00	100.00	0.00	0.00	**1.28**	6	0.08
Melaleuca linariifolia	0.00	0.00	100.00	0.00	0.00	0.00	**0.90**	5	0.07
Acer palmatum	0.00	40.00	60.00	0.00	0.00	0.00	**0.75**	5	0.07
Prunus ilicifolia lyonii	0.00	0.00	40.00	60.00	0.00	0.00	**1.13**	5	0.07
Acacia spp.	0.00	0.00	40.00	40.00	20.00	0.00	**0.87**	5	0.07
Araucaria heterophylla	0.00	0.00	40.00	60.00	0.00	0.00	**1.13**	5	0.07
Prunus serrulata	0.00	0.00	20.00	80.00	0.00	0.00	**1.21**	5	0.07
Lyonothamnus floribundus asplen	0.00	20.00	40.00	40.00	0.00	0.00	**0.98**	5	0.07
Tristaniopsis laurina	0.00	0.00	0.00	100.00	0.00	0.00	**1.28**	4	0.05
Schinus molle	0.00	50.00	25.00	25.00	0.00	0.00	**0.81**	4	0.05
Ulmus spp.	0.00	0.00	25.00	50.00	25.00	0.00	**0.87**	4	0.05
Leptospermum scoparium	0.00	0.00	0.00	100.00	0.00	0.00	**1.28**	4	0.05
Laurus nobilis	0.00	25.00	0.00	75.00	0.00	0.00	**1.09**	4	0.05
Pyrus kawakamii	0.00	0.00	50.00	50.00	0.00	0.00	**1.09**	4	0.05
Trachycarpus fortunei	0.00	0.00	25.00	75.00	0.00	0.00	**1.19**	4	0.05
Alnus rhombifolia	0.00	0.00	100.00	0.00	0.00	0.00	**0.90**	4	0.05
Eucalyptus species	25.00	0.00	75.00	0.00	0.00	0.00	**0.72**	4	0.05
Ceanothus spp.	0.00	0.00	100.00	0.00	0.00	0.00	**0.90**	4	0.05
Betula nigra	0.00	0.00	100.00	0.00	0.00	0.00	**0.90**	4	0.05
Washingtonia filifera	0.00	0.00	0.00	100.00	0.00	0.00	**1.28**	3	0.04
Acer rubrum	0.00	0.00	0.00	100.00	0.00	0.00	**1.28**	3	0.04
Nyssa sylvatica	0.00	0.00	33.33	66.67	0.00	0.00	**1.16**	3	0.04
Cupressus spp.	0.00	0.00	33.33	66.67	0.00	0.00	**1.16**	3	0.04
Eucalyptus polyanthemos	0.00	0.00	100.00	0.00	0.00	0.00	**0.90**	3	0.04
Pinus thunbergiana	0.00	0.00	66.67	33.33	0.00	0.00	**1.03**	3	0.04
Schinus terebinthifolius	0.00	0.00	66.67	33.33	0.00	0.00	**1.03**	3	0.04
Arecastrum romanzoffianum	0.00	0.00	33.33	66.67	0.00	0.00	**1.16**	3	0.04
Pseudotsuga menziesii	0.00	33.33	33.33	33.33	0.00	0.00	**0.90**	3	0.04
Eucalyptus conferruminata	0.00	0.00	66.67	33.33	0.00	0.00	**1.03**	3	0.04

Species	Dead or Dying	Poor	Fair	Good	N/A	Very Good	RPI	# of Trees	% of Pop
Ginkgo biloba	0.00	0.00	33.33	66.67	0.00	0.00	**1.16**	3	0.04
Ligustrum lucidum	0.00	0.00	0.00	100.00	0.00	0.00	**1.28**	2	0.03
Pterocarya stenoptera	0.00	50.00	50.00	0.00	0.00	0.00	**0.72**	2	0.03
Grevillea robusta	0.00	0.00	100.00	0.00	0.00	0.00	**0.90**	2	0.03
Morus alba	0.00	0.00	100.00	0.00	0.00	0.00	**0.90**	2	0.03
Juglans nigra	0.00	0.00	100.00	0.00	0.00	0.00	**0.90**	2	0.03
Fraxinus uhdei	0.00	50.00	50.00	0.00	0.00	0.00	**0.72**	2	0.03
Cercis canadensis	0.00	0.00	50.00	50.00	0.00	0.00	**1.09**	2	0.03
Sequoiadendron giganteum	0.00	0.00	100.00	0.00	0.00	0.00	**0.90**	2	0.03
Pyrus communis	0.00	0.00	0.00	100.00	0.00	0.00	**1.28**	2	0.03
Acacia baileyana	0.00	0.00	50.00	50.00	0.00	0.00	**1.09**	2	0.03
Citrus limon	0.00	0.00	0.00	100.00	0.00	0.00	**1.28**	2	0.03
Eucalyptus citriodora	0.00	0.00	100.00	0.00	0.00	0.00	**0.90**	2	0.03
Calocedrus decurrens	0.00	0.00	50.00	50.00	0.00	0.00	**1.09**	2	0.03
Myrtus communis	0.00	0.00	50.00	50.00	0.00	0.00	**1.09**	2	0.03
Robinia pseudoacacia	0.00	0.00	100.00	0.00	0.00	0.00	**0.90**	2	0.03
Dodonaea viscosa	0.00	0.00	100.00	0.00	0.00	0.00	**0.90**	2	0.03
Pyracantha species	0.00	0.00	50.00	50.00	0.00	0.00	**1.09**	2	0.03
Myrica californica	0.00	0.00	50.00	50.00	0.00	0.00	**1.09**	2	0.03
Aesculus californica	0.00	0.00	50.00	50.00	0.00	0.00	**1.09**	2	0.03
Abies pinsapo	0.00	0.00	100.00	0.00	0.00	0.00	**0.90**	1	0.01
Citrus sinensis	0.00	0.00	0.00	100.00	0.00	0.00	**1.28**	1	0.01
Ficus carica	0.00	0.00	0.00	100.00	0.00	0.00	**1.28**	1	0.01
Liriodendron tulipifera	0.00	0.00	100.00	0.00	0.00	0.00	**0.90**	1	0.01
Prunus species	0.00	0.00	100.00	0.00	0.00	0.00	**0.90**	1	0.01
Cupressocyparis x leylandii	0.00	0.00	100.00	0.00	0.00	0.00	**0.90**	1	0.01
Quercus species	0.00	0.00	100.00	0.00	0.00	0.00	**0.90**	1	0.01
Rhus lancea	0.00	0.00	0.00	100.00	0.00	0.00	**1.28**	1	0.01
Prunus domestica	0.00	0.00	100.00	0.00	0.00	0.00	**0.90**	1	0.01
Prunus subhirtella	0.00	0.00	0.00	100.00	0.00	0.00	**1.28**	1	0.01
Salix matsudana	0.00	0.00	0.00	100.00	0.00	0.00	**1.28**	1	0.01
Agonis flexuosa	0.00	0.00	100.00	0.00	0.00	0.00	**0.90**	1	0.01
Ligustrum japonicum	0.00	0.00	100.00	0.00	0.00	0.00	**0.90**	1	0.01
Pinus sylvestris	0.00	0.00	0.00	100.00	0.00	0.00	**1.28**	1	0.01
Cunninghamia lanceolata	0.00	0.00	0.00	100.00	0.00	0.00	**1.28**	1	0.01
Persea americana	0.00	0.00	100.00	0.00	0.00	0.00	**0.90**	1	0.01
Aesculus species	0.00	0.00	0.00	100.00	0.00	0.00	**1.28**	1	0.01
Cotinus coggygria	0.00	0.00	0.00	100.00	0.00	0.00	**1.28**	1	0.01
Eriobotrya japonica	0.00	0.00	0.00	100.00	0.00	0.00	**1.28**	1	0.01
Casuarina cunninghamiana	0.00	0.00	100.00	0.00	0.00	0.00	**0.90**	1	0.01
Prunus dulcis	0.00	0.00	0.00	100.00	0.00	0.00	**1.28**	1	0.01

Species	Dead or Dying	Poor	Fair	Good	N/A	Very Good	RPI	# of Trees	% of Pop
Yucca elephantipes	0.00	0.00	0.00	100.00	0.00	0.00	**1.28**	1	0.01
Geijera parviflora	0.00	0.00	0.00	100.00	0.00	0.00	**1.28**	1	0.01
Eucalyptus cinerea	0.00	0.00	100.00	0.00	0.00	0.00	**0.90**	1	0.01
Eucalyptus viminalis	0.00	100.00	0.00	0.00	0.00	0.00	**0.53**	1	0.01
Xylosma congestum	0.00	0.00	0.00	100.00	0.00	0.00	**1.28**	1	0.01
Garrya elliptica	0.00	0.00	0.00	100.00	0.00	0.00	**1.28**	1	0.01
Ribes sanguineum	0.00	0.00	0.00	100.00	0.00	0.00	**1.28**	1	0.01
Salix babylonica	100.00	0.00	0.00	0.00	0.00	0.00	**0.15**	1	0.01
Prunus ilicifolia	0.00	0.00	100.00	0.00	0.00	0.00	**0.90**	1	0.01
Albizia julibrissin	0.00	100.00	0.00	0.00	0.00	0.00	**0.53**	1	0.01
Ulmus pumila	0.00	0.00	100.00	0.00	0.00	0.00	**0.90**	1	0.01
Platanus racemosa	0.00	0.00	0.00	100.00	0.00	0.00	**1.28**	1	0.01
Fremontodendron californicum	0.00	0.00	0.00	100.00	0.00	0.00	**1.28**	1	0.01
All Trees	**4.11**	**8.47**	**43.63**	**41.71**	**0.64**	**1.45**	**1.00**	**7,394**	**100%**

City of Pacific Grove

Urban Tree Canopy Assessment

2015

DAVEY RESOURCE GROUP

A Division of The Davey Tree Expert Company

City of Pacific Grove

Urban Tree Canopy Assessment

2015

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Executive Summary

Pacific Grove is a coastal community with a unique public tree population including a substantial portion of native species. The City of Pacific Grove is committed to proactive management of their community tree resource (City of Pacific Grove Forestry, 2015). In an effort to comprehensively evaluate the urban forest, Pacific Grove contracted with Davey Resource Group (DRG) in 2015 to conduct a Public Tree Inventory, a Resource Analysis, and an Urban Tree Canopy Assessment. While the inventory and analysis evaluated data collected by field crews about individual public trees, the Urban Tree Canopy Assessment (UTC) provides uses remote image sensing and GIS analysis to develop a birds-eye view of the entire urban forest, including public and private trees. This helps managers understand several factors about the community tree canopy, including:

- Quantity and distribution of existing tree canopy
- Potential impacts of tree planting and removal
- Quantified annual benefits trees provide to the community
- Benchmark canopy percent values over the past 15 years

Canopy distribution was evaluated at several levels, including overall, neighborhoods, and by zoning. Land cover changes from 2005 to 2014 were analyzed and projections for 2024 are based on this history. Functional values, including canopy health and stormwater impact, were mapped and priority planting locations were identified for reducing erosion and soil degradation during storm events.

Land Cover

The City of Pacific Grove encompasses a total area of 1,837 acres. Excluding impervious surfaces (784 acres) and open water (5 acres), Pacific Grove includes 0.82 square miles (523 acres) with the potential to support tree canopy. The following information characterizes land cover within the City of Pacific Grove:

- 28.6% existing canopy, including trees and woody shrubs (525 acres) (Figure 1)
- 57% canopy potential, considering suitable planting sites on areas of existing pervious surface (523 acres) and the existing canopy (525 acres), for a total of 1,048 acres
- 43% impervious surfaces, including roads, parking lots, and structures (784 acres)
- 73% of canopy (377 acres) is in good to excellent condition
- The Government zoning class has the highest canopy percent (50%), followed by Planned Unit Development (42%), and Residential (33%)
- By neighborhood, Country Club Gate/Forest Grove has the highest canopy cover (51%) followed by Pacific Grove Acres (48%) and Del Monte Park (41%)
- 312 acres of potential planting areas, including 9,901 sites
- From 2005 to 2014 tree canopy increased from 25.8% to 28.6%
- By 2024, land cover projections estimate that tree canopy will increase by 41 acres to 31%.

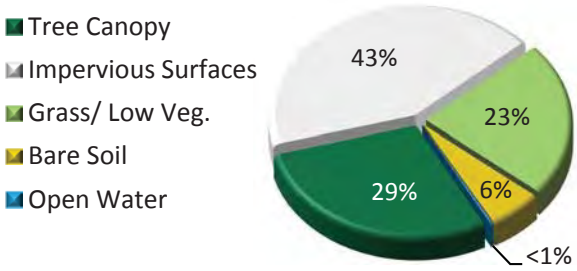


Figure 1. Land Cover in Pacific Grove

Environmental Benefits

Pacific Grove's land cover data was used with i-Tree Canopy (v6.1) (Appendix B) to estimate the environmental benefits from the entire urban forest (public and private). Trees in Pacific Grove are providing air quality and stormwater benefits worth nearly $1.8 million annually (Figure 2) by:

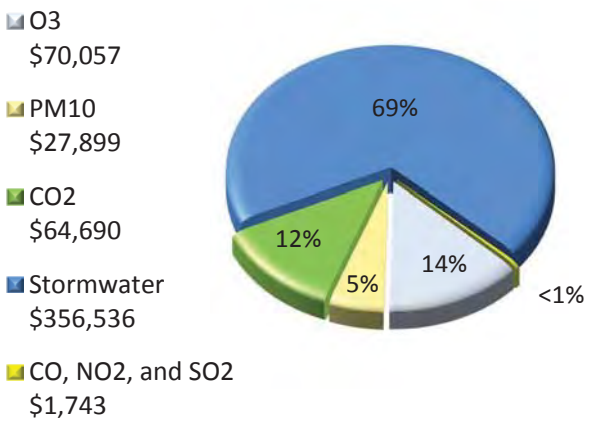


Figure 2. Environmental Benefits in Pacific Grove

- Removing 19.4 tons of air pollutants, including carbon monoxide (CO), nitrogen dioxide (NO_2), ozone (O_3), sulfur dioxide (SO_2), and particulate matter (PM_{10})
- Reducing stormwater runoff by more than 35.6 million gallons, valued at $356,536
- Pacific Grove's urban forest is currently storing 66,044 tons of carbon (CO_2) in its biomass, valued at nearly $1.3 million
- Annually, this resource removes (sequesters) an additional 3,341 tons of CO_2, valued at $64,690

Management Applications

Understanding the location and extent of tree canopy is key to developing and implementing sound management strategies that promote the sustainability of Pacific Grove's urban forest resource and the benefits it provides. The data, combined with existing and emerging urban forestry research, enables managers to strike a balance between urban growth and tree preservation and aid in identifying and assessing urban forestry opportunities. Spatial understanding of the past, present, and potential for tree canopy is a valuable tool to help managers align urban forestry management with the community's vision for the urban forest in Pacific Grove.

Pacific Grove has set a canopy goal of 33% canopy by 2037. Considering that tree canopy is projected to increase to 31% by 2024, the City is on track to achieve this goal. Recommendations for maintaining canopy growth include:

- Remove and replace failing trees identified in the public tree inventory collected in 2015.
- Use stormwater priority planting site analysis to identify new tree planting locations to reduce erosion and soil degradation (Figure 3).
- Use GIS canopy and land cover mapping to explore under-treed neighborhoods and zoning locations to identify potential planting sites.
- Incentivize tree planting on private property.

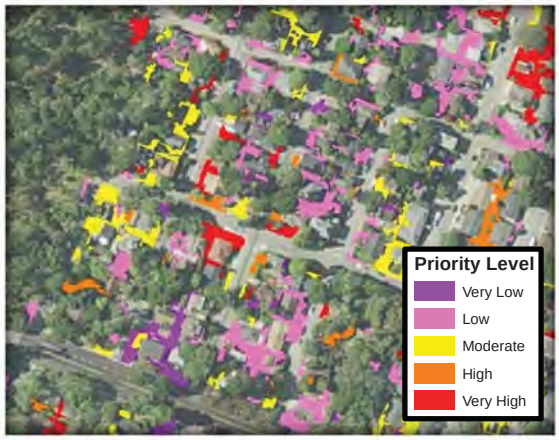


Figure 3. Stormwater Planting Priority

Introduction

The Urban Tree Canopy (UTC) Assessment used high-resolution, infrared aerial imagery and remote sensing software (See Appendix C for Methodology). The assessment resulted in a GIS map layer detailing the location and extent of existing tree canopy (public and private) along with other primary land cover classifications, including impervious and pervious surfaces, bare soils, and water.

Urban Tree Canopy and Geographic Information Systems (GIS)

Urban tree canopy is the layer of leaves, branches, and stems of trees that cover the ground when viewed from above. The UTC assessment does not distinguish between publicly-owned and privately-owned trees. Since trees provide benefits to the community that extend beyond property lines, the assessment includes all tree canopy within the borders of the community. To place tree canopy in context and better understand its relationship within the community, the assessment included other primary landcover classifications, including impervious surfaces, pervious surfaces, bare soils, and water.

As more communities focus attention on environmental sustainability, community forest management has become increasingly dependent on geographic information systems (GIS) for urban tree canopy mapping and analysis. Understanding the extent and location of existing canopy is key to identifying various types of community forest management opportunities, including:

- Future planting plans
- Stormwater management
- Water resource and quality management
- Impact and management of invasive species based on tree condition
- Preservation of benefit stream and sustainability
- Outreach and education

High-resolution aerial imagery and infrared technology was used to remotely map tree canopy and land cover (Figure 4). The results of the study provide a clear picture of the extent and distribution of tree canopy within Pacific Grove. The data developed during the assessment becomes an important part of the City's GIS database and provides a foundation for developing community goals and urban forest policies. The primary purpose of the assessment was to establish benchmark values at 5-year increments for the past 15 years. These values will enable managers to understand recent changes in the urban forest and measure the success of long-term management objectives over time.

With this data, managers can determine:

- Pacific Grove’s progress towards local and regional canopy goals
- Changes in tree canopy over time and in relation to growth and development
- The location and extent of canopy at virtually any level, including neighborhood, land use, zoning, parking lots and parcels
- The location of available planting space and develop strategies to increase canopy in underserved areas

In addition to quantifying existing UTC, the assessment illustrates the potential for increasing tree canopy across Pacific Grove. The data, combined with existing and emerging urban forestry research and applications, can provide additional guidance for determining a balance between growth and preservation and aid in identifying and assessing urban forestry opportunities.

Figure 4. High-resolution aerial imagery (left) is used to remotely identify existing land cover. Infrared technology delineates living vegetation including tree canopy (middle). Remote sensing software identifies and maps tree canopy and other land cover (right).

Benefits of Urban Tree Canopy

Urban forests continuously mitigate the effects of urbanization and development and protect and enhance lives within the community in the following ways:

Air Quality

Urban trees improve air quality in five fundamental ways:

- Reducing particulate matter (dust)
- Absorbing gaseous pollutants
- Shade and transpiration
- Reducing power plant emissions
- Increasing oxygen levels

Urban trees protect and improve air quality by intercepting particulate matter (PM_{10}), including dust, ash, pollen, and smoke. The particulates are filtered and held in the tree canopy where they are eventually washed harmlessly to the ground. Trees and forests absorb harmful gaseous pollutants like ozone (O_3), nitrogen dioxide (NO_2), and sulfur dioxide (SO_2). Shade and transpiration reduces the formation of O_3, which is created during higher temperatures. In fact, scientists are now finding that some trees may absorb more volatile organic compounds (VOC's) than previously thought (Karl, T. et al; Science NOW, 2010). VOC's are a class of carbon-based particles emitted from automobile exhaust, lawnmowers, and other human activities. By reducing energy needs, trees also reduce emissions from the generation of power. And, through photosynthesis, trees and forests increase oxygen levels.

Annually, in Pacific Grove, trees remove 19.4 tons of air pollutants for a total value of $99,557, including carbon monoxide (CO 860 lbs, $571), nitrogen dioxide ($NO_2$, 2,540 lbs, $1,030), ozone ($O_3$, 25,740, $70,057), sulfur dioxide (SO_2), and particulate matter (PM_{10}, 8,940 lbs, $27,899).

Carbon Reduction

Trees and forests reduce atmospheric carbon dioxide (CO_2) in two ways:

- Directly, through growth and carbon sequestration
- Indirectly, by lowering the demand for energy

Trees and forests directly reduce CO_2 in the atmosphere through growth and sequestration of CO_2 as woody and foliar biomass. Indirectly, trees and forests reduce CO_2 by lowering the demand for energy and reducing the CO_2 emissions from the consumption of natural gas and the generation of electric power.

As environmental awareness continues to increase, governments and individuals are paying particular attention to climate change and the effects of greenhouse gas emissions. Two national policy options are currently making headlines; the establishment of a carbon tax and a greenhouse gas cap-and-trade system, aimed at reducing atmospheric CO_2 and other greenhouse gases. A carbon tax places a tax burden on each unit of greenhouse gas emissions and would require regulated entities to pay for their level of emissions. Alternatively, in a cap-and-trade system, an upper limit (or cap) is placed on global (federal, regional, or other jurisdiction) levels of greenhouse gas emissions and the regulated entities are required to either reduce emissions to required limits or purchase emissions allowances in order to meet the cap (Williams et al, 2007).

In 2006, California adopted the Global Warming Solutions Act (AB32) which commits California to reduce its greenhouse gas emissions to 1990 levels by 2020. Beginning in 2013, a statewide cap on greenhouse gases places a mandatory limit on large businesses that emit more than 25,000 metric tons of CO_2. The limit is set to decline 2-3% each year and to expand the scope of businesses and industries that are regulated. Companies that are regulated must obtain an allowance (or permit) for each ton of carbon they emit. These allowances have value and can be traded on the open market.

The concept of purchasing emission allowances (offsets) has led to the acceptance of carbon credits as a commodity that can be exchanged for financial gain. As a result, some communities are exploring the concept of planting trees to develop a carbon offset (or credit). The Center for Urban Forest Research Pacific Southwest Research Station and USDA Forest Service recently led the development of Urban Forest Greenhouse Gas Reporting Protocol (McPherson et al, 2008/2010). The protocol incorporates methods of the Kyoto Protocol and Voluntary Carbon Standard and establishes methods for calculating reductions, provides guidance for accounting and reporting, and guides urban forest managers in developing tree planting and stewardship projects that could be registered for greenhouse gas reduction credits. The protocol can be applied to urban tree planting projects within municipalities, educational campuses, and utility service areas anywhere in the U.S. or its territories.

Pacific Grove's urban forest is currently storing 66,044 tons of carbon (CO_2) in its biomass, valued at nearly $1.3 million. Furthermore, annually, Pacific Grove's trees sequester 3,341 lbs of carbon valued at $64,690.

Stormwater

Trees and forests improve and protect the quality of surface waters, such as creeks, rivers, and lakes, by reducing the impacts of stormwater runoff through:

- Interception
- Increasing soil capacity and rate of infiltration
- Reducing soil erosion

Trees intercept rainfall in their canopy, which act as a mini-reservoir (Xiao et al, 1998). During storm events, this interception reduces and slows runoff. In addition to catching stormwater, canopy interception lessens the impact of raindrops on bare soil. Root growth and decomposition increase the capacity and rate of soil infiltration by rainfall and snowmelt (McPherson et al, 2002). Each of these processes greatly reduce the flow and volume of stormwater runoff, avoiding erosion and preventing sediments and other pollutants from entering local waterways and the ocean.

Annually, Pacific Grove's urban forest reduces stormwater runoff by more than 35.6 million gallons, valued at $356,536. This constitutes 69% of the environmental benefits. The role of trees in stormwater management is discussed in further detail in the Canopy & Stormwater Management Section (Pg. 19).

Energy Savings

Urban trees and forests modify climate and conserve energy in three principal ways:

- Shading dwellings and hardscape
- Transpiration
- Wind reduction

Shade from trees reduces the amount of radiant energy absorbed and stored by hardscapes and other impervious surfaces, thereby reducing the heat island effect, a term that describes the increase in urban temperatures in relation to surrounding locations. Transpiration releases water vapor from tree canopies, which cools the surrounding area. Through shade and transpiration, trees and other vegetation within an urban setting modify the environment and reduce heat island effects. Temperature differences of more than 9°F (5°C) have been observed between city centers without adequate canopy cover and more vegetated suburban areas (Akbari et al, 1997).

Trees reduce wind speeds relative to their canopy size and height by up to 50% and influence the movement of warm air and pollutants along streets and out of urban canyons. By reducing air movement into buildings and against conductive surfaces (e.g., glass and metal siding), trees reduce conductive heat loss from buildings, translating into potential annual heating savings of 25% (Heisler, 1986). Reducing energy needs has the added bonus of reducing carbon dioxide (CO_2) emissions from fossil fuel power plants.

Aesthetics and Socioeconomics

While perhaps the most difficult to quantify, the aesthetic and socioeconomic benefits from trees may be among their greatest contributions, including:

- Beautification, comfort, and aesthetics
- Shade and privacy
- Wildlife habitat
- Opportunities for recreation and passive recreation
- Creation of a sense of place and history
- Human health

Many of these benefits are captured as a percentage of property values, through higher sales prices where individual trees and forests are located.

Calculating Tree Benefits

Pacific Grove has conducted a Resource Analysis (2015) to calculate tree benefits for the subset of the urban tree canopy including just the public trees, based on the 2014 complete inventory. This analysis was completed using the USDA Forest Service i-Tree software tools. This state-of-the-art, peer-reviewed software suite considers regional environmental data and costs to quantify the ecosystem services unique to a given urban forest resource. Individuals can calculate the benefits of trees to their property by using the National Tree Benefit Calculator or with **i-Tree Design.** (www.itreetools.org/design)

i-Tree Design

Calculate My Tree Benefits

Land Cover in Pacific Grove

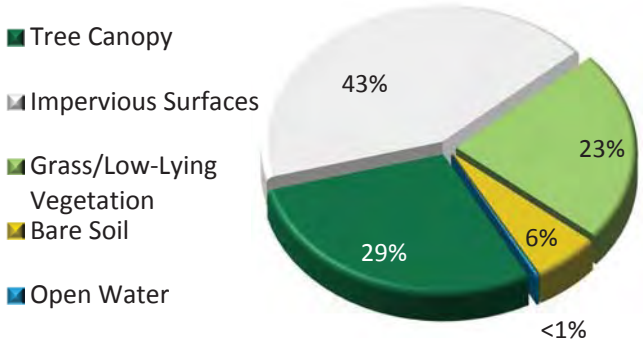
Existing Overall Land Cover

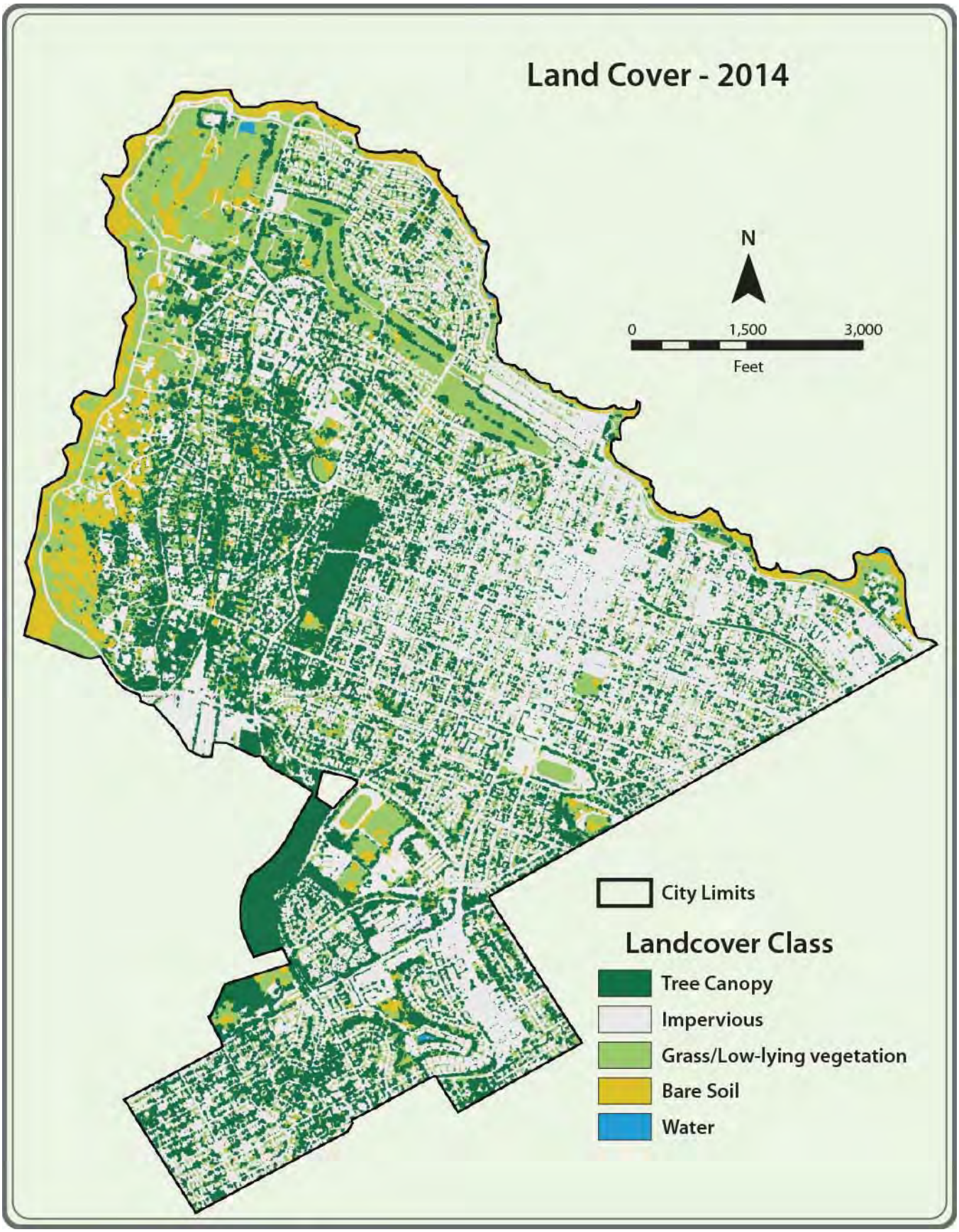
The City of Pacific Grove encompasses a total area of 2.9 square miles. Land cover classification within the city limits includes almost 29% tree canopy, 23% grass and low vegetation, and 43% impervious surfaces, including roads and buildings (Table 1, Figure 5, and Map 1). Bare soil, grass, and low vegetation are considered plantable areas, which cover 523 acres, 28% of the community. Considering the existing tree canopy and possible tree canopy over impervious areas, the canopy potential of Pacific Grove is 57%, although the actual potential may be higher where tree canopy can shade impervious surfaces such as roads, parking lots, and buildings.

Table 1. Land Cover Classes

Land Cover Class	Acres	%
Tree Canopy	525.46	28.60
Buildings	326.56	17.78
Roads	244.03	13.28
Other Impervious	213.56	11.63
Grass/Low-Veg.	413.33	22.50
Bare Soil	109.44	5.96
Open Water	5.02	0.27
Total	**1,837.40**	**100%**

Figure 5. Land Cover Classes





Map 1. Land Cover Classes in Pacific Grove

Tree Canopy Health

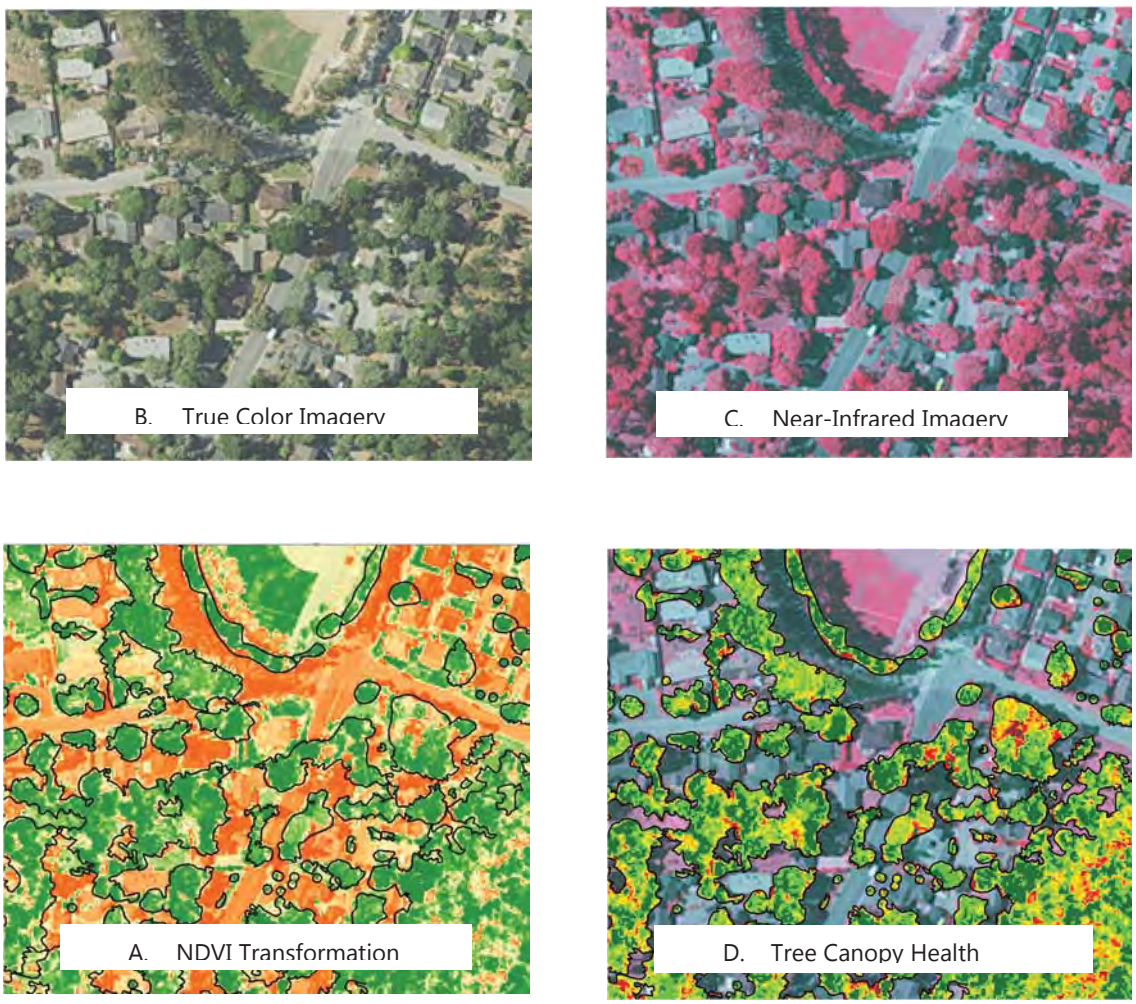
Canopy health was determined using near –infrared imagery and NDVI transformation (Figure 6 and Appendix C). In Pacific Grove, 73% of the canopy (377 acres) is in good to excellent condition. Healthy trees are vigorous, often producing more leaf surface area each year. The amount and distribution of leaf surface area is the driving force behind the urban forest's ability to produce benefits for the community (Clark et al, 1997). As canopy cover increases, so do the benefits contributed by leaf area. These benefits, which include energy savings, air quality, water quality, stormwater interception, aesthetic and other socio-economic benefits are quantified for their value to the community in the following section.

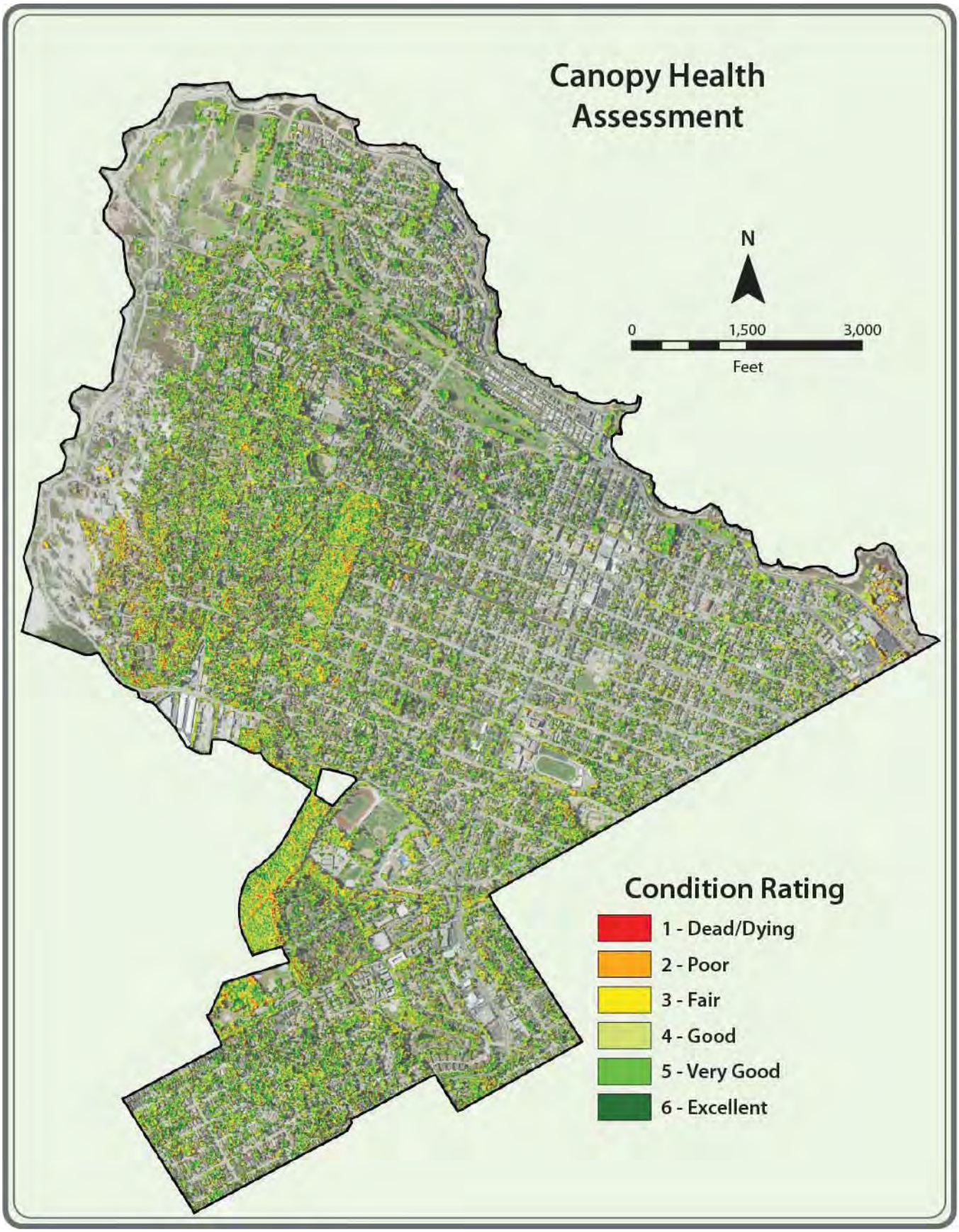
Table 2. Tree Condition

Health Condition	Acres	Percent
1 - Dead/Dying	28.00	5.44%
2 - Poor	44.59	8.67%
3 - Fair	65.36	12.70%
4 - Good	97.48	18.95%
5 - Very Good	140.38	27.28%
6 - Excellent	138.73	26.96%

The population of 7,394 inventoried public trees is a subset of the overall urban tree canopy. The Pacific Grove Resource Analysis (2015) found 43% of public trees in good to excellent condition. However, the inventory used a ground-based inspection procedure, which differs from the methodology used in the aerial canopy condition assessment.

Figure 6. Tree Canopy Health Workflow





Map 2. Tree Condition in Pacific Grove

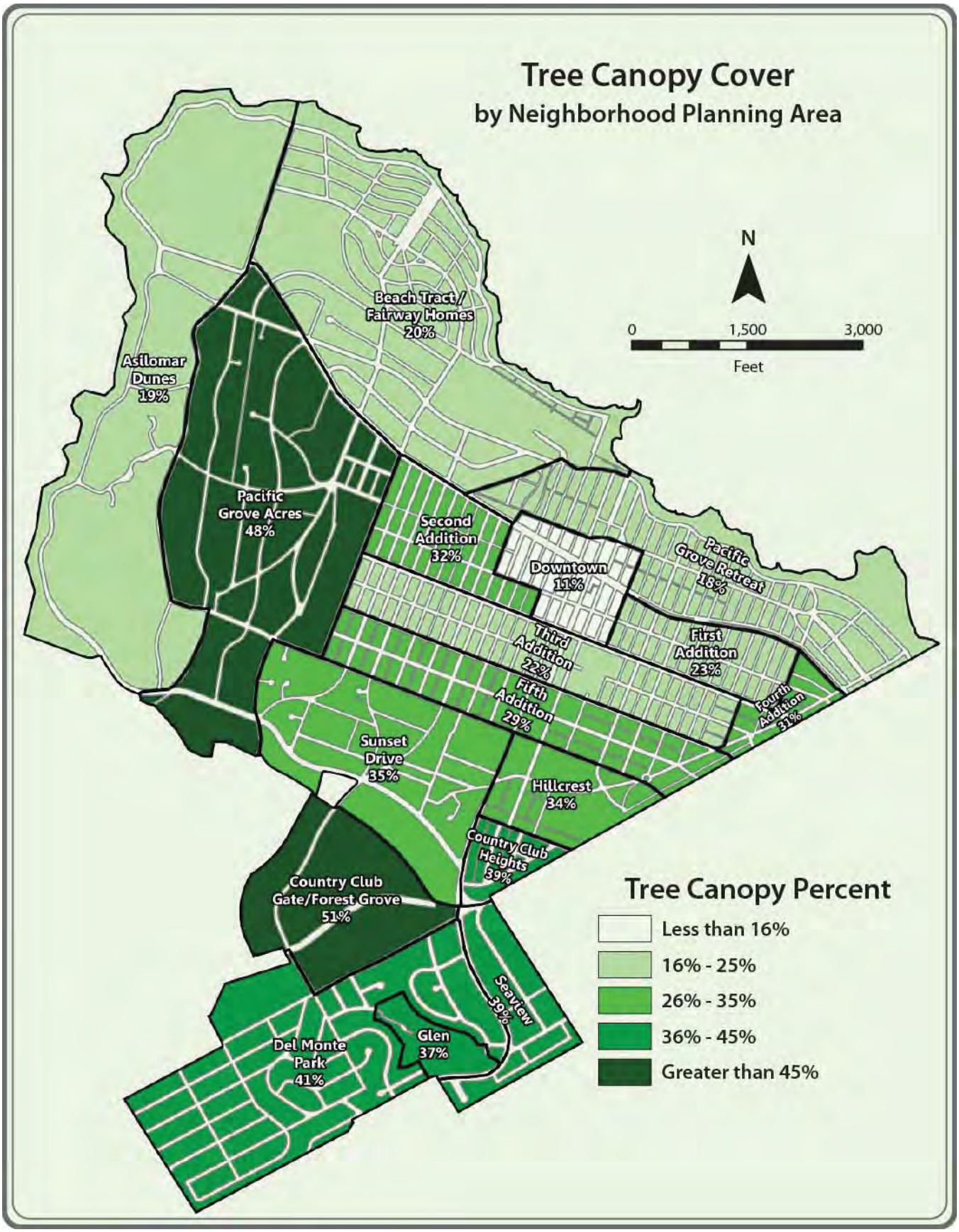
Tree Canopy by Neighborhood

In Pacific Grove, neighborhood boundaries encompass 1,438 acres of the city's 1,837 total acres. The remaining acres fall within the City's right-of-way. Neighborhood boundaries are often used to understand tree canopy, as they tend to reflect geographies that are well understood by community members and elected officials. Exploring canopy distribution and socio-economic indicators at this level can help facilitate outreach and education activities as well as develop a deeper understanding of tree canopy at a meaningful scale.

Pacific Grove is divided into 17 neighborhoods (Map 3). Overall, each neighborhood has a percent canopy cover greater than 18%, with the exception of downtown (11%), which generally has higher impervious surfaces. Country Club Gate/Forest Grove (42 acres) has the highest canopy cover of 51% followed by Pacific Grove Acres (48%) and Del Monte Park (41%). By area, Pacific Grove Acres has the greatest area of canopy (106 acres).

Table 3. Tree Canopy and Impervious Surface by Neighborhood Association

Neighborhood	Acres	Canopy Acres	% Canopy	Impervious Acres	% Impervious
Asilomar Dunes	254.05	47.51	18.70	31.46	12.38
Beach Tract / Fairway Homes	208.19	42.57	20.45	68.27	32.79
Country Club Gate/Forest Grove	83.64	42.86	51.24	28.44	34.00
Country Club Heights	13.56	5.27	38.91	5.16	38.10
Del Monte Park	148.28	60.08	40.52	60.70	40.94
Downtown	26.88	3.08	11.47	21.89	81.42
Fifth Addition	57.11	16.30	28.55	28.31	49.57
First Addition	27.22	6.23	22.90	15.32	56.30
Fourth Addition	12.27	3.77	30.77	5.34	43.57
Glen	18.19	6.68	36.72	7.03	38.64
Hillcrest	36.88	12.46	33.80	13.53	36.70
Pacific Grove Acres	219.99	105.57	47.99	67.43	30.65
Pacific Grove Retreat	105.06	19.14	18.22	52.12	49.61
Seaview	34.05	13.14	38.58	13.78	40.48
Second Addition	31.80	10.07	31.66	15.95	50.16
Sunset Drive	106.29	36.94	34.75	41.04	38.61
Third Addition	55.42	12.14	21.90	30.85	55.65
All Neighborhoods	**1,438.87**	**443.83**	**31.01%**	**506.62**	**42.92%**



Map 3. Tree Canopy by Neighborhood in Pacific Grove

Tree Canopy by Zone

In Pacific Grove, zoning class boundaries encompass 1,444 acres of the city's 1,837 total acres. Zoning class is a reflection of development patterns and the community's plan for growth in specific areas. In general, open spaces and residential areas typically have less impervious surface and are able to support a greater percentage of tree canopy. Commercial and Industrial areas tend to have a higher proportion of impervious surface and lower canopy cover.

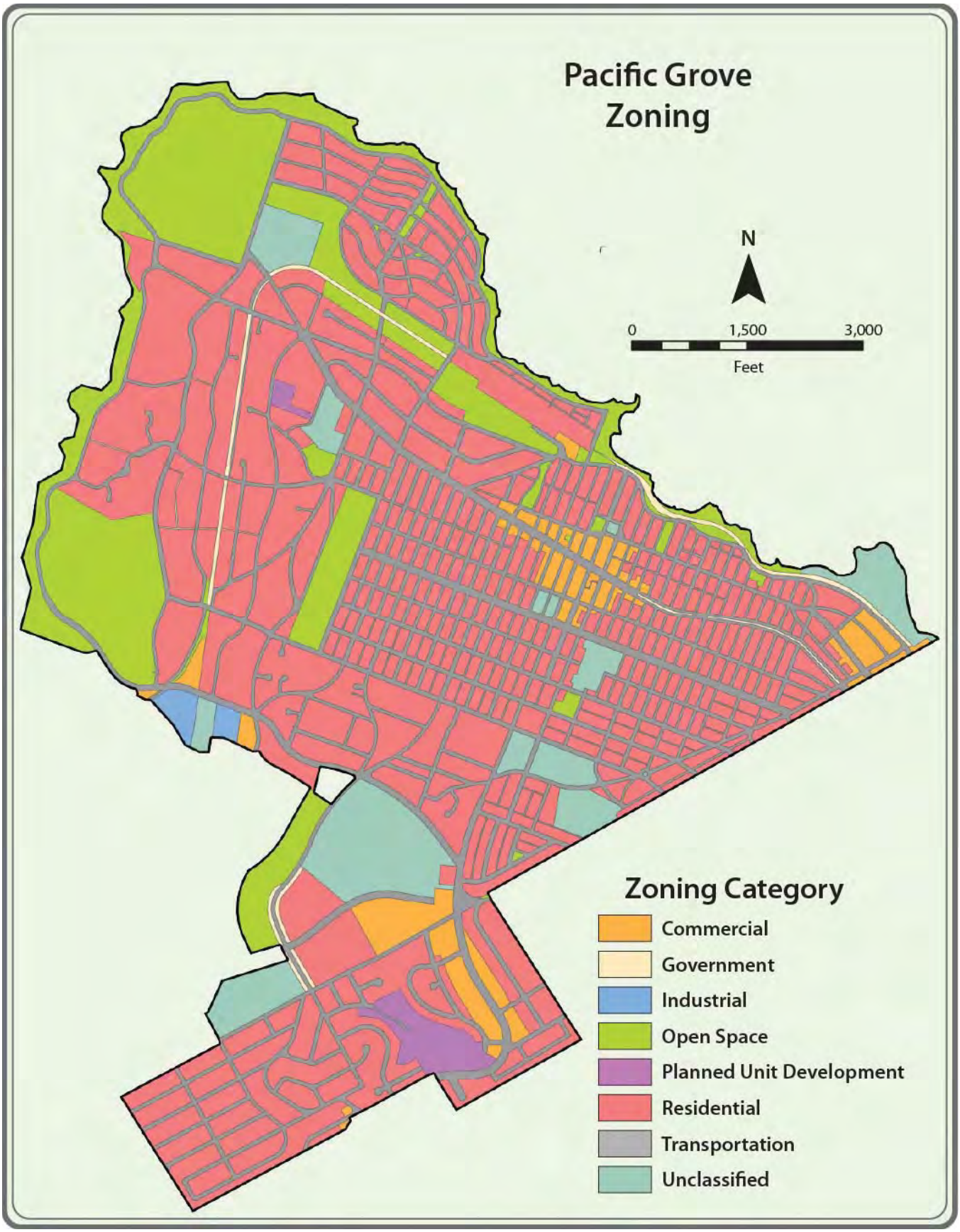
Government zoned parcels have the highest canopy cover (50%); this zoning class encompasses all parks that are maintained by the Parks and Recreation Department. Government zoned parcels have the potential to increase canopy cover by 22 percentage points (4.4 acres) to nearly 72%. Planned Unit Development (PUD) has the second highest canopy cover (42%). These parcels generally contain multi-use areas, where parks and other green spaces are commonly found. This class, along with Residential zoning, each have the potential to increase their canopy cover to nearly 60%. Residential zoned parcels have 220 acres of plantable area and PUD has nearly 4 acres of plantable area. Industrial zoned parcels have the lowest canopy cover at 9%. This is typical, as a result of site uses and generally high impervious surfaces (89%) (Table 5).

On average, Pacific Grove's zoning classes have close to 30% canopy cover with the potential to increase that cover to nearly 43%.

Table 4. Acreage and Percent Canopy Cover and Preferred Plantable Space by Zoning Class

Zoning Class	% Canopy	% Impervious	% Pervious	% Preferred Plantable	Maximum UTC
Commercial	18.22	76.58	4.71	4.91	23.13
Government	49.87	17.39	23.18	22.10	71.97
Industrial	8.65	88.83	2.17	2.45	11.10
Open Space	26.30	8.48	40.16	10.32	36.62
Planned Unit Development	41.86	35.23	16.22	17.94	59.80
Residential	33.41	41.12	23.16	24.40	57.81
Unclassified	27.78	32.20	30.19	12.07	39.85
Total	**29.44%**	**42.84%**	**19.97%**	**13.46%**	**42.90%**

Zoning Class	Acres	Canopy Acres	Impervious Acres	Pervious Acres	Preferred Plantable Acres	Maximum UTC
Commercial	67.09	12.22	51.55	3.19	3.29	22.40
Government	19.69	9.82	3.43	4.56	4.35	73.97
Industrial	9.00	0.78	7.99	0.20	0.22	11.10
Open Space	298.04	78.40	25.27	119.68	30.75	46.79
Planned Unit Development	21.28	8.91	7.50	3.45	3.82	59.80
Residential	899.99	300.68	370.09	208.46	219.60	59.80
Unclassified	128.62	35.73	41.42	38.82	15.53	46.06
Total	**1,443.69**	**446.54**	**507.07**	**378.34**	**277.56**	**42.90**



Map 4. Pacific Grove Zoning

Canopy & Stormwater Management

Federal Clean Water Act regulations, require municipalities to obtain a permit for managing their stormwater discharges into water bodies. Each city's program must identify the best management practices it will implement to reduce its pollutant discharge. Nationwide, non-point source pollution is one of the biggest contributors to poor water quality. Non-point source pollution occurs when stormwater carries surface contaminants into surface or ground water. Preventing non-point source pollution and reducing stormwater runoff is becoming a serious environmental concern for many communities.

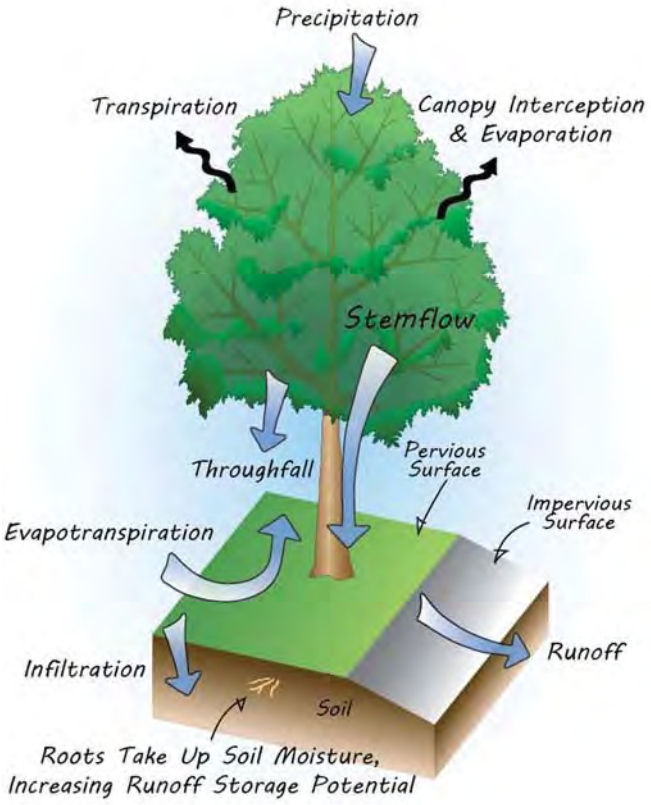


Figure 7. Role of trees in reducing stormwater runoff

Trees and forests are a natural, cost-efficient, and highly effective part of a stormwater management program (Figure 7). Many communities are turning to trees to help solve their stormwater issues in a more holistic manner. Engineered and natural stormwater systems that incorporate and take advantage of the natural benefits provided by trees and forests are proving to be more cost-effective and sustainable than traditional detention and treatment methods. While there are many methods and construction designs available for integrating urban trees into stormwater management infrastructure, including pervious pavement systems, suspended sidewalks, structural soils, bioswales, and stormwater tree pits, some of these designs can be costly to implement. Preserving natural or engineered forest stands and existing trees before, during, and after development reduces runoff from urban and suburban properties and effectively solves many stormwater issues before they become costly and/or detrimental to the surrounding environment.

Trees intercept rainfall in their canopy, which act as a mini-reservoir (Xiao et al, 1998). During storm events, this interception reduces and slows runoff. Furthermore, root growth and decomposition increase the capacity and rate of soil infiltration by rainfall (McPherson et al, 2002) Combined, this reduces and prolongs storm events so that water is less likely to overwhelm stormwater infrastructure. These benefits reduce the city's costs associated with maintaining and increasing the capacity of aging stormwater infrastructure. These costs are modeled based on typical costs of stormwater management in the Northern California Coast Region (i-tree Canopy v 6.1).

In Pacific Grove, the community tree canopy reduces stormwater runoff by more than 35.6 million gallons, valued at $356,536. This accounts for 69% of the total environmental benefits provided by this resource.

Assessing Stormwater Risk Potential

The impact of trees on stormwater systems is variable across the urban landscape. In Pacific Grove, tree planting at certain planting sites will produce greater stormwater benefits compared to other sites.

Identifying possible planting sites begins by mapping all grass, low-lying vegetation, and bare soil. However, not all of these areas are suitable planting sites because of site uses, including golf courses, cemeteries, sports fields, and other conflicts. Furthermore, some impervious areas can realistically be covered in tree canopy. Potential realistic plantable areas are determined by excluding those pervious areas that are unsuitable for planting and including impervious areas where trees could realistically be added, such as in parking lot islands, along sidewalks and near road edges. This UTC analysis included consideration of site design and environmental factors to prioritize planting sites on both public and private property with the greatest potential for return on investment, as young trees mature to provide maximum stormwater benefits.

Prioritized Planting Sites

To identify areas where additional trees would provide the greatest benefits to stormwater management and reducing runoff and erosion, Pacific Grove's existing landcover data was analyzed along with impervious surface and environmental factors (Table 5). Each of the datasets was classified based on the value of "risk" from 0-4, with 4 representing the greatest risk of contributing to stormwater runoff. Variables were weighted to produce a results grid. The grid was summarized using zonal statistics by each feature layer and each was assigned an average risk score. Areas and locations with the greatest risk score were classified as higher priority.

Table 5. Environmental Factors Used to Prioritize Tree Planting Sites

Dataset	Weight	Source
Impervious Distance	0.35	Urban Tree Canopy Assessment
Slope	0.25	National Elevation Dataset
Soils	0.20	Natural Resource Conservation Service
K-Factor	0.10	Natural Resource Conservation Service
Canopy Distance	0.10	Urban Tree Canopy Assessment

The Stormwater Priority Planting Map illustrates planting priority sites based on runoff risk (Figure 8 and Map 5). Increasing the number of trees and canopy in areas with the highest priority (red) will provide the greatest benefits to stormwater management by increasing capture rates, reducing runoff, and providing greater soil stability.

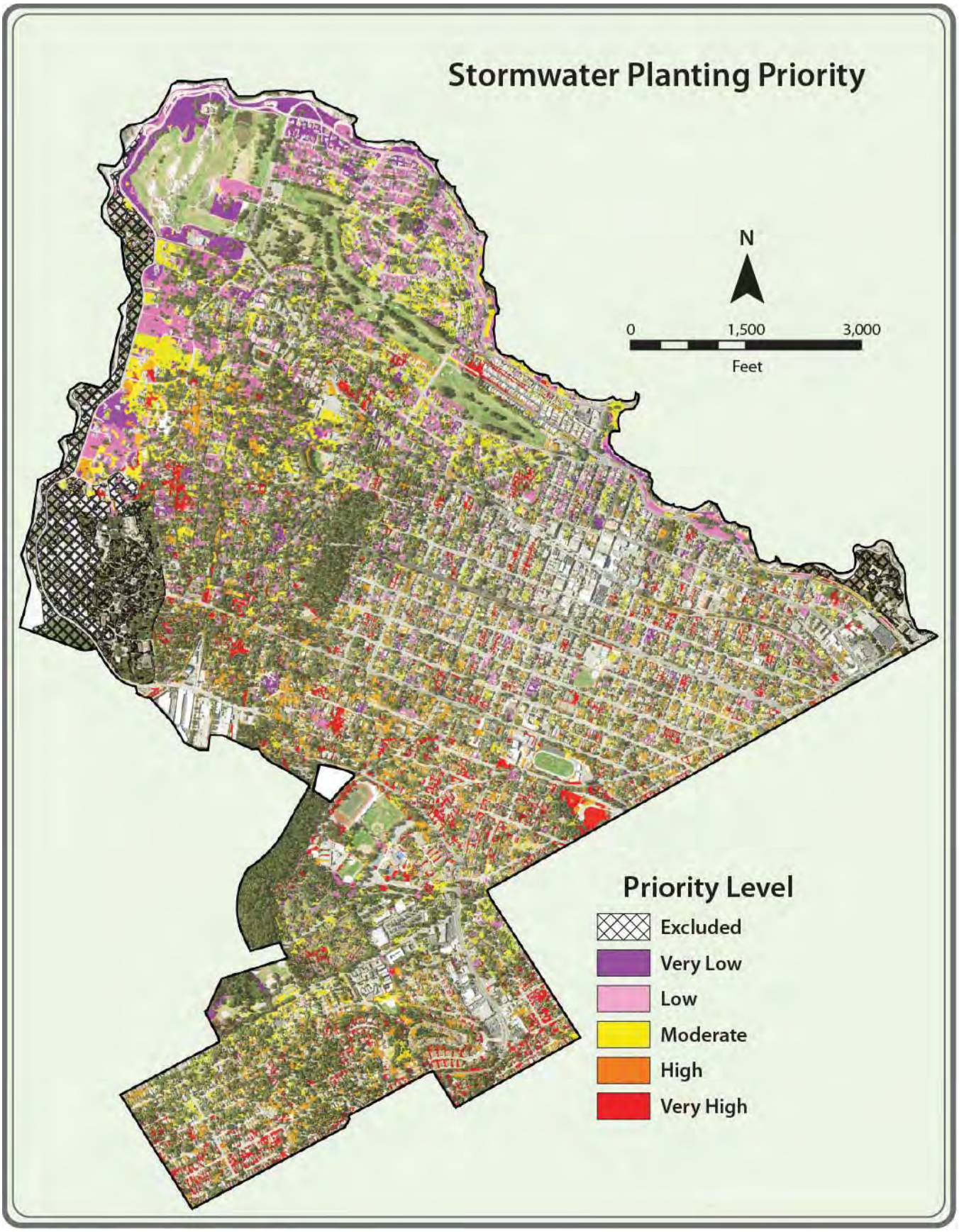
Based on stormwater runoff potential, the analysis identified 312 acres for priority planting and 9,901 potential planting areas or sites (Table 6).

Table 6. Acres of Planting Priority Sites

Priority Level	Planting Areas	Acres
Very High	2,217	57.6
High	2683	65.2
Moderate	2,596	83.6
Low	1932	71.7
Very Low	473	33.6
Excluded	418	70.7
	9,901	**311.7**

A final determination on priority planting sites should be made through site inspections with additional consideration for community values and further prioritized by zone, neighborhood, and parcel to determine the most optimal planting priorities. In addition, the 2015 public tree inventory revealed that, in public areas alone, 16% of tree sites will be available within the next five years due to vacant sites and recommended removals. Beyond those public sites, many planting opportunities exist on private property as well.

Figure 8. Planting Priorities Based on Site Uses and Environmental Factors



Map 5. Planting Priority

Historic Land Cover Change

Net Change

Over time, land cover shifts with development, tree planting, growth and removal, and with changes in land use. While Pacific Grove's population increased from 14,831 to 15,601 (5%) between 2005 and 2014, impervious surface remained nearly constant (42.8% to 42.7%) and tree canopy increased 51 acres (25.8% to 28.6%) (Figure 9 and Table 7). Grass and low-lying vegetation fluctuated between 23% and 25%, but resulted in little net change. Bare soils were reduced by 37 acres to 6%. Open water fluctuated as well, but this is to be expected in a coastal community and is a result of fluctuating tide levels in conjunction with the acquisition of aerial imagery.

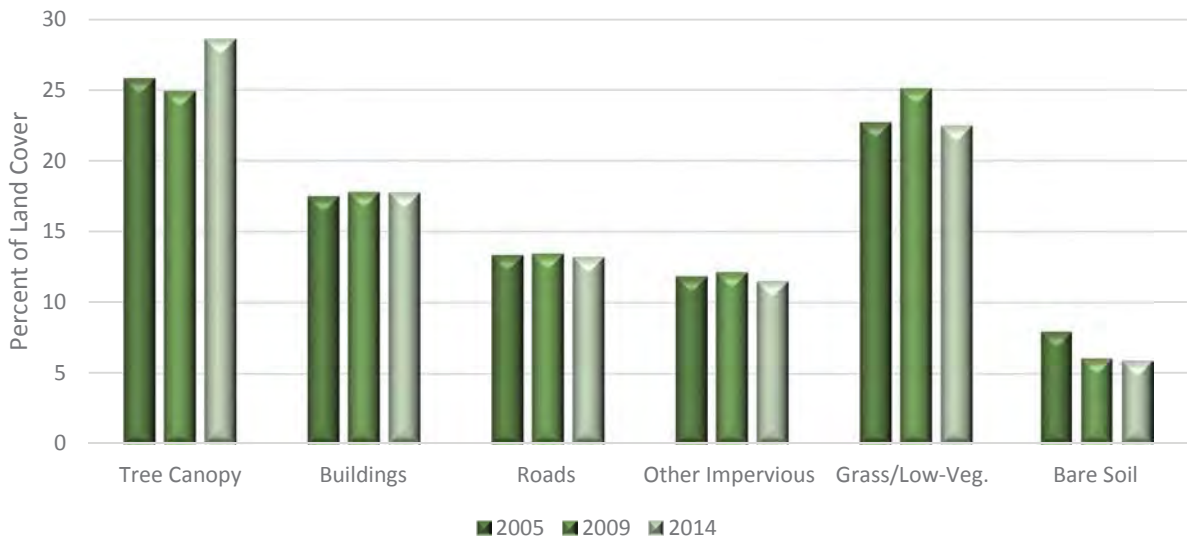


Figure 9. Net Land Cover Change by Year

Table 7. Net Land Cover Change 2005 - 2014

	2005		2009		2014	
Land Cover Class	**Acres**	**%**	**Acres**	**%**	**Acres**	**%**
Tree Canopy	474	25.8	457	24.9	525	28.6
Buildings	321	17.5	328	17.8	327	17.8
Roads	247	13.4	247	13.5	244	13.3
Other Impervious	219	11.9	224	12.2	214	11.6
Grass/Low-Veg.	416	22.7	461	25.1	413	22.5
Bare Soil	146	8.0	111	6.1	109	6.0
Open Water	14	0.7	9	0.5	5	0.3
Citywide	**1,837**	**100%**	**1,837**	**100%**	**1,837**	**100%**

Land Cover Gains and Losses (2005-2014)

In addition to net change, an understanding of the dynamic fluctuations of land cover and in relation to geography can provide additional useful information. Tree Canopy and Grass and Low-lying Vegetation gained and lost the most acreage between 2005 and 2014 (Figure 10). This illustrates how dynamic and highly susceptible to change these land cover classes can be.

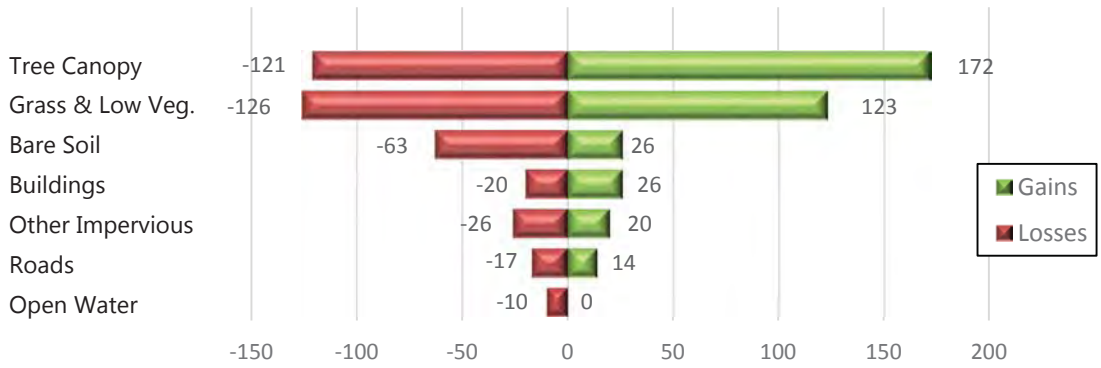


Figure 10. Gains and Losses (2005 – 2014)

Between 2005 and 2014, Tree Canopy gained 172 acres and lost 121 acres. Grass and low-lying vegetation on the other hand gained 123 acres and lost 126 acres. Bare soils gained 26 acres and lost 63 acres.

Buildings, Roads, and Other Impervious Surfaces gained 60 acres and lost 63 acres. However, it is most likely that any losses in impervious surface can be attributed to the overgrowth of tree canopy. Further illustrating that tree canopy has a great potential to share space with impervious surface. Purposeful design and planning can facilitate this relationship.

Figure 11 illustrates the spatial trend from All Land Cover Classes to Tree Canopy between 2005 and 2014. This is a best fit, third-order polynomial trend map of the pattern of tree canopy transitions from other land cover classes. The locations of the highest values (red) give an indication of where the greatest change most likely occurred. The area of greatest change is concentrated within the western segment of the city extending southwards; the area bordered by the Pacific Grove Golf Links, Asilomar State Beach, Hayward Park, Rip Van Winkle Open Space Park and George Washington Park area. The centroid of this hot spot is around the George Washington Park. This is where the greatest fluctuation between tree canopy and other land cover classes occurred. This variability highlights the fact that management for urban forest canopy must anticipate both gains and losses in order to ultimately promote strategies that result in net canopy growth.

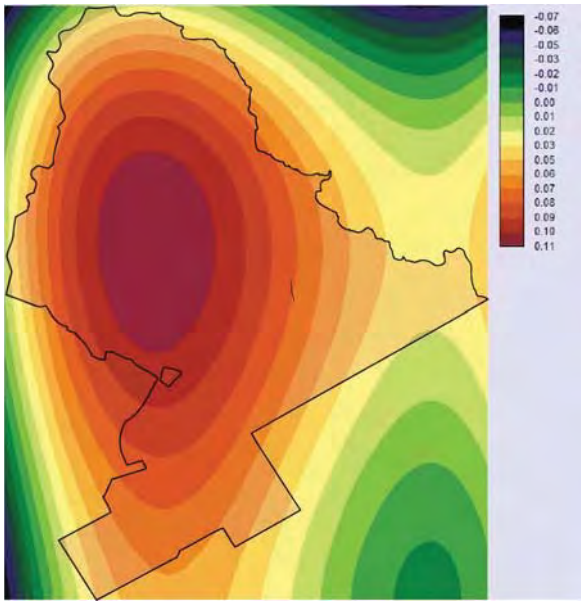
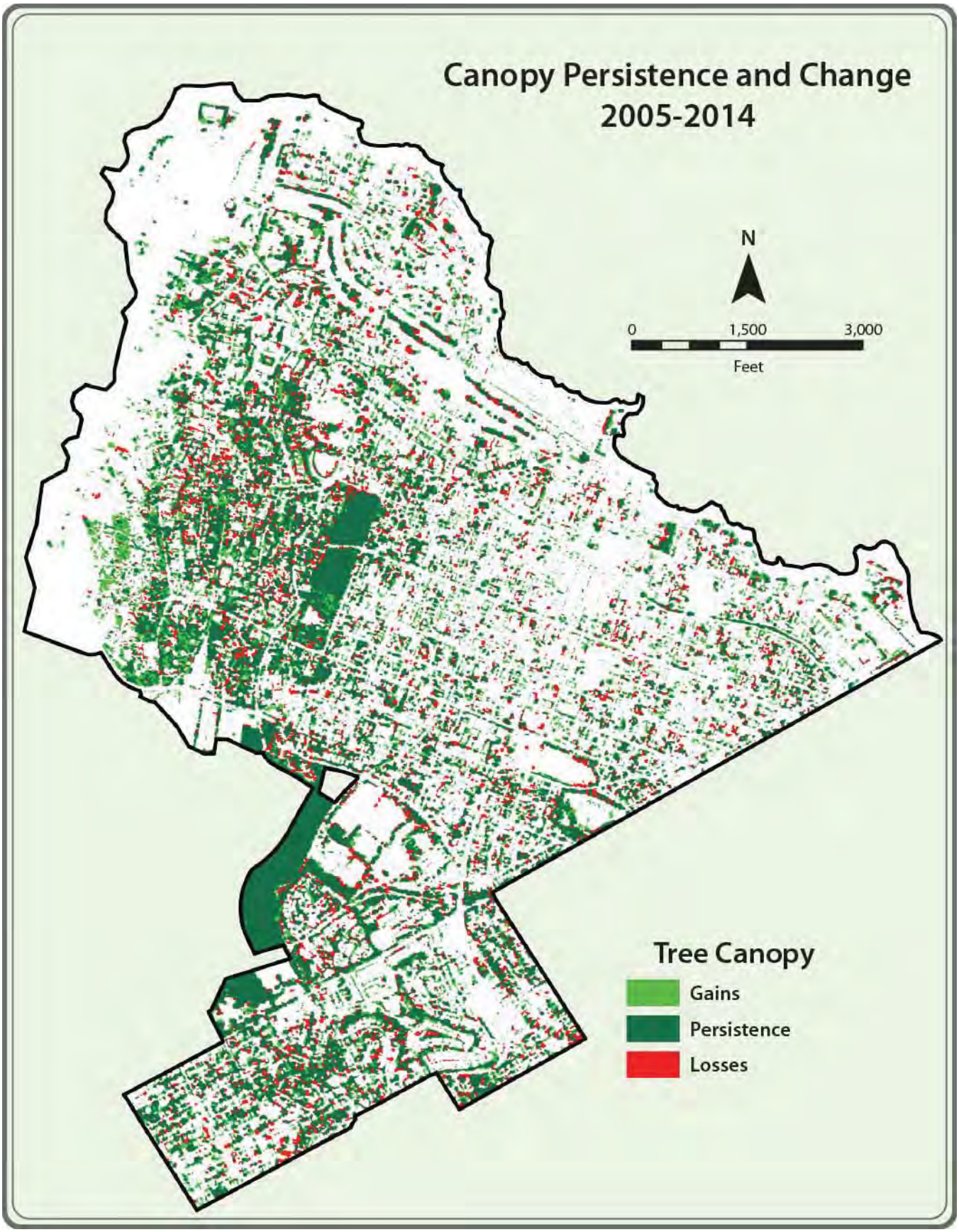


Figure 11. Hot Spot of Land Cover Changing to Tree Canopy

Map 6 illustrates areas of persistence and change in tree canopy from 2005 through 2014.



Map 6. Canopy Persistence and Change (2005-2014)

Net Change in Tree Canopy by Zone

In Pacific Grove, zoning class boundaries encompass 1,444 acres of the city's 1,837 total acres, and the remaining land is in the right-of-way. In the land use zones, from 2005 to 2014, canopy cover increased from 26% to 29%. The highest increases were seen in Government (44% to 50%) and PUD (37% to 42%) zoning classes. Residential had the highest canopy loss (from 30% to 28%) from 2005 to 2009, but gained 5% from 2009 to 2014 resulting in a total of 33% (Table 6). Based on these trends, with proactive management and ongoing strategic tree planting Pacific Grove will continue to enjoy the benefits of their current and future tree canopy.

Table 8. Percent Canopy Cover Change by Zoning Class from 2005 to 2014.

Zoning Class	2005 % Canopy	2009 % Canopy	2014 % Canopy
Commercial	15.20	15.94	18.22
Government	44.16	45.04	49.87
Industrial	4.57	6.14	8.65
Open Space	22.79	23.38	26.30
Planned Unit Development	37.18	40.20	41.86
Residential	30.44	28.47	33.41
Unclassified	27.61	26.63	27.78
Zoning Class Total	**25.99%**	**26.54%**	**29.44%**

Net Change in Tree Canopy by Neighborhood

In Pacific Grove, neighborhood boundaries encompass 1,438 acres of the city's 1,837 total acres. The overall canopy cover in neighborhoods is 443 acres (31%). In previous years, canopy cover has fluctuated. Asilomar has increased canopy cover from 12% to 19% since 2005. In contrast, Seaview neighborhood has lost canopy cover, from 40.4% in 2005 to 28.6% in 20014. Forth Addition neighborhood lost canopy cover from 2005 (30%) to 2009 (21%), but regained that lost cover by 2014 (31%). While the canopy cover has varied in the last decade, overall, the City increased canopy cover from 28.5% to 31% within all neighborhoods.

Table 9. Percent Canopy Cover Change From 2005-2014

Neighborhood	% Canopy 2005	% Canopy 2009	% Canopy 2014
Asilomar Dunes	12.4	13.6	18.7
Beach Tract / Fairway Homes	17.8	16.4	20.5
Country Club Gate/Forest Grove	52.0	51.6	51.2
Country Club Heights	37.0	34.7	38.9
Del Monte Park	37.7	38.8	40.5
Downtown	7.4	6.9	11.5
Fifth Addition	24.2	22.0	28.6
First Addition	18.8	15.4	22.9
Fourth Addition	30.1	20.9	30.8
Glen	33.5	37.8	36.7
Hillcrest	33.8	32.8	33.8
Pacific Grove Acres	46.4	43.3	48.0
Pacific Grove Retreat	15.3	13.4	18.2
Seaview	40.4	36.0	38.6
Second Addition	27.3	27.7	31.7
Sunset Drive	33.8	31.6	34.8
Third Addition	16.6	15.0	21.9
All Neighborhoods	**28.5%**	**26.9%**	**31.0%**

Projected Land Cover

Using IDRISI® Selva Edition 17.0 Land Change Modeler (LCM) software, DRG projected a net change in land cover for Pacific Grove by 2024 (Figure 12 and Map 7). The analysis was generated based on the gains and losses, net change, contributions and exchanges between land cover classes and the persistence and spatial trends of land cover classes that occurred between 2005 and 2014. It must be noted that the projections are based purely on the above without consideration for urban planning interventions and/or drastic modifications to the urban landscape.

Projection modeling estimates that of all land cover, tree canopy will experience the greatest increase, gaining 39 additional acres by 2024. As a result, tree canopy cover in 2024 is anticipated to reach 31%. This growth will most likely correspond with losses in Grass and Low-lying Vegetation and Other Impervious Surfaces.

The western segment of the city extending southwards; the area bordered by the Pacific Grove Golf Links, El Carmelo Cemetery, Asilomar State Beach, Hayward Park, Rip Van Winkle Open Space Park and George Washington Park area and surrounding areas will continue to provide the most conducive environment for Tree Canopy gain and to be the hotbed for most land cover changes.

Buildings are expected to increase 8.3 acres to 18.2%, with the majority of growth occurring around the area east of CA-68 in the northern segment of the city and west of CA-68 south of the intersection with Sunset Drive.

From an aerial viewpoint, Roads are projected to decline by less than an acre as the result of canopy growth along tree lined streets.

Other Impervious Surfaces will have the greatest decline, losing 4.5 acres and accounting for 11.3% of the city by 2024. Most significant losses are projected to be within the western section of the city and the area south-west of the intersection between CA-68 and Sunset Drive.

As mentioned previously, a decline in impervious surface is generally not a loss of impervious surface, but rather a result of shared space between tree canopy and impervious surface as canopy growth expands to provide shade for buildings, roads, sidewalks, and parking areas. This process and the longevity and health of trees in areas with a high percentage of impervious surface can be facilitated and improved with purposeful planning and design, including structural soils, suspended pavements, and pervious pavements that improve and increase uncompacted soil volume below grade.

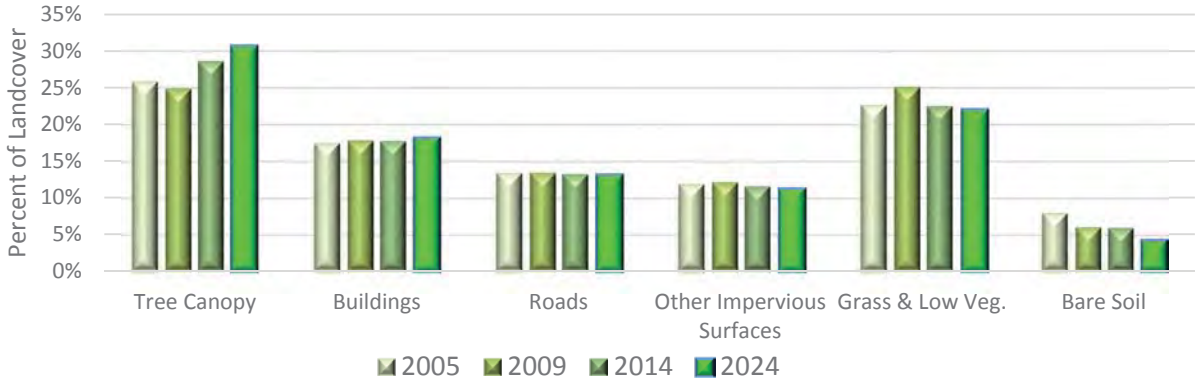
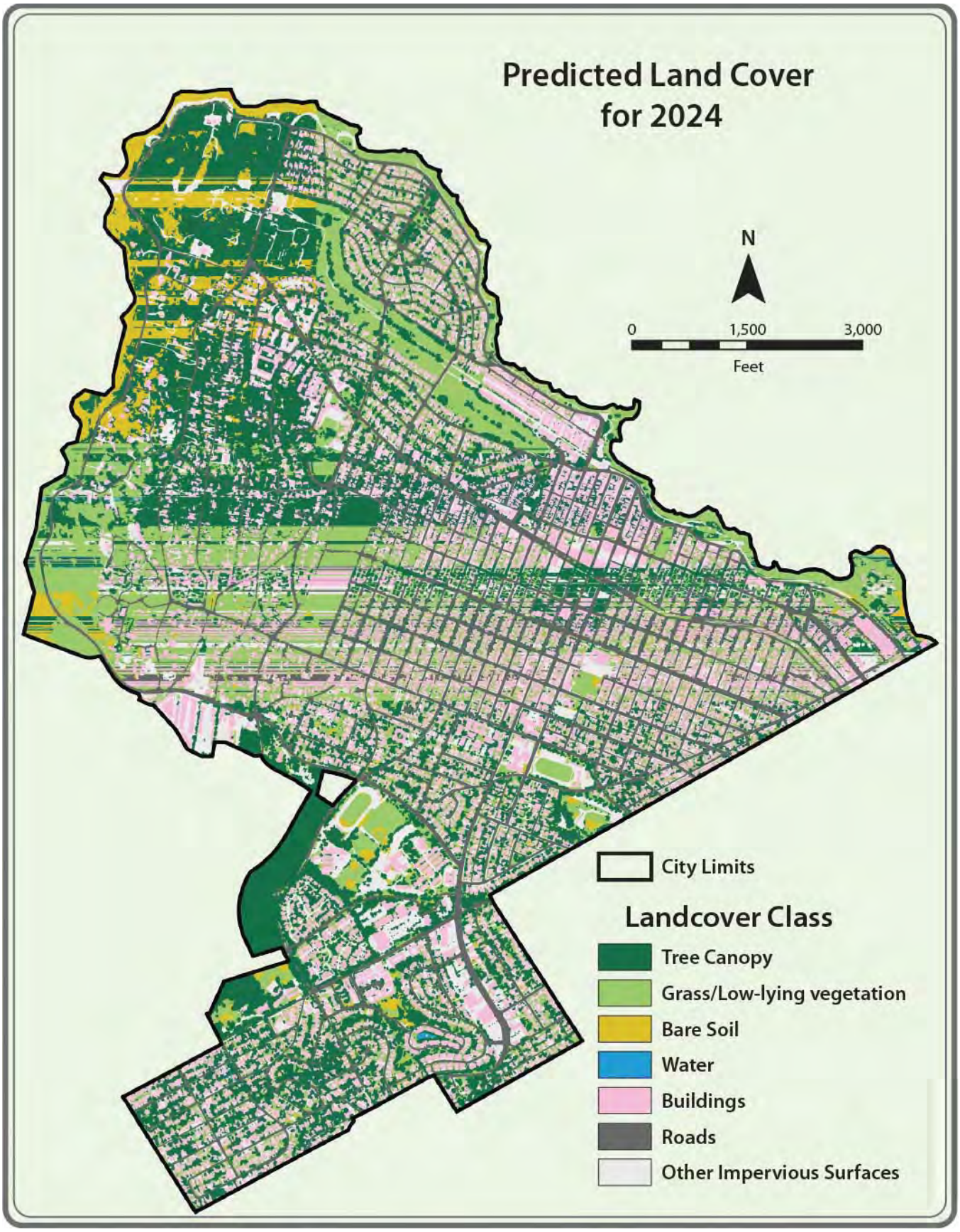


Figure 12. Historic and Predicted Change in Land Cover



Map 7. Land Cover Predicted by 2024

Tree Canopy Potential

The potential for tree canopy can be estimated by adding the area of existing canopy to the area of low-lying vegetation and impervious surface that appears, from aerial imagery and other GIS datasets, to provide potential for trees. This typically excludes sports fields, golf courses, cemeteries, and coastal dunes. Based on this methodology, the potential tree canopy for Pacific Grove is 57% (1,048 acres).

Tree Canopy Goals

Understanding canopy potential is helpful information when setting tree canopy goals. However, it is just as important to balance this information with what is economically, ecologically, and politically feasible for the community. This often requires input and support from multiple stakeholders, including residents, local leaders, and urban forest managers. Canopy goals should reflect local values, local environmental and quality of life goals, compliance with federal and local clean air and water regulations, and economic development plans. These goals can vary based on land use and jurisdiction.

In 2012, Pacific Grove established a canopy goal of an overall 33% tree canopy by 2037. Based on historical growth between 2005 (25.8%) and 2014 (28.6%), and predicted tree canopy in 2024 (31%), the community is on track for achieving this goal (Figure 13). Success will rely partly on increasing trees on private property, where City code has specific tree canopy requirements. Pacific Grove Municipal Code (PGMC) provides guidelines for tree planting on residential properties based on the available landscaped area, specifying 1-4 trees depending on residential lot size. Guidelines for Commercial and Governmental properties specify one tree per 30' frontage, and a minimum of two trees per property if space is available. Parks and Parking Lots have standard canopy goals of 33%. The GIS information developed as a result of the UTC assessment provides benchmarks for canopy distribution over the previous 10 years, which can provide a valuable tool for measuring the success of the these goals and for making future urban forest management decisions.

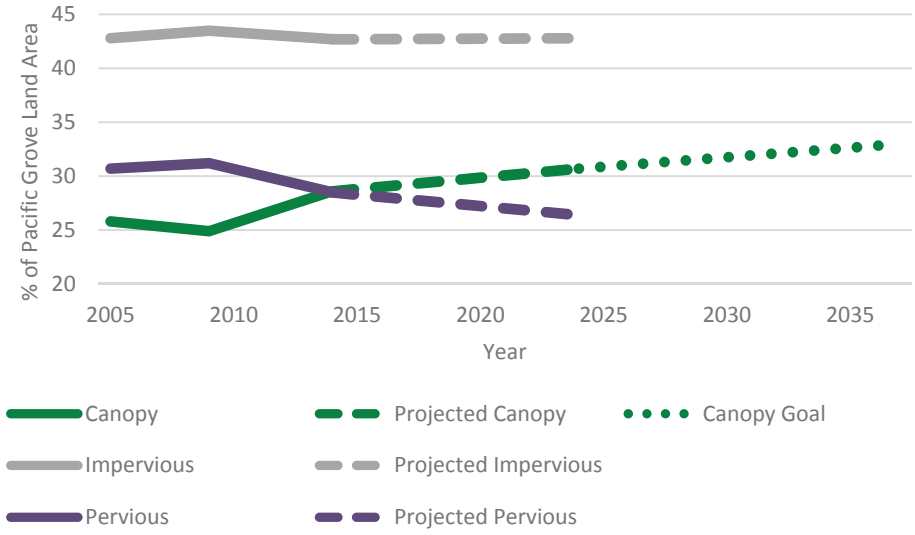


Figure 13. Land Use Trends, Projections, and Goal

Conclusion

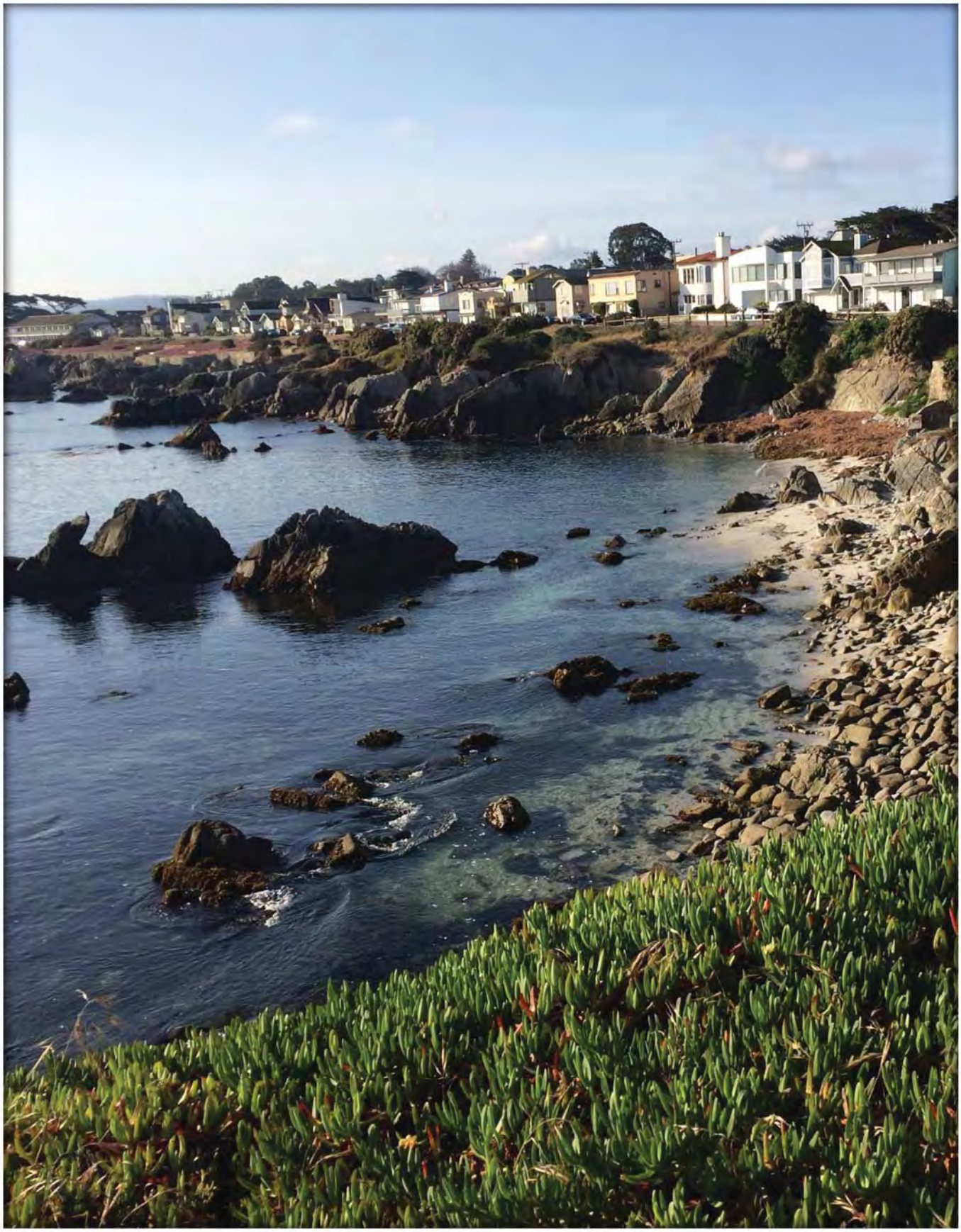
Pacific Grove's existing tree canopy is substantial, covering 29% of the city, and the preservation and protection of this resource is essential to maintaining a healthy and sustainable community. Based on both historical (2005-2014) and projected growth, the community is on track for reaching the established goal of 33% tree canopy by 2037. Proactive preservation and mitigation policies and ongoing tree replacement can ensure that canopy cover continues to grow over time.

The Urban Tree Canopy Assessment establishes a GIS data layer that can be used in conjunction with other infrastructure layers to prioritize planting sites and increase canopy cover strategically by zone, neighborhood or parcel. This assessment establishes a baseline for developing urban forest management strategies and measuring the success of those strategies over time.

Based on this assessment, Pacific Grove has the following opportunities:

- Considering that nearly 43% of the community is covered by impervious surfaces, including roads, parking lots, and structures, and based on possible planting sites near those impervious areas, Pacific Grove has the potential to support 57% overall canopy cover.
- Prioritized maps provide a basis for a strategically focused planting plan to increase trees and canopy that will support stormwater management, preserve soil, and complement the existing urban infrastructure for the greatest impact and return on investment.
- New tree planting can include strategies for increasing canopy cover on both public and private property.
- This report provides an overview of the existing tree canopy and an important outreach tool for engaging public interest and support. However, the accompanying GIS layer that maps the location and extent of existing landcover can support a vast range of additional analysis when used in conjunction with other data layers. The data supports analysis from an overall community level down to the parcel level and can provide an important tool for investigating the relationship of tree canopy in correlation with other important issues, including transportation, walkability, human health, and social and economic concerns.

Land Cover Projections through 2024 can help managers envision future tree canopy gains and losses depending development, tree preservation, and strategically locating tree planting. This spatial understanding the past, present and possible tree canopy can is a valuable tool to help managers align urban forestry management with the community's vision for tree canopy in Pacific Grove.



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Appendix B: Environmental Calculations

Air Quality

The i-Tree Canopy v6.1 Model was used to quantify the value of ecosystem services for air quality. i-Tree Canopy was designed to give users the ability to estimate tree canopy and other land cover types within any selected geography. The model uses the estimated canopy percentage and reports air pollutant removal rates and monetary values for carbon monoxide (CO), nitrogen dioxide (NO_2), ozone (O_3), sulfur dioxide (SO_2), and particulate matter (PM) (Hirabayashi 2014).

Within the i-Tree Canopy application, the U.S. EPA's BenMAP Model estimates the incidence of adverse health effects and monetary values resulting from changes in air pollutants (Hirabayashi 2014; US EPA 2012). Different pollutant removal values were used for urban and rural areas. In i-Tree Canopy, the air pollutant amount annually removed by trees and the associated monetary value can be calculated with tree cover in areas of interest using BenMAP multipliers for each county in the United States.

To calculate ecosystem services for the study area, canopy percentage metrics from UTC land cover data performed during the assessment were transferred to i-Tree Canopy. Those canopy percentages were matched by placing random points within the i-Tree Canopy application. Benefit values were reported for each of the five listed air pollutants.

Carbon Storage and Sequestration

The i-Tree Canopy v6.1 Model was used to quantify the value of ecosystem services for carbon storage and sequestration. i-Tree Canopy was designed to give users the ability to estimate tree canopy and other land cover types within any selected geography. The model uses the estimated canopy percentage and reports carbon storage and sequestration rates and monetary values. Methods on deriving storage and sequestration can be found in Nowak et al. 2013.

To calculate ecosystem services for the study area, canopy percentage metrics from UTC land cover data performed during the assessment were transferred to i-Tree Canopy. Those canopy percentages were matched by placing random points within the i-Tree Canopy application. Benefit values were reported for carbon storage and sequestration.

Stormwater

The i-Tree Hydro v5.0 Model was used to quantify the value of ecosystem services for stormwater runoff. i-Tree Hydro was designed for users interested in analysis of vegetation and impervious cover effects on urban hydrology. This most recent version (v5.0) allows users to report hydrologic data on the city level rather than just a watershed scale giving users more flexibility. For more information about the model, please consult the i-Tree Hydro v5.0 manual (http://www.itreetools.org).

To calculate ecosystem services for the study area, land cover percentages derived for Pacific Grove were used as inputs into the model. Precipitation data from 2011 was selected within the model as that year closely represented the average rainfall (16.1in) for the city (NOAA 2015). Model simulations were run under a Base Case as well as an Alternate Case. The Alterative Case increased canopy by 1% and assumed that impervious and vegetation cover would decrease by 0.7 for vegetated cover

and 0.3% for impervious cover as plantings would ultimately reduce these land cover types. This process was completed to assess the runoff reduction volume associated with a 1% increase in tree canopy since i-Tree Hydro does not directly report the volume of runoff reduced by tree canopy. The volume (in cubic meters) was converted to gallons and multiplied by the current canopy percentage (28.6%) in Pacific Grove to retrieve the overall volume reduced by the tree canopy.

Through model simulation, it was determined that tree canopy decreases the runoff volume in Pacific Grove by 35.7 million gallons during an average precipitation year. This equates to approximately 67,852 gallons per acre of tree canopy (35.7M gals/525.5 acres).

To place a monetary value on stormwater reduction, the City of Berkeley Municipal Tree Guide Report (Maco et al. 2005) provided the price to treat a gallon of storm water used in several research studies within the area ($0.01 per gallon). Tree canopy was estimated to contribute roughly $356,500 annually to Pacific Grove.

Appendix C: Methods

Land Cover Assessment Methods

Davey Resource Group utilized an object-based image analysis (OBIA) semi-automated feature extraction method to process and analyze current high-resolution color infrared (CIR) aerial imagery and remotely-sensed data to identify tree canopy cover and land cover classifications. The use of imagery analysis is cost-effective and provides a highly accurate approach to assessing your community's existing tree canopy coverage. This supports responsible tree management, facilitates community forestry goal-setting, and improves urban resource planning for healthier and more sustainable urban environments.

Advanced image analysis methods were used to classify, or separate, the land cover layers from the overall imagery. The semi-automated extraction process was completed using Feature Analyst, an extension of ArcGIS®. Feature Analyst uses an object-oriented approach to cluster together objects with similar spectral (i.e., color) and spatial/contextual (e.g., texture, size, shape, pattern, and spatial association) characteristics. The land cover results of the extraction process was post-processed and clipped to each project boundary prior to the manual editing process in order to create smaller, manageable, and more efficient file sizes. Secondary source data, high-resolution aerial imagery provided by each UTC city, and custom ArcGIS® tools were used to aid in the final manual editing, quality checking, and quality assurance processes (QA/QC). The manual QA/QC process was implemented to identify, define, and correct any misclassifications or omission errors in the final land cover layer.

Classification Workflow

1) Prepare imagery for feature extraction (resampling, rectification, etc.), if needed.
2) Gather training set data for all desired land cover classes (canopy, impervious, grass, bare soil, shadows). Water samples are not always needed since hydrologic data are available for most areas. Training data for impervious features were not collected because the City maintained a completed impervious layer.
3) Extract canopy layer only; this decreases the amount of shadow removal from large tree canopy shadows. Fill small holes and smooth to remove rigid edges.
4) Edit and finalize canopy layer at 1:2000 scale. A point file is created to digitize-in small individual trees that will be missed during the extraction. These points are buffered to represent the tree canopy. This process is done to speed up editing time and improve accuracy by including smaller individual trees.
5) Extract remaining land cover classes using the canopy layer as a mask; this keeps canopy shadows that occur within groups of canopy while decreasing the amount of shadow along edges.
6) Edit the impervious layer to reflect actual impervious features, such as roads, buildings, parking lots, etc. to update features.
7) Using canopy and actual impervious surfaces as a mask; input the bare soils training data and extract them from the imagery. Quickly edit the layer to remove or add any features. Davey

Resource Group tries to delete dry vegetation areas that are associated with lawns, grass/meadows, and agricultural fields.

8) Assemble any hydrological datasets, if provided. Add or remove any water features to create the hydrology class. Perform a feature extraction if no water feature datasets exist.

9) Use geoprocessing tools to clean, repair, and clip all edited land cover layers to remove any self-intersections or topology errors that sometimes occur during editing.

10) Input canopy, impervious, bare soil, and hydrology layers into Davey Resource Group's Five-Class Land Cover Model to complete the classification. This model generates the pervious (grass/low-lying vegetation) class by taking all other areas not previously classified and combining them.

11) Thoroughly inspect final land cover dataset for any classification errors and correct as needed.

12) Perform accuracy assessment. Repeat Step 11, if needed.

Automated Feature Extraction Files

The automated feature extraction (AFE) files allow other users to run the extraction process by replicating the methodology. Since Feature Analyst does not contain all geoprocessing operations that Davey Resource Group utilizes, the AFE only accounts for part of the extraction process. Using Feature Analyst, Davey Resource Group created the training set data, ran the extraction, and then smoothed the features to alleviate the blocky appearance. To complete the actual extraction process, Davey Resource Group uses additional geoprocessing tools within ArcGIS®. From the AFE file results, the following steps are taken to prepare the extracted data for manual editing.

1) Davey Resource Group fills all holes in the canopy that are less than 30 square meters. This eliminates small gaps that were created during the extraction process while still allowing for natural canopy gaps.

2) Davey Resource Group deletes all features that are less than 9 square meters for canopy (50 square meters for impervious surfaces). This process reduces the amount of small features that could result in incorrect classifications and also helps computer performance.

3) The Repair Geometry, Dissolve, and Multipart to Singlepart (in that order) geoprocessing tools are run to complete the extraction process.

4) The Multipart to Singlepart shapefile is given to GIS personnel for manual editing to add, remove, or reshape features.

Accuracy Assessment Protocol

Determining the accuracy of spatial data is of high importance to Davey Resource Group and our clients. To achieve to best possible result, Davey Resource Group manually edits and conducts thorough QA/QC checks on all urban tree canopy and land cover layers. A QA/QC process will be completed using ArcGIS® to identify, clean, and correct any misclassification or topology errors in the final land cover dataset. The initial land cover layer extractions will be edited at a 1:2000 quality control scale in the urban areas and at a 1:2500 scale for rural areas utilizing the most current high-resolution aerial imagery to aid in the quality control process.

To test for accuracy, random plot locations are generated throughout the city area of interest and verified to ensure that the data meet the client standards. Each point will be compared with the most current NAIP high-resolution imagery (reference image) to determine the accuracy of the final land cover layer. Points will be classified as either correct or incorrect and recorded in a classification matrix. Accuracy will be assessed using four metrics: overall accuracy, kappa, quantity disagreement, and allocation disagreement. These metrics are calculated using a custom Excel® spreadsheet.

Land Cover Accuracy

The following describes Davey Resource Group's accuracy assessment techniques and outlines procedural steps used to conduct the assessment.

1) *Random Point Generation*—Using ArcGIS, 1,000 random assessment points are generated.

2) *Point Determination*—Each point is carefully assessed by the GIS analyst for likeness with the aerial photography. To record findings, two new fields, CODE and TRUTH, are added to the accuracy assessment point shapefile. CODE is a numeric value (1–5) assigned to each land cover class and TRUTH is the actual land cover class as identified according to the reference image. If CODE and TRUTH are the same, then the point is counted as a correct classification. Likewise, if the CODE and TRUTH are not the same, then the point is classified as incorrect. In most cases, distinguishing if a point is correct or incorrect is straightforward. Points will rarely be misclassified by an egregious classification or editing error. Often incorrect points occur where one feature stops and the other begins.

Figure 14. Land Cover Accuracy

3) *Classification Matrix*—During the accuracy assessment, if a point is considered incorrect, it is given the correct classification in the TRUTH column. Points are first assessed on the NAIP imagery for their correctness using a "blind" assessment—meaning that the analyst does not know the actual classification (the GIS analyst is strictly going off the NAIP imagery to determine cover class). Any incorrect classifications found during the "blind" assessment are scrutinized further using sub-meter imagery provided by the client to determine if the point was incorrectly classified due to the fuzziness of the NAIP imagery or an actual misclassification. After all random points are assessed and recorded; a classification (or confusion) matrix is created. The classification matrix for this project is presented in Table 10. The table allows for assessment of user's/producer's accuracy, overall accuracy, omission/commission errors, kappa statistics, allocation/quantity disagreement, and confidence intervals (Figure 12 and Table 10).

Table 10. Classification Matrix

Reference Data	Classification Data									
Classes	**Tree Canopy**	**Buildings**	**Roads**	**Other Impervious**	**Grass & Low Veg.**	**Bare Soils**	**Water**	**Row Total**	**Producer's Accuracy**	**Errors of Omission**
Tree Canopy	**279**	5	10	4	11	0	0	**309**	90.29%	9.71%
Buildings	0	**187**	0	0	2	1	0	**190**	98.42%	1.58%
Roads	0	0	**116**	0	1	0	0	**117**	99.15%	0.85%
Other Impervious	3	1	2	**103**	9	1	0	**119**	86.55%	13.45%
Grass & Low Veg.	11	0	1	4	**178**	2	0	**196**	90.82%	9.18%
Bare Soils	0	0	0	1	6	**57**	0	**64**	89.06%	10.94%
Water	0	0	0	0	0	0	**5**	**5**	100.00%	0.00%
Column Total	**293**	**193**	**129**	**112**	**207**	**61**	**5**	**1,000**		
User's Accuracy	95.22%	96.89%	89.92%	91.96%	85.99%	93.44%	100.00%		Overall Accuracy	92.50%
Errors of Commission	4.78%	3.11%	10.08%	8.04%	14.01%	6.56%	0.00%		Kappa Coefficient	0.9062

Following are descriptions of each statistic as well as the results from some of the accuracy assessment tests.

Overall Accuracy – Percentage of correctly classified pixels; for example, the sum of the diagonals divided by the total points ((279+187+116+103+178+57+5)/1,000 = 92.50%).

User's Accuracy – Probability that a pixel classified on the map actually represents that category on the ground (correct land cover classifications divided by the column total [279/293 = 95.22%]).

Producer's Accuracy – Probability of a reference pixel being correctly classified (correct land cover classifications divided by the row total [279/309 = 90.29%]).

Kappa Coefficient – A statistical metric used to assess the accuracy of classification data. It has been generally accepted as a better determinant of accuracy partly because it accounts for random chance agreement. A value of 0.80 or greater is regarded as "very good" agreement between the land cover classification and reference image.

Errors of Commission – A pixel reports the presence of a feature (such as trees) that, in reality, is absent (no trees are actually present). This is termed as a false positive. In the matrix below, we can determine that 4.78% of the area classified as canopy is most likely not canopy.

Errors of Omission – A pixel reports the absence of a feature (such as trees) when, in reality, they are actually there. In the matrix below, we can conclude that 9.71% of all canopy classified is actually present in the land cover data.

Errors of Omission – A pixel reports the absence of a feature (such as trees) when, in reality, they are actually there. In the matrix below, we can conclude that 10.29% of all canopy classified is actually present in the land cover data.

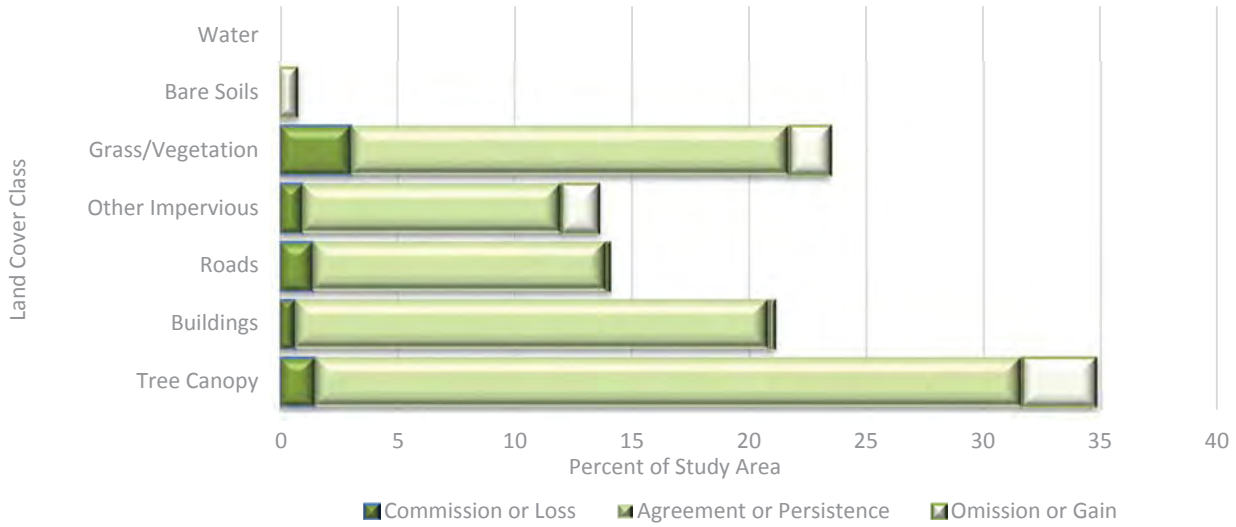

Figure 16. Omission/Commission Errors

Allocation Disagreement – The amount of difference between the reference image and the classified land cover map that is due to less than optimal match in the spatial allocation (or position) of the classes.

Quantity Disagreement – The amount of difference between the reference image and the classified land cover map that is due to less than perfect match in the proportions (or area) of the classes.

Confidence Intervals – A confidence interval is a type of interval estimate of a population parameter and is used to indicate the reliability of an estimate. Confidence intervals consist of a range of values (interval) that act as good estimates of the unknown population parameter based on the observed probability of successes and failures. Since all assessments have innate error, defining a lower and upper bound estimate is essential.

Table 11. Omission/Commission Errors

Class	Acreage	%	Lower Bound	Upper Bound
Tree Canopy	526	28.60%	27.50%	29.70%
Buildings	327	17.80%	16.90%	18.70%
Roads	244	13.30%	12.50%	14.10%
Other Impervious	214	11.60%	10.90%	12.40%
Grass & Low Veg.	413	22.50%	21.50%	23.50%
Bare Soils	109	6.00%	5.40%	6.50%
Open Water	5	0.30%	0.20%	0.40%
Total	**1,837**	**100%**		

Statistical Metrics Summary	
Overall Accuracy =	92.50%
Kappa Coefficient =	90.62%
Allocation Disagreement =	7.00%
Quantity Disagreement =	1.00%

Accuracy Assessment

Class	User's Accuracy	Lower Bound	Upper Bound	Producer's Accuracy	Lower Bound	Upper Bound
Tree Canopy	95.20%	94.00%	96.50%	90.30%	88.60%	92.00%
Buildings	96.90%	95.60%	98.10%	98.40%	97.50%	99.30%
Roads	89.90%	87.30%	92.60%	99.10%	98.30%	100.00%
Other Impervious	92.00%	89.40%	94.50%	86.60%	83.40%	89.70%
Grass & Low Veg.	86.00%	83.60%	88.40%	90.80%	88.80%	92.90%
Bare Soils	93.40%	90.30%	96.60%	89.10%	85.20%	93.00%
Open Water	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

Land Cover Change Assessment

Davey Resource Group utilized IDRISI® Selva Edition 17.0 Land Change Modeler (LCM) software to analyze land cover change and prediction with an assessment of the gains and losses of land cover classes, net change, persistence and specific transitions displayed in a map and graphical form.

Land cover class change analysis was conducted between 2005 and 2014 to identify the transitions from one land cover type to another.

The potentials of the land cover classes to transition over a period of time were modeled based on a driver variable – elevation. Based on an assessment of the rates of change of land cover classes and the corresponding transition potentials, a change prediction analysis was conducted to predict future scenario for 2024 in a map and video format.

Assessment Workflow

1) Convert Land cover layers from ESRI Shapefiles to Rasta data sets and subsequently to American Standard Code for Information Interchange (ASCII) formats in ArcMap 10.2.2 for compatibility and import into IDRISI Selva 17.0 Raster data formats. Ensure the following conditions are met:

   a. The legends in both maps are the same.

   b. The categories in both maps are the same and sequential.

   c. The backgrounds in both maps are the same and have a value of zero.

   d. The spatial dimensions, including resolution and coordinates, are the same.

2) In the Change Analysis Tab, set the Earlier (2005) and Later (2014) Land cover Raster Images within the project parameters Panel.
3) Assess the gains and losses by land cover class category based on the land cover Raster images for 2005 and 2014. All changes were analyzed in acreage and percentage change unless specified.
4) Conduct a net change by category was based on the land cover Raster images.
5) Assess the contributions to net change per land cover category.
6) Create map showing the changes by land cover class.
7) Create a persistence map to depict the land cover class which
8) Create map showing gains and losses in each land cover class.
9) Create maps depicting transitions from specified land cover classes.
10) Create maps depicting exchanges from specified land cover classes
11) Conduct a Spatial Trend Analysis for specified land cover classes using the third order of polynomial within the Spatial Trend of Change panel.
12) Determine all Land cover Transition sub-models and evaluate them accordingly.
13) Assign All Transitions to a specific land cover class to a group and notate them accordingly. All land cover transitions to Tree Canopy are sub-modeled and named 'Tree Canopy' An evaluation of the sub-model 'Tree Canopy' therefore depicts transitions from Impervious Surfaces, Buildings, Roads, Open Water and Bare Soils.

14) Include a variable – Elevation as a Static variable within the Transition sub-model structure.
15) Run the Transition Sub-model using the Multi-Layer perceptron Neural Network.
16) Create a Transition Potential Map for each sub-model: Tree Canopy, Impervious Surfaces, Buildings, Roads, Open Water and Bare Soils.
17) Using the Markov Chain option under the Change Demand Modeling, set the Prediction Date to 2024
18) In the Change Allocation ensure that the set predicted date is correctly reflected and specify the Recalculation stages to 2.
19) Check the create AVI video, specify the Frame Rate (sec) to 0.5 and check the display the intermediate stage images.
20) Run model to create Projected Land cover (2024) map and AVI video.

Tree Canopy Health Assessment

Following the mapping and analysis of tree canopy cover, additional models were completed to evaluate the condition of the tree canopy. Broad band based vegetation indices, based on sensors with broad wavelength region bands, are the most frequently used indicators for monitoring ecosystem dynamics and vegetation health. Many vegetation indices have been developed and applied in vegetation studies since the first vegetation index was introduced. Vegetation indices were created to evaluate cover, chlorophyll content, leaf area, phenology, and absorbed photosynthetically active radiation. Since live green vegetation and tree canopy absorb solar radiation in the photosynthetically active radiation (PAR) spectral region, they scatter solar radiation in the near-infrared spectral region. When the two spectral regions are assessed in ratio-based indices, they contrast with cover that absorbs or reflects light similarly in both regions.

Normalized Difference Vegetation Index

The Normalized Difference Vegetation Index (NDVI) is a numerical indicator that uses the visible and near-infrared bands of the electromagnetic spectrum, and is adopted to analyze remote sensing measurements and assess whether the target being observed contains live green vegetation or not. NDVI is a ratio (using red and near-infrared bands) ranging from -1 to 1 with vegetation being a positive value – normally greater than 0.3. Increasing positive values indicates healthier vegetation communities. Generally, healthy vegetation will absorb most of the visible light that falls on it, and reflects a large portion of the near-infrared light; thus, healthy vegetation will be more pronounced than dead or dying vegetation because of the amount of chlorophyll within the leaves to absorb visible light.

Determining Tree Canopy Health

To assess canopy health and to identify areas with dead or dying trees, Davey Resource Group utilized NDVI to extract ratio values from the 2014 NAIP imagery using the red and near-infrared bands. The NDVI values were normalized on a scale from 0 – 1 to highlight canopy communities and the overall condition of the trees. Results of this analysis include a breakdown of tree canopy health into six classes: Excellent, Very Good, Good, Fair, Poor, and Dead/Dying. The number of acres for each canopy health class was tabulated and shown below. The results of this analysis can be used by Pacific Grove to further inspect the poor condition canopy to find out the real cause of poor health (i.e. drought, disease, fire, dying trees, etc.).

LANDSCAPE TREES FOR PACIFIC GROVE

The recommended landscape tree list for Pacific Grove was updated in April 2015 by the Beautification and Natural Resources Commission and included the development of an informational handout, brochure, and a Guide to Selection, Planting, and Care of Landscape Trees.

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Landscape Trees for Pacific Grove

a Guide to Selection, Planting and Care

January 11, 2011

CITY OF PACIFIC GROVE
300 FOREST AVENUE
PACIFIC GROVE, CALIFORNIA 93950
TELEPHONE (831) 648-3100
FAX (831) 375-9863
www.ci.pg.ca.us

Dear Friend:

More than a century ago, the City of Pacific Grove was founded in a forest. Trees grew in profusion—pine, oak, cypress, even redwood. Since then, we have lost much of that forest.

Trees have always been an integral part of Pacific Grove's character, lending charm and a distinctive appearance, setting us apart from other coastal communities. In a time when many of California's cities are losing trees faster than they are being replaced, we must do we all we can to ensure that trees will always flourish in Pacific Grove.

To achieve this goal, we ask you, the residents and business people of Pacific Grove, to join the City, your friends, and neighbors in helping to restore our urban forest.

This Landscape Tree Guide was developed to provide assistance in choosing and caring for our trees. City staff and committees will use the guide for tree plantings along streets, in parks, and in other public places. We hope you will review the more than 40 species listed here and find a species you would like to plant at your home or business.

Trees are one of our most valuable assets. They make our neighborhoods more livable, creating a buffer from the busy pace of modem life. They contribute towards clean air, soil and water conservation, and energy savings. They increase the value of our homes and the economic vitality of our businesses. They provide a habitat for wildlife—including over-wintering Monarch butterflies.

Most of all, trees greatly enhance the unique beauty of Pacific Grove. Through our combined efforts, we can ensure that it will always be so. Thank you for your active participation.

Sincerely,

Carmelita Garcia
Mayor

January 11, 2011

Printed on Recycled Paper

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BENEFITS OF TREES

The City of Pacific Grove is committed to a policy of maintaining and expanding a diverse population of street trees as an essential component of the urban forest in the City. Benefits of a healthy urban forest include the following:

- **Increased real estate values**
- **Improved air quality**
- **Improved water quality**
- **Saves heating and cooling energy**
- **Reduces noise pollution**
- **Improved aesthetic environment**
- **Improved wildlife habitat**
- **Improved psychological well-being**

In addition, the City aims to increase public participation and involvement in the promotion of a healthy urban forest. The City currently maintains approximately one quarter of Pacific Grove's urban forest. The balance is maintained by the private property owner. Consequently, the individual property owner plays a vital role in the maintenance and development of Pacific Grove's urban forest. This guide is designed to assist the property owner in making informed decisions for the trees on his/her property. It includes information on the selection, planting and maintenance of trees, as well as the permit process and references to tree-related organizations.

PLANNING AHEAD - CHOOSING THE RIGHT TREE FOR THE RIGHT SPOT

Thinking and planning ahead may be the most important step in your effort to help our urban forest. How well you plan may determine whether or not your tree lives and thrives. Here are a few sample questions to consider:

Have I chosen the right tree?

- Will the tree grow well in this climate and soil?
- Did the seed or seedling come from my local area, giving it a better chance to survive?
- Is it the size and shape I want?

Have I chosen the right place to plant it?

- Is anything overhead or around it that might obstruct its growth?
- What kind of human activity takes place here?
- Is there good drainage and room for the roots to expand?

Do I have enough resources to plant and care for the tree?

- How much money will I need?
- What materials and equipment will I need?
- How many people can I get to help?

Do I have permission to plant here?

- What do the city and county ordinances say about who can plant what and where?
- Will my neighbors or whoever share the space agree?

We hope this booklet will help you answer these questions. For more details about planting trees contact the City Forester, your local nursery, or a certified arborist.

FOR FURTHER INFORMATION:

- *Sunset Western Garden Book*: Lane Publishing Co., Menlo Park, CA.; an encyclopedia of plants and a good horticultural guide. It is available at most bookstores.
- *Trees for San Francisco - A Guide to Street-Tree Planting and Care*: Friends of the Urban Forest's street tree photos and information booklet. Call Friends of the Urban Forest at (415)-543-5000 to purchase.

Pacific Grove Landscape Tree List

	Botanical Name Common Name 'Cultivated Variety'	Height				Spread			Shape						Density			Growth Rate Per Year			Sun Exposure		
		Small - Up to 15 ft.	Medium - 15 to 30 ft.	Large - 30 to 50 ft.	Very Large - Over 50 ft.	Narrow, under 20 ft.	Average, 20 to 40 ft.	Broad, over 40 ft.	Round	Spreading	Columnar	Oval	Upright	Pyramidal	Open	Medium	Dense	6" Max - Slow	Moderate	1' Min - Rapid	Sun	Sun - Shade	Shade
	CONIFERS																						
1	Cedrus deodora Deodar Cedar			●			●							●			●		●		●		
2	Cupressus macrocarpa Monterey Cypress (Ca. Native)			●				●		●						●				●	●	●	
3	Pinus canariensis Canary Island Pine				●		●				●					●				●	●		
4	Pinus pinea Italian Stone Pine			●				●		●						●			●		●	●	
5	Pinus radiata Monterey Pine (Ca. Native)				●				●							●				●	●	●	
6	Pinus torreyana Torrey Pine (Ca. Native)			●						●						●				●	●		
7	Sequoia sempervirens Coast Redwood (Ca. Native)				●		●							●			●			●	●	●	
	BROADLEAF EVERGREEN TREES																						
8	Acacia melanoxylon Blackwood Acacia				●		●					●					●			●	●	●	●
9	Arbutu unedo Stawberry Tree 'Marina'		●				●		●			●				●			●		●	●	●
10	Callistemon citrinus Lemon Bottlebrush		●			●			●							●			●		●	●	
11	Callistemon viminalis Weeping Bottlebrush		●			●				●					●				●		●	●	
12	Cinnamomum camphora Camphor Tree			●				●	●								●		●		●	●	
13	Eriobotrya deflexa Bronze Loquat		●				●			●							●			●	●	●	
14	Eriobotrya japonica Loquat		●				●			●							●			●	●	●	
15	Eucalyptus ficifolia Red Flowering Gum			●			●		●								●		●		●	●	

Tree Shapes

Round Spreading Columnar Oval Upright Pyramidal

Drought	Coastal Conditions	Wind	Oak Root Fungus Resistant	Frost Tolerant to 26° F	Aromatic	Attracts Birds	Attracts Monarch Butterflies	Fruit - Flower	Fall Color	Unusual Leaves	Clean - Neat	Bark	Deer Resistant	Good Under Utilities	Small, Contained Areas	Lawn or Irrigated Areas	Good for Street Tree	Comments	
Tolerances					Outstanding Characteristics									Possible Sites				Comments	
●				●									●					Grey-green, short needles; openly spaced branches; pendulous ends give tree a graceful habit. Needs large space.	1
●	●	●		●	●								●					Needs periodic thinning to limit wind damage. Prune branch ends to strengthen limbs.	2
●			●	●								●	●					Resistant to oak root fungus and pitch canker. Attractive in groups; vertical accent tree for taller buildings; good in narrow spaces.	3
●	●			●									●					Good roadside and large garden tree. Resistat to pine pitch canker.	4
●	●	●	●	●									●					Very fast growing; plant at least 10' from paved surfaces and foundations; plant pitch canker resistant varieties.	5
●		●	●	●									●					Distinctive gray-green, long needles. Resistant to pitch canker. Young trees handsome, old trees striking. Produces pine nuts.	6
			●	●								●	●			●		Likes ample water; needs large space and protection from wind (susceptible to salt burn near ocean).	7
●	●	●	●										●			●	●	Cream-colored flower clusters in spring; 4" seed pods in late summer, drop in fall; disease and pest resistant; requires annual removal of suckers; self sows.	8
●	●	●				●		●				●				●	●	Rosy pink flowers in fall; yellow to orange-red berries in summer & winter attract birds; Red-brown shreddy bark; excellent lawn or raised-bed tree.	9
●	●	●	●		●	●		●					●	●	●		●	Long blooming period; red flowers attract hummingbirds & monarchs; good for small spaces; requires light annual pruning & sidewalk clean-up during flower drop.	10
●	●		●			●		●					●	●	●	●	●	Pendulous branches; flower characteristics and care same as Lemon Bottlebrush; stake & trim to prevent top-heavy growth.	11
●	●			●	●					●								Shiny foliage, dark bark, clusters of tiny yellow flowers in March, followed by blackish fruits; needs good drainage.	12
●				●		●		●		●							●	Large dark green leaves have coppery color when new. Needs good drainage; stake & prune when young. *Eriobotyra x Coppertone* retains copper foliage most of year; stays small, to 15'.	13
●				●		●		●		●						●		Big, leatherey, glossy green leaves show rusty wool beneath; small, dull white flowers borne in fall, fragrant but not showy. Grafted varieties produce 1-2 in. edible orange fruits.	14
●	●		●			●		●		●			●	●		●	●	Striking red to orange flowers cover tree in winter & summer. Requires pruning to avoid branch breakage; flower and seed capsule require clean-up.	15

Note about deer resistance: Although some trees are more resistant to deer browsing than others, hungry deer will nibble nearly any newly planted tree. For best success, protect young trees with wire exclosures.

Pacific Grove Landscape Tree List

	Botanical Name Common Name 'Culivated Variety'	Height				Spread			Shape						Density			Growth Rate Per Year			Sun Exposure		
		Small - Up to 15 ft.	Medium - 15 to 30 ft.	Large - 30 to 50 ft.	Very Large - Over 50 ft.	Narrow, under 20 ft.	Average, 20 to 40 ft.	Broad, over 40 ft.	Round	Spreading	Columnar	Oval	Upright	Pyramidal	Open	Medium	Dense	6" Max - Slow	Moderate	1' Min - Rapid	Sun	Sun - Shade	Shade
	BROADLEAF EVERGREEN TREES																						
16	Eucalyptus nicholii Nichol's Willow-Leafed Peppermint			●							●				●					●	●		
17	Geijera parviflora Australian Willow		●			●						●				●			●		●		
18	Magnolia grandiflora Southern Magnolia 'Russett' 'St. Marys'				●		●		●								●		●		●	●	
19	Lyonothamnus floribundus asplenifolius Fernleaf Catalina Ironwood			●		●						●				●			●		●	●	
20	Maytenus boaria Mayten Tree 'Green Showers'		●			●			●	●						●		●			●	●	
21	Melaleuca quinquenervia Cajeput Tree			●			●				●					●			●		●		
22	Melaleuca styphelioides Rigid Leaf Paperbark Tree			●			●					●				●	●		●		●	●	
23	Meterosideros excelsus New Zealand Christmas Tree			●			●		●								●		●		●	●	
24	Myoporum laetum Myoporum		●			●			●								●			●	●	●	●
25	Olea europaea Olive		●			●			●							●		●			●		
26	Pittosporum undulatum Victorian Box			●			●		●							●			●		●	●	
27	Podocarpus gracilior African Fern Pine		●	●		●			●								●	●			●	●	●
28	Prunus Caroliniana Carolina Laurel Cherry			●			●		●								●		●		●		
29	Quercus agrifolia Coast Live Oak (Calif. Native)			●			●			●							●		●		●		

Tree Shapes

Round Spreading Columnar Oval Upright Pyramidal

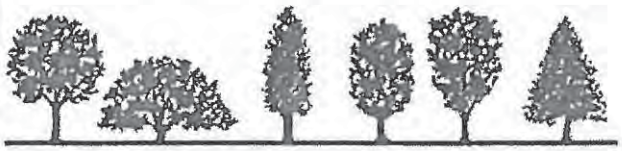
Tolerances					Outstanding Characteristics									Possible Sites				Comments	
Drought	Coastal Conditions	Wind	Oak Root Fungus Resistant	Frost Tolerant to 26° F	Aromatic	Attracts Birds	Attracts Monarch Butterflies	Fruit - Flower	Fall Color	Unusual Leaves	Clean - Neat	Bark	Deer Resistant	Good Under Utilities	Small, Contained Areas	Lawn or Irrigated Areas	Good for Street Tree		
				●	●								●				●	Gracefull, weeping blue-green, fine-textured foliage has peppermint smell when crushed. Too much water can cause chlorosis.	16
●			●	●						●	●			●			●	Has grace of willow; toughness of eucalyptus; deep, non-invasive roots; pest free.	17
			●	●				●		●			●				●	Large white fragrant flowers; large glossy leaves & pods a litter problem. Surface roots lift side-walks. Likes ample water. 'St. Mary's, a smaller, slower growing variety, is ok beneath wires.	18
●	●	●						●		●		●						Tiny white flowers in clusters; Rough, shredding, red-brown bark. Requires annual pruning; Stake & prune when young. Needs good drainage.	19
			●										●			●		Weeping form; delicate, apple-green foliage; needs good drainage & deep initial watering to avoid suckers & voracious surface roots that destroy concrete; Prune to remove suckers.	20
●	●	●		●							●	●	●				●	Peeling, spongy, cream to brown bark; yellowish flowers in summer & fall,1/2" hard brown seed capsules; good for narrow sidewalks; tolerates poor drainage.	21
●		●	●					●		●		●	●			●	●	Pendulous branchlets; lacy, open growth; peeling bark; creamy white flowers summer to fall; brittle wood; tolerates water, good in lawns.	22
●	●	●						●		●			●			●	●	Showy red flowers in early summer; sidewalk cleanup during flower drop; stake & prune when young; good street tree, needs root barrier in narrow site; excellent in windy, salt air.	23
●	●	●		●			●	●		●			●					Attractive multi-trunked tree if staked & pruned; thin to prevent top-heaviness & wind damage; superb for seaside use; not for tailored gardens; some leaf drop at all times; invasive roots.	24
●	●	●				●						●	●	●				Grey-green foliage; insignificant flowers. Dark green to black 1" edible fruit in late fall attracts birds but stains sidewalks. Plant fruitless varieties to avoid fruit drop; requires frequent pruning & removal of suckers.	25
●		●			●			●					●			●	●	Wavy-edged leaves, Fragrant creamy white flowers in early spring open to sticky orange seeds that are messy. Shallow, greedy root system limits other plants.	26
			●								●				●	●	●	Not a pine; irregular form; dark blue-green, glossy narrow leaves; insignificant fruit & flowers; train to single trunk when young; Needs good drainage; disease & pest resistant.	27
●		●		●		●	●	●										Attractive as multistemmed tree; small creamy white flowers in spikes, Feb-April. Half inch black fruit a litter problem over pavement. Does poorly in alkaline soils.	28
●		●		●		●							●				●	Needs considerable space; avoid watering within 4' of base; attracts many native birds.	29

Note about deer resistance: Although some trees are more resistant to deer browsing than others, hungry deer will nibble nearly any newly planted tree. For best success, protect young trees with wire exclosures.

Pacific Grove Landscape Tree List

	Botanical Name Common Name 'Culivated Variety'	Height				Spread			Shape						Density			Growth Rate Per Year			Sun Exposure		
		Small - Up to 15 ft.	Medium - 15 to 30 ft.	Large - 30 to 50 ft.	Very Large - Over 50 ft.	Narrow, under 20 ft.	Average, 20 to 40 ft.	Broad, over 40 ft.	Round	Spreading	Columnar	Oval	Upright	Pyramidal	Open	Medium	Dense	6" Max - Slow	Moderate	1' Min - Rapid	Sun	Sun - Shade	Shade
	BROADLEAF EVERGREEN TREES																						
30	Quercus suber Cork Oak			●				●	●							●		●			●		
31	Schinus terebinthifolius Brazilian Pepper Tree		●			●			●								●		●		●		
32	Ulmus parvifolia Chinese Elm 'Drake'			●				●		●							●	●			●		
	DECIDUOUS TREES																						
33	Aesculus carnea Ruby Horse Chestnut 'Briotii'			●			●		●				●				●		●		●		
34	Fagus sylvatica Copper Beech				●			●						●			●			●	●		
35	Gingko biloba Maidenhair Tree 'Autumn Gold'			●			●		●							●			●		●		
36	Liquidambar styraciflua American Sweet Gum 'Burgundy' 'Festival' 'Palo Alto'			●			●					●				●			●		●		
37	Liriodendron tulipifera Tulip Tree			●		●						●				●				●	●		
38	Magnolia soulangeana Saucer Magnolia		●				●		●								●		●		●	●	●
39	Malus floribunda Japanese Flowering Crabapple		●			●			●	●						●			●			●	
40	Pyrus calleryana Ornamental Flowering Pear			●			●							●		●			●		●		
41	Platanus acerifolia London Plane Tree 'Bloodgood' 'Yarwood'			●			●			●						●				●		●	
42	Prunus cerasifera Flowering Plum 'Krauter Vesuvias' 'Thundercloud'		●			●			●							●			●		●		

Tree Shapes



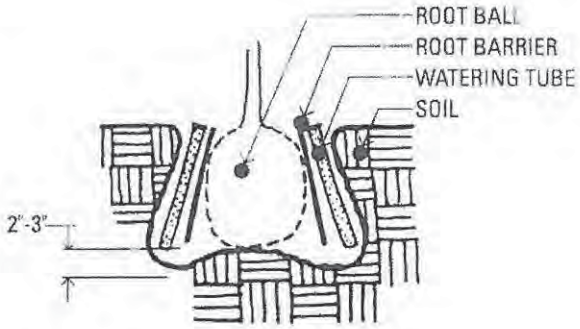
Round Spreading Columnar Oval Upright Pyramidal

Tolerances					Outstanding Characteristics									Possible Sites				Comments	
Drought	Coastal Conditions	Wind	Oak Root Fungus Resistant	Frost Tolerant to 26° F	Aromatic	Attracts Birds	Attracts Monarch Butterflies	Fruit - Flower	Fall Color	Unusual Leaves	Clean - Neat	Bark	Deer Resistant	Good Under Utilities	Small, Contained Areas	Lawn or Irrigated Areas	Good for Street Tree		
●				●								●	●				●	Trunks with thick, corky bark; very drought tolerant; needs good drainage.	30
●		●		●		●		●							●		●	Bright red berries showy in winter; feed & water infrequently & deeply to discourage surface roots.	31
●			●	●							●						●	Weeping habit; older trees have sheding bark. Aggressive surface roots can damage sidewalks; stake & prune when young.	32
						●		●					●	●		●	●	Showy pink to red flower clusters April-May; requires sidewalk clean-up during flower drop; needs summer watering; susceptible to powdery mildew & leaf spot.	33
									●			●						Beautiful foliage; protect from winds; salts in soil or water stunt growth & turn leaves brown.	34
●										●	●		●	●		●	●	Brilliant yellow leaves in fall, drop all at once; likes well drained soil. Never prune central leader; stake when young; disease & pest resistant; long-lived.	35
●		●	●						●	●			●				●	Maple-like leaves; dependable fall color varies with variety from yellow-orange-red to burgundy; spiny seed capsules, though decorative, drop in winter & require clean-up; surface roots can be nuisance in lawns or parking strips. Disease & pest resistant.	36
			●	●					●	●						●		Bright yellow-green leaves; tulip shaped greenish yellow flowers in late spring; likes well drained soil; susceptible to aphids; good lawn tree.	37
				●				●			●			●		●	●	Large white, pink, or purplish red flowers bloom in winter before leaves come out. Blooms at 3-5 yrs.	38
			●	●		●		●	●					●	●	●		Fine textured foliage; red to pink buds open to white flowers; prune only to build framework and to correct shape; needs summer watering; susceptible to aphids.	39
			●	●				●	●							●		White flowers in early spring; purplish-red fall color; narrow crotches subject to breakage as tree matures.	40
●			●	●				●	●			●	●			●	●	Lobed, maplelike leaves. Bark sheds in striking patches. Brown, ball-like seed clusters hang from branches through winter. Watch for spider mites and scale. 'Bloodgood' somewhat resistant to anthracnose; 'Yarwood' resistant to powdery mildew.	41
				●		●	●	●		●				●	●	●		Pink to white flowers in early spring. Green, red, or purple foliage depending on variety. Susceptible to caterpillars, slugs, aphids and spider mites; some fruit drop; will grow in almost any soil.	42

Note about deer resistance: Although some trees are more resistant to deer browsing than others, hungry deer will nibble nearly any newly planted tree. For best success, protect young trees with wire exclosures.

PLANTING TREES

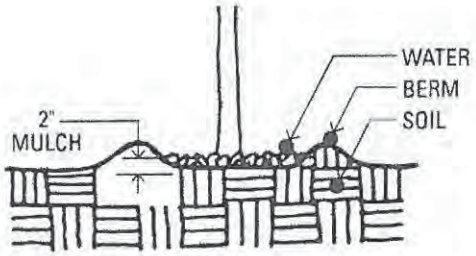
Planting Hole: The planting hole should be excavated 1-2 inches less than the height of the root ball and twice the root ball diameter. Loosen soil at the sides and bottom of the hole. If amendments are added to the backfill soil, they should be composed of slowly decomposing organic matter, thoroughly mixed, and amount to no more than 40% of the overall soil volume. Filling the pit with water and observing the water percolate into the soil will determine whether the soil has adequate drainage. Areas with poor drainage (i.e. very little drainage in 24 hours) should be modified and planted with a species tolerant of wet soil.



Watering Tube: (optional) Placement of a 4" by 24" watering tube should be at the grade of the soil and filled with gravel. This tube allows for water to be delivered to the root zone without surface run-off while encouraging deep roots. The application of water through the tube should be done only after the tree is established, usually within 18 to 24 months. Two tubes can also be installed on opposite sides of the root ball to maximize deep watering. Trees planted on a grade should always have the watering tube installed on the uphill side of the root ball.

Root Barrier: (optional) Root barriers may be utilized when planting in paved areas and near driveways and sidewalks. They are thought to direct roots down in the soil and consequently minimize root growth directly under pavement.

Tree Placement: The tree should be carefully removed from the container to avoid damage to the root ball. Cut any circling roots and remove any matted roots on the surface of the root ball. Orient the tree with the strongest branches facing the prevailing winds.



Backfilling and Mulching: Eliminate air pockets by thoroughly flooding the partially backfilled tree pit. The soil should be firmly packed around the root ball to stabilize the newly planted tree. Fill the basin to grade and construct a berm around the outside of the root ball for watering.

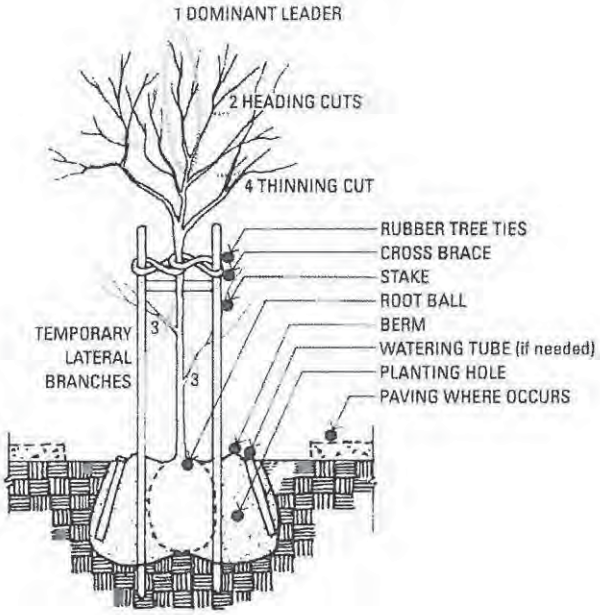
Staking: Two 2" x 8' lodge pole pine stakes should be driven into the ground on appropriate sides of the tree and adjacent to the root ball. A one inch by four inch board nailed between the stakes adds to the stability of the stakes but should be positioned in such a way as to avoid damage to the tree by rubbing. Two rubber tree ties should be nailed to the stakes and wrapped in a figure eight pattern around the tree six inches above the point where the tree, if held by hand, will maintain an upright position. Tie the trunk so that the tree can move at least three inches in each direction. This movement stimulates the growth of the tree.

MAINTENANCE OF NEWLY PLANTED TREES

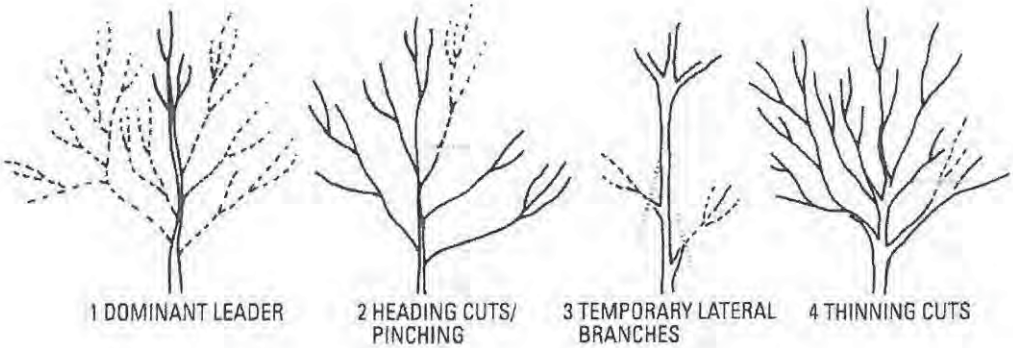
Basin Maintenance: Basin maintenance consists of weed and debris removal, stake and strap adjustment or removal, and sucker removal.

Watering: Deep, infrequent and slow watering directly over the root ball area will promote deep root growth. Depending on soil type, plant requirements and climatic conditions, a newly planted 15 gallon tree should receive about 5 gallons of water each week during the dry season. After 18 to 24 months of watering directly over the root ball, start watering through the watering tube.

Pruning: The most important aspect of young tree pruning is the establishment of a **dominant leader (1)**; **pinch** or **head back (2)** branches that are competing with the dominant leader. **Temporary lateral branches (3)** (branches that will not be present on the mature tree) must be left to feed and shade the trunk. These branches, which may also be headed appropriately, should be removed only after the tree is established. Do not allow the temporary branches to block pedestrian access on sidewalks. Pruning should emphasize the plant's natural growth habit and be limited to **thinning cuts (4)** and removal of unsound or poorly attached branches.



Staking: As soon as the tree is established (usually two years,) the stakes should be removed or modified to encourage a strong trunk, deep rooting and sufficient anchorage.



PERMITS

Tree Planting Procedure
Property owners are required to have a permit to plant a street tree in a City easement. No permit is needed to plant trees on private property.

1. Phone 648-3122 for information.
2. Complete form and return to the City Forester at the Department of Public Works.
3. Department inspection: sidewalk marked where tree is to be planted.

Permit approved: Property owner proceeds with planting the tree.
Permit denied: A letter of denial is sent to the property owner.

Tree Removal Procedure
Property owners are required to have a permit to remove street trees. Property owners are required to have a permit to remove any tree on private property which is four inches in diameter at four and one-half feet above the ground.

1. Tree permit applications are available at the Public Works office (648-3122) and at City Hall (648-3100).
2. Completed applications should be returned to the Public Works office.
3. Department inspection: The City Forester will visit your property and inspect the tree(s) within 10 days. Tree(s) will be posted with removal notice for a period of 10 days if City Forester determines public notice is appropriate.

Permit approved: If there are no public objections and the City Forester recommendation concurs, a permit is granted.
Permit denied: If there are public objections, a public hearing is scheduled. Notices are posted and mailed out to those concerned.

Public Hearing: Any person objecting to any determination of the City Forester shall have the right of appeal to the Natural Resources Committee.

Permit approved: Property owner proceeds with removal.
Permit denied: Decision may be appealed to City Council.

REFERENCES

City Agencies:

- City Forester, Department of Public Works - 648-3122
  For questions regarding permits, responsibilities, or professional advice and tree jurisdiction.
- City Hall - 648-3100
  For copy of the Tree Conservation and Protection Ordinance

Prepared by the City of Pacific Grove's
Natural Resources Committee
1998

The City of Pacific Grove
gratefully acknowledges the
San Francisco Department of Public Works
for permission to use information and illustrations from
Trees of San Francisco - A Plan for the Management of the City's Urban Forest,
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Katy Travaille

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January 11, 2011

Landscape Trees

For

Pacific Grove

A Guide to

Selection, Planting, and Care

BENEFITS OF TREES

The City of Pacific Grove is committed to a policy of maintaining and expanding a diverse population of street trees as an essential component of the urban forest in the city. Benefits of a healthy forest include the following:

- Increased real estate values
- Improved air quality
- Improved water quality
- Reduced heating and cooling energy
- Reduced noise pollution
- Improved aesthetic environment
- Improved wildlife habitat
- Reduced soil erosion

In addition, the City aims to increase public awareness and participation of a healthy urban forest. The individual property owner plays a vital role in the maintenance and development of Pacific Grove's urban forest. This guide is designed to assist the property owner in making informed decisions for the trees on their property. It includes information on the selection, planting and care of trees, as well as the permit process (required) at www.cityofpacificgrove.org and also tree-related organizations.

In September 2012 the city of Pacific Grove established a 25 – year city-wide target to maintain the existing canopy cover with the goal of a total canopy cover of 33% (Reference)

PLANNING AHEAD – CHOOSING THE RIGHT TREE FOR THE RIGHT PLACE

A healthy community forest begins with careful planning. With a little research and a simple layout, you can produce a landscape that will cool your home in summer and tame the winter winds. Your well-planned yard will contain trees that grow well in the soil and moisture of your neighborhood. Your trees will be properly placed to avoid collisions with power lines and buildings, and the aesthetics will increase your property value.

A proper landscape plan takes each tree into consideration:

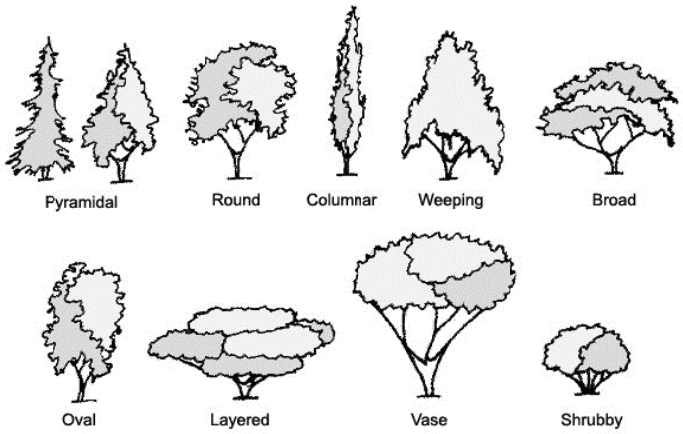
1. **Height.** Will the tree bump into anything when it is fully grown?
2. **Canopy spread.** How wide will the tree grow?
3. **Is the tree deciduous or evergreen?** (Will it lose its leaves in the winter?)
4. **Form or shape.** A columnar tree will grow in less space. Round and V-shaped species provide the most shade
5. **Growth rate.** How long will it take for your tree to reach its full height? Slow growing species typically live longer than fast growing species.
6. **Soil, sun, and moisture** requirements.
7. **Fruit**. No one wants messy droppings on busy sidewalks.
8. **Environmental exposures.** Locations exposing the tree to environmental conditions such as salt air, wind, and other Pacific Grove conditions.

FOR FURTHER INFORMATION:

Sunset western Garden Book: Lane Publishing Co., Menlo Park, CA

Trees for San Francisco: A Guide to Street-Tree Planting and Care

http://selectree.calpoly.edu/



Tree selection is one of the most important decisions that a home owner makes when landscaping or replacing a tree lost to damage or disease. When selecting a new tree consider the following questions:

- What is the purpose of the tree?
- What is the size and location of the planting site?
- What type of soil do you have?

City of Pacific Grove

300 Forest Ave.

Pacific Grove, CA 93950

(831) 648-5722 www.cityofpacificgrove.org

Contact the City Arborist for alternative trees.

City of Pacific Grove

Recommended Tree List

A Guide To

Selection, Planting,

And Care

Lower Canopy Deciduous

Washington hawthorn	*Crataegus cordata*
Saucer magnolia	*Magnolia soulangiana*
Maidenhair tree	*Ginko biloba*
Robinia locust "Purple Robe"	*Robinia pseudoacia*
Purple leaf plum	*Prunus c.* "Thundercloud"
Japanese maple	*Acer palmatum*

Upper Canopy Deciduous

Dawn Redwood	*Metasequoia glyptostroboides*
American elm	*Ulmus americanas*
Red maple	*Acer rubrum*
American sweet gum	*Liquidambar* "Palo Alto"
London plane	*Platanus x acerfolia*

Lower Canopy Evergreen

Strawberry tree	*Arbutus* "Marina"
Bottlebrush	*Callistemon viminalis*
Toyon	*Heteromeles arbutifolia*
Southern magnolia	*Magnolia grandiflora*
Fruitless olive "Swan Hill"	*Olea europaea*
Catalina ironwood	*Lyonothamnus floribunda*
Magnolia "Little Gem"	*Magnolia grandiflora*
Japanese black pine	*Pinus thumbergiana*
Italian stone pine	*Pinus pinea*
*Coast live oak	*Quercus agrifolia*

Upper canopy Evergreen

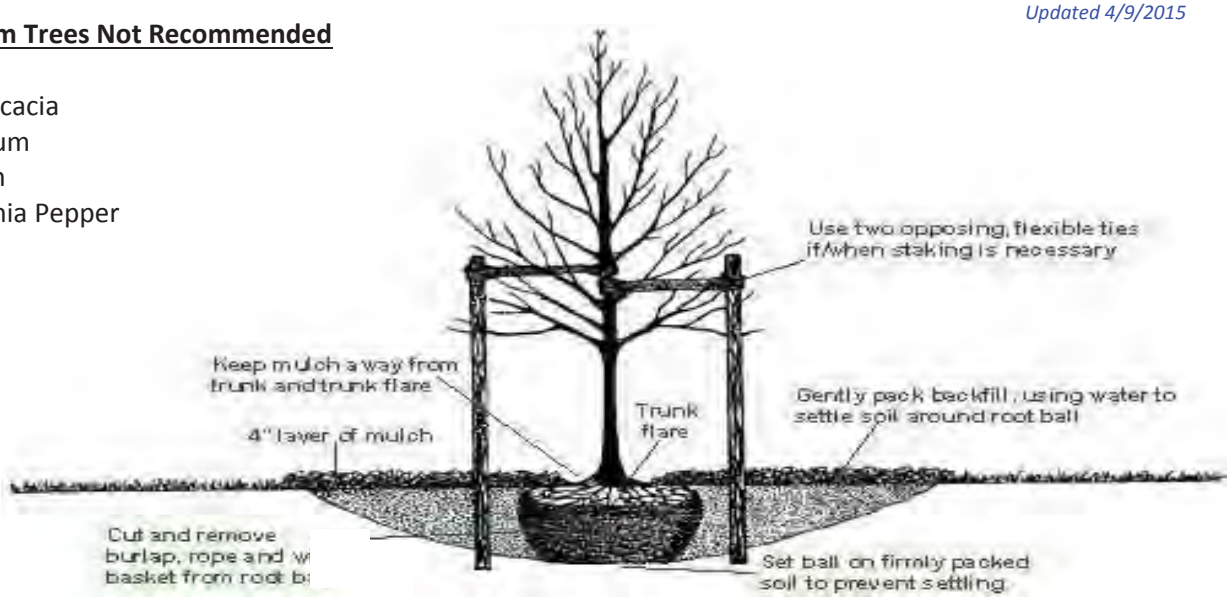
*Monterey pine	*Pinus radiata*
*Torrey pine	*Pinus torreyana*
*Monterey cypress	*Cupressus macrocarpa*
Canary island pine	*Pinus canariensis*
New Zealand Christmas tree	*Metrosideros excelsa*
Norfolk Island pine	*Araucaria heterophyla*
Deodar cedar	*Cedrus deodara*
Incense cedar	*Calocedrus decurrens*
Cork oak	*Quercus suber*
Atlas cedar	*Cedrus atlantica*

Native protected tree

Updated 4/9/2015

Problem Trees Not Recommended

Black Acacia
Blue Gum
Mayten
California Pepper



Updated 4/9/2015

LANDSCAPING GUIDELINES AND POLICIES

The Pacific Grove Landscape Guidelines and Plant Palette document is a guiding document with recommendations for landscape design, planting practices, and maintenance for the homeowner and to assist landscape and construction professionals. It provides an integrated approach to creating healthy, environmentally friendly landscapes for the Pacific Grove environment.

The final Landscape Guidelines and Plant Palette document was accepted in February 2016 by the Beautification and Natural Resources Commission.

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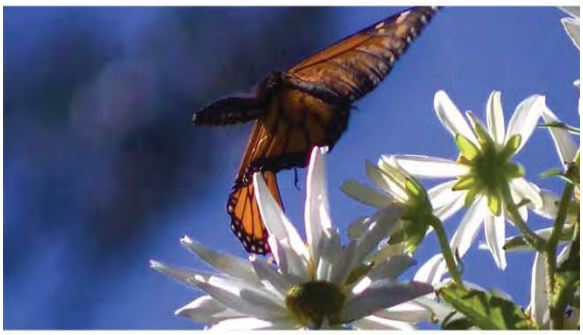
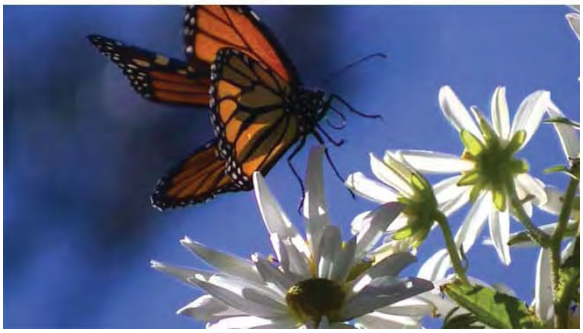
PACIFIC GROVE
LANDSCAPE GUIDELINES & PLANT PALETTE



FINAL VERSION

FEBRUARY 16, 2016



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City of Pacific Grove Planning
Oona Johnsen Landscape Architecture, Inc.

PACIFIC GROVE
LANDSCAPE GUIDELINES & PLANT PALETTE

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PACIFIC GROVE
LANDSCAPE GUIDELINES & PLANT PALETTE

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APPENDIX A

PLANT PALETTE

1.0 INTRODUCTION

1. INTRODUCTION
   1.1. Purpose of document

Located on the Central California Coast, the City of Pacific Grove provides habitat to special and unique flora and fauna while maintaining a population of 15,504 residents (2013) within 2.9 square miles and being a tourist destination. This small community provides an abundance of coastal access opportunities, outdoor recreational activities such as parks, golfing, and beach sport activities, historical interests, and a quaint, walkable downtown. Residents feel a strong sense of community pride and involvement.

The City was established in the mid-1880s with the arrival of the Southern Pacific Railroad. Houses for year-round occupancy were built, and a summer religious retreat was developed. Many distinct neighborhoods formed as population growth continued and preserving the architectural character of the neighborhoods has been important for the local community. The *Pacific Grove Historical Context Statement*, October 2011, provides a comprehensive overview of Pacific Grove's history with a specific emphasis on historic themes and patterns. It identifies and evaluates historic properties, as well as informs future preservation efforts.

Pacific Grove residents contend with a number of landscaping challenges. Drought conditions restrict availability and use of potable water. Non-native plantings are slowly being replaced with native species to ameliorate coastal erosion. And state and federal regulations of the Monterey Bay Marine Sanctuary limits storm water pollutants discharged into Monterey Bay and the designated Areas of Special Biological Significance.

Landscape design, planting practices, and maintenance can be challenging in this area for residents. Even with the persistent fog layer and cool, coastal temperatures, low rainfall amounts keep the area dry with the same drought conditions that the rest of California is battling. Promoting and providing resources to encourage the proper landscape design and environmentally friendly practices has become increasingly important.

The Pacific Grove Landscape Guidelines and Plant Palette document is a guiding document with recommendations for landscape design, planting practices, and maintenance for the homeowner and to assist landscape and construction professionals. It provides an integrated approach to creating healthy, environmentally friendly landscapes for the Pacific Grove environment.

Note: This document does not include the subject of trees. Information about trees is available on the City of Pacific Grove's web site: http://www.cityofpacificgrove.org/living/community-economic-development/planning/tree-permits

GOALS:

1. Encourage Landscapes That Fit With the Natural Conditions of Pacific Grove
2. Conserve Water
3. Promote Healthy Soils
4. Use Integrated Pest Management
5. Reduce Stormwater Flows and Pollutants
6. Protect and Enhance Native Plant and Wildlife Habitat and Diversity

This document was funded by Proposition 84 to improve the sustainability and livability of California's communities through the Strategic Growth Council's Urban Greening for Sustainable Communities Grant Program. It was written and produced by Oona Johnsen Landscape Architecture, Inc., a local landscape architect in conjunction with the City of Pacific Grove Public Works Department, with community input. Reference documents used are listed at the end of each chapter.

OONAJOHNSEN
LANDSCAPE ARCHITECTURE

1.2. Disclaimer

The information in Pacific Grove Landscape Guidelines and Plant Palette document is provided for consideration by property owners and landscape professionals in the course of designing, planting, and maintaining landscapes. The practices in these Guidelines are

strictly for use on a voluntary basis. They are not a substitute for the exercise of sound judgement and are not intended as recommendations for particular products or services.

1.3. City Planning References

The City of Pacific Grove has planning rules and regulations as well as permit requirements that may be needed for various landscape improvements. Below is a list of few that may be helpful. For more information, refer to the City's web site http://www.cityofpacificgrove.org or contact the City Planning Office, 831-648-3190, located at 300 Forest Avenue, 2nd Floor, Pacific Grove.

Quick Links to Community and Economic Development Department Information:
http://www.cityofpacificgrove.org/living/community-economic-development

All About Fences:

http://www.cityofpacificgrove.org/sites/default/files/general-documents/planning-bulletins-and-handouts/fences-information-bulletin.pdf

Butterfly Habitat:

http://www.cityofpacificgrove.org/sites/default/files/general-documents/planning-bulletins-and-handouts/cdd-7-butterfly-habitat.pdf

Coastal Zone:

http://www.cityofpacificgrove.org/sites/default/files/general-documents/planning-bulletins-and-handouts/cdd-17-coastal-zone.pdf

Environmentally Sensitive Habitat Areas:
http://www.cityofpacificgrove.org/sites/default/files/general-documents/planning-bulletins-and-handouts/cdd-35-esha.pdf

Privacy Design Guidelines:

http://www.cityofpacificgrove.org/sites/default/files/general-documents/planning-bulletins-and-handouts/information-bulletin-no.35-privacy-design-guidelines.pdf

Post-Construction Requirements for Stormwater:
http://www.cityofpacificgrove.org/living/community-economic-development/planning/stormwater

Tree Permit Facts:

http://www.cityofpacificgrove.org/sites/default/files/general-documents/planning-bulletins-and-handouts/cdd-28-treepermitfaq.pdf

Landscape Trees for Pacific Grove:
http://www.cityofpacificgrove.org/sites/default/files/general-documents/tree-permits/landscape-trees-handout-approved-bnrc-publication.pdf

Landscape Trees Brochure:

http://www.cityofpacificgrove.org/sites/default/files/general-documents/tree-permits/landscape-trees-brochure-approved-bnrc-publication.pdf

Landscape Trees Spreadsheet:
http://www.cityofpacificgrove.org/sites/default/files/general-documents/tree-permits/recommended-landscaping-tree-spreadsheet-one-page.pdf

Watering Guidelines: http://cemarin.ucanr.edu/files/174267.pdf

Tree Ring Irrigation Contraption:
http://ccuh.ucdavis.edu/public/drought/tree-ring-irrigation-contraption-tric-1/tree-ring-irrigation-contraption-tric

How to Help Trees Survive the Drought:
http://saveourwater.com/blog-posts/how-to-help-trees-survive-the-drought/

Rainwater and Graywater Harvesting and Reuse:

To understand the permitting process for rainwater and graywater harvesting and reuse, contact the City of Pacific Grove Planning Office, 831-648-3190, located at 300 Forest Avenue, 2nd Floor, Pacific Grove.

1.3.1. RainScapes

RainScapes is a program of the City of Pacific Grove established in summer of 2015 with funding support from the State Water Resources Control Board. RainScapes are a vital

component of the City's stormwater management efforts required by the Stormwater Permit (under the federal Clean Water Act) and the State of California's ASBS regulations.

A RainScape is a landscape that uses Low Impact Development (LID) techniques to slow down and clean stormwater runoff from individual properties.

RainScapes help to:

1. Reduce and filter stormwater runoff in your neighborhood by capturing rain water and releasing it at a slower rate from your property.
2. Protect our community, fish, and other marine wildlife by keeping pollutants such as oil and grease from driveways and pesticides and fertilizers from lawns from entering the Monterey Bay.
3. Improve water quality by preventing bacterial contamination from bird droppings entering the stormwater system.
4. Provide wildlife habitat for beneficial insects and birds
5. Beautify your home and urban landscape

RainScapes
Landscapes for Healthy Watersheds

RainScapes Program:

http://www.cityofpacificgrove.org/living/green-pg/rainscapes-rebate-program

Design Guidelines for:

1. Roof Downspout Direction
2. Creating Rain Gardens
3. Rain Water Harvesting
4. Replacement of Impervious Surfaces with Pervious Surfaces
5. New Tree Planting
6. Gull Rooftop Deterrents

2.0 ENVIRONMENT OF PACIFIC GROVE

2. THE ENVIRONMENT OF PACIFIC GROVE

Understanding the environmental conditions of Pacific Grove will not only help residents and landscape and construction professionals choose the appropriate plants for local landscapes, it will deepen the appreciation and pride in where we live. The result will be a luscious, boastful garden that is beautiful for the owner, providing value to beneficial wildlife, keeping the Monterey Bay National Marine Sanctuary cleaner, promoting coastal native plant species, using no or little potable water, and less maintenance than typical gardens.

It is difficult to indicate every nature resource that Pacific Grove offers. This section will describe a general sense of the environment, including the significant native plant communities, the general wildlife, climate, geology and soils, watersheds, topography, and urban conditions. This information will help residents learn about their immediate environment and make insightful decisions about landscape design improvements.

If your property is located within the Coastal Zone, as indicated in the map in figure 2.0, specific requirements regarding plant species and other components to landscape improvements must be considered. Contact the Pacific Grove Planning Department for more information: phone: (831) 648-3190; address: 300 Forest Ave (Second Floor), Pacific Grove, CA 93950.

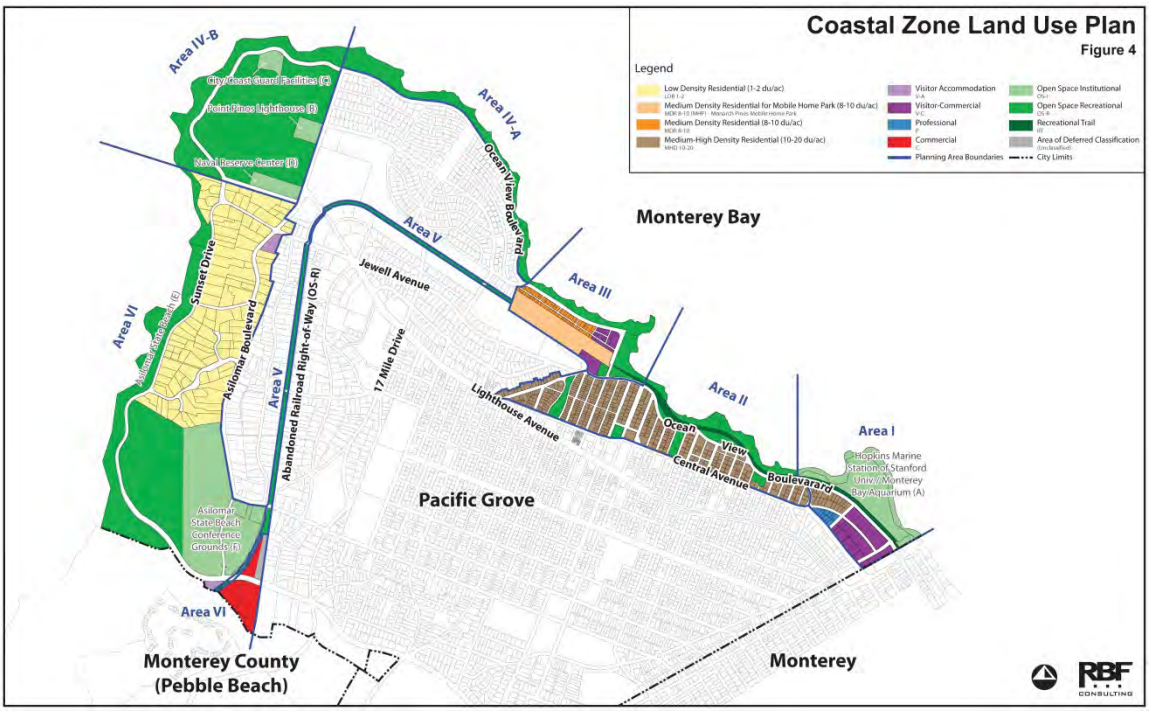


Figure 2.0 – Coastal Zone Area

2.1. Precipitation and Temperature

The climate of Pacific Grove is regulated by its proximity to the Pacific Ocean, culminating in a warm-summer Mediterranean climate (Köppen climate classification: Csb). As a result, Pacific Grove's average high temperature ranges from around 61°F in winter to 72°F during the summer months.

Average annual precipitation is approximately 19.73 inches (501.1 mm), with most rainfall occurring during the wet season between November and April, while little or no precipitation falls during the summer months. There is an average of 70 days with measurable precipitation annually. See Figure 2.1. Summers in Pacific Grove are more likely to be cool and foggy. Landscape plants can be categorized by Sunset Zone 17.

Climate data for Monterey/Pacific Grove													
Month	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Year**
Record high °F (°C)	90 (32)	86 (30)	85 (29)	93 (34)	95 (35)	101 (38)	98 (37)	96 (36)	101 (38)	104 (40)	95 (35)	89 (32)	104 (40)
Average high °F (°C)	59.9 (15.5)	61.3 (16.3)	61.9 (16.6)	63.1 (17.3)	64.3 (17.9)	66.5 (19.2)	67.5 (19.7)	68.8 (20.4)	71.5 (21.9)	70.1 (21.2)	65 (18)	60.2 (15.7)	65 (18)
Average low °F (°C)	43.4 (6.3)	44.4 (6.9)	45 (7)	45.8 (7.7)	47.9 (8.8)	50.2 (10.1)	51.9 (11.1)	52.8 (11.6)	52.8 (11.6)	50.7 (10.4)	46.9 (8.3)	43.6 (6.4)	48 (9)
Record low °F (°C)	22 (−6)	26 (−3)	32 (0)	35 (2)	35 (2)	41 (5)	43 (6)	45 (7)	41 (5)	35 (2)	30 (−1)	20 (−7)	20 (−7)
Precipitation inches (mm)	4.46 (113.3)	3.32 (84.3)	3.20 (81.3)	1.45 (36.8)	0.5 (13)	0.18 (4.6)	0.06 (1.5)	0.08 (2)	0.24 (6.1)	0.85 (21.6)	2.07 (52.6)	3.32 (84.3)	19.73 (501.1)
Avg. precipitation days (≥ 0.01 in)	11	10	10	6	4	3	2	2	2	4	7	10	70
Source #1: WRCC (temperature 1981–2010, precipitation and extremes 1906–present) http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?ca5795													
Source #2: Weather Channel http://www.weather.com/outlook/health/achesandpains/climatology/monthly/USCA0724?from=36hr_newslinker2													

Figure 2.1 - Climate data for Monterey/Pacific Grove

2.2. Geology and Soils

Sand is the main component of soil in Pacific Grove refer to Figure 2.2. These soils tend to have high infiltration (fast draining) and are often low in nutrients. See Figure 2.3 to review the range of infiltration characteristics found in Pacific Grove soils. According to the Web Soil Survey from the SDA Natural esources Conservation Service (N CS) soils in Pacific Grove range from hydrologic soil group[1] A (higher infiltration potential) in the lower portions of the watersheds near the ocean and D (lower infiltration potential) mainly located in the upper portions of the watersheds. nderlays of sandstone and bedroc layers reduce the infiltration capacity in these areas. nowing the type of soil and its infiltration rate is important to understanding proper soil amendment. For more detailed information refer to Section 4.0 Soils Soil Amendments and Fertilizers.

[1] Hydrologic soil groups (HSG) refer to soils grouped according to their runoff potential. The soil properties that influence this potential include depth to a seasonal high water table, the infiltration rate, and depth to a layer that significantly restricts the downward movement of water. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. http://websoilsurvey.sc.egov.usda.gov, last accessed September 2013

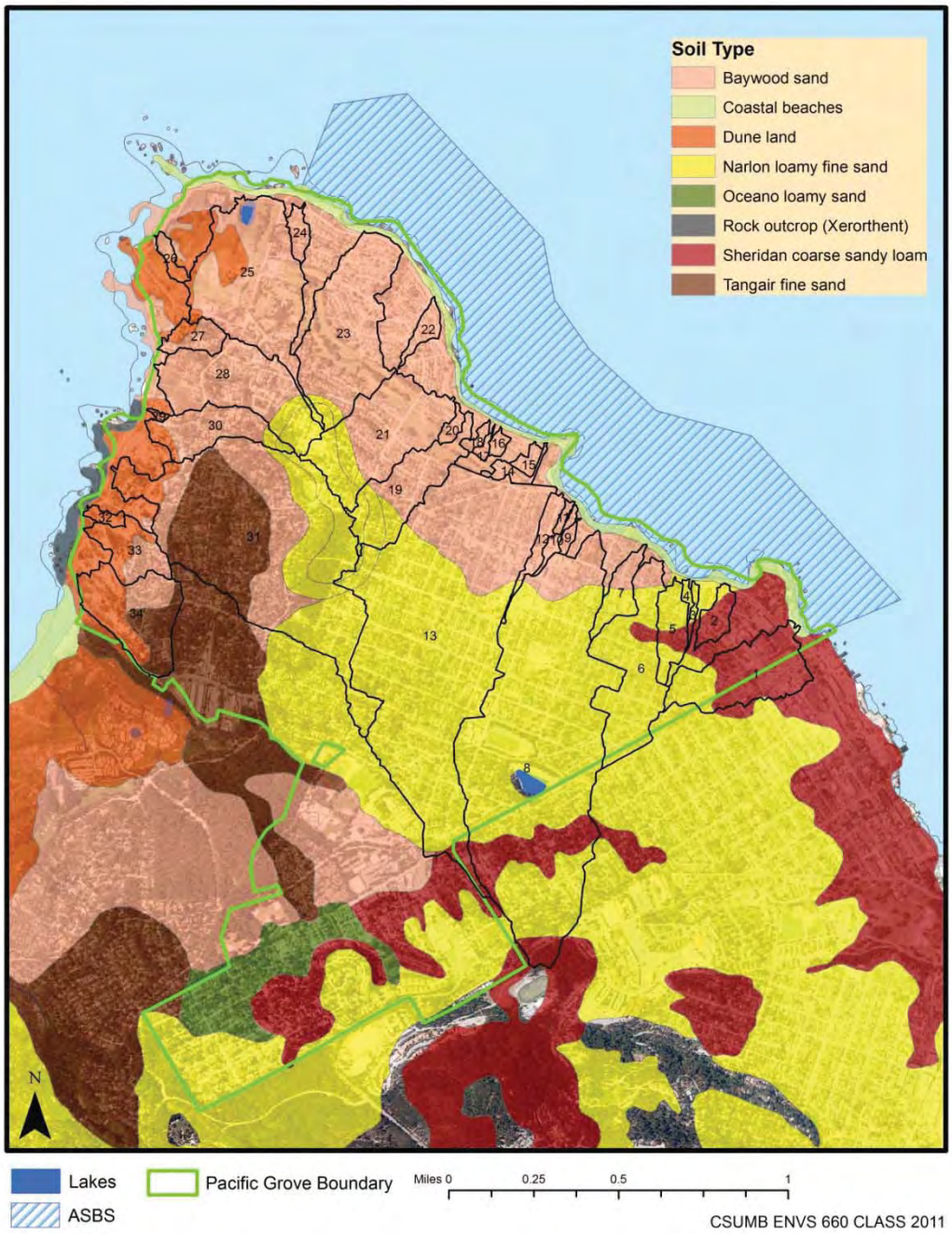


Figure 2.2 - Surface soil types located in the City of Pacific Grove, CA. The dominant soil texture is sand, with variable drainage rates. Stratified layers of less permeable soil may exist below the soil types presented in this map. Soil data source: NRCS, SSURGO 2006.

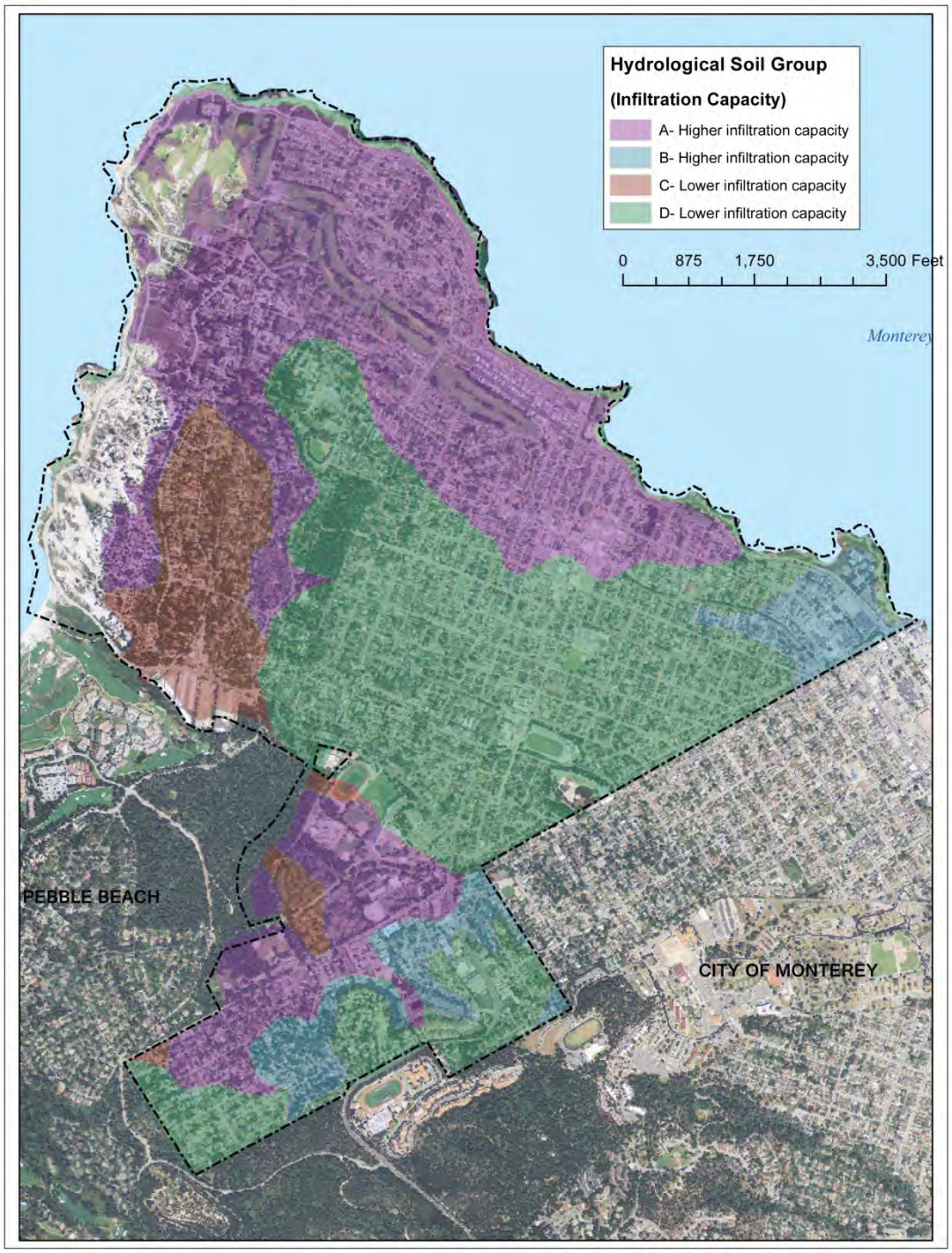


Figure 2.3 - Distribution of Hydrological Soil Groups (infiltration capacity) in the Greenwood Gulch Watershed. Hydrological soil group data: NRCS, SSURGO

2.3. Watersheds

Stormwater runoff in Pacific Grove drains into the Monterey Bay National Marine Sanctuary (MBNMS). And a large area of the City drains into the Area of Special Biological Significance (ASBS) a State designated area within the MBNMS. efer to Figure 2.4.

The watersheds of Pacific Grove are shown in Figure 2.5. Each colored area indicates a watershed. The red lines inside the watershed indicate the stormwater mainline pipe system. The red dot at the coast represents the storm drain outfall location and size. nderstanding where your property drains to will help you be more aware about where your stormwater flows and how it affect the environment.

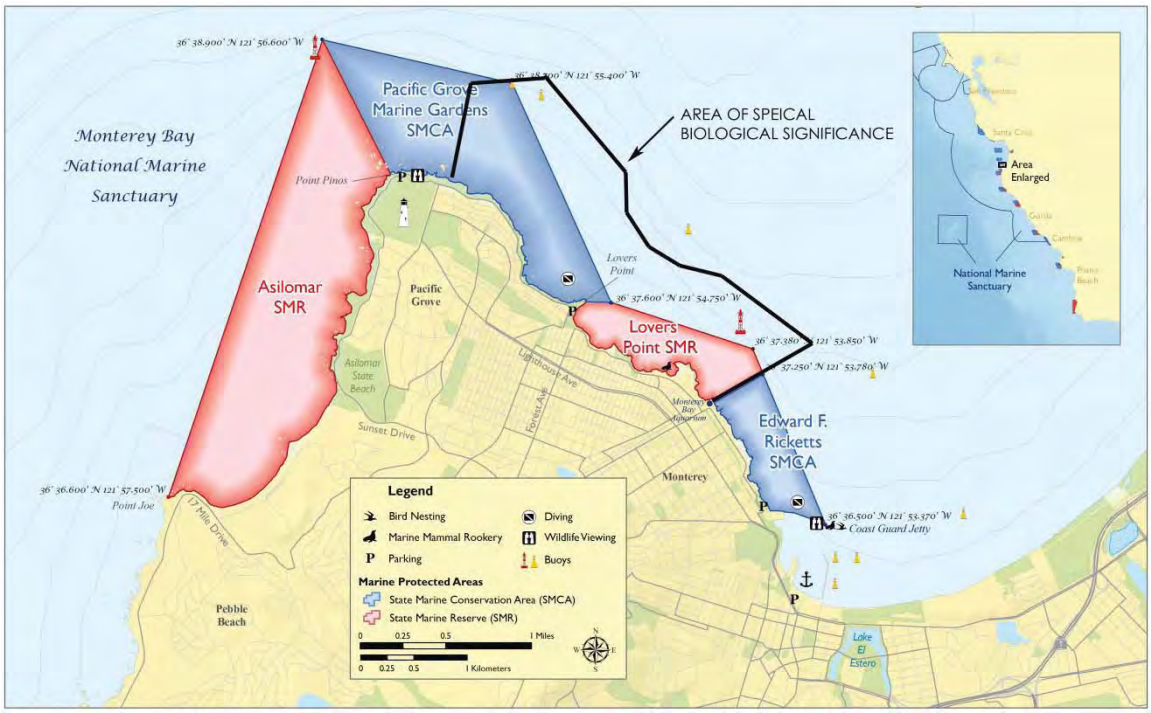


Figure 2.4 - Map of Monterey National Marine Sanctuary and other marine protected areas.

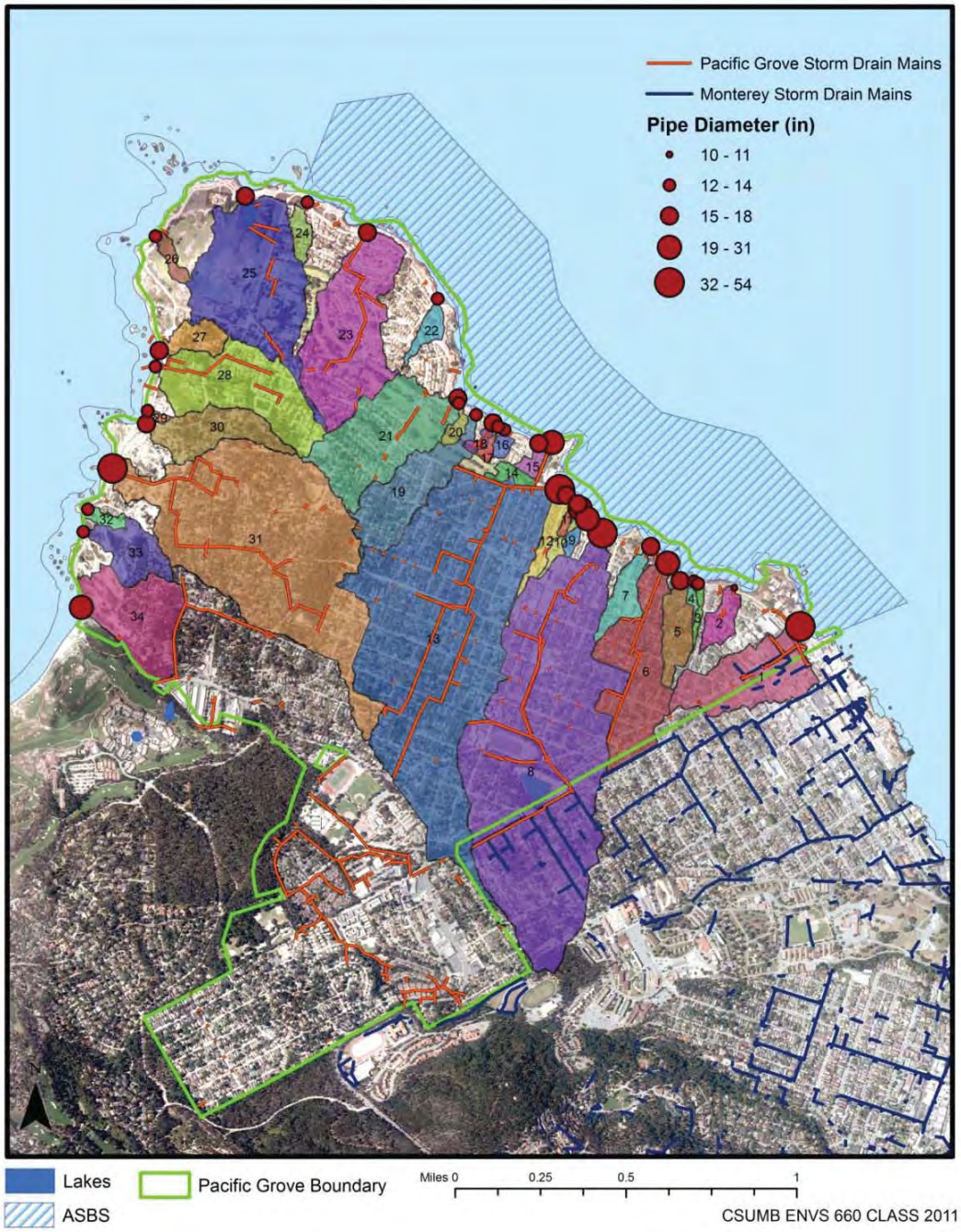


Figure 2.5 - Watershed boundaries in the City of Pacific Grove, CA, shown over aerial imagery. Each watershed terminates at a storm drain outfall along the Pacific Ocean coastline. Watersheds are colored, and numbered east to west based on outfall location. Aerial image source: NAIP 2009.

2.4. Topography

Figure 2.6 shows slope calculations in Pacific Grove. The ma ority of the watershed slopes range between 3-7 with higher slopes in the urban areas of Pacific Grove. This type of topography indicates positive drainage of stormwater. Depending the residential landscape topographical conditions not all properties are suitable for every stormwater management design solutions. efer to the ainScapes Design Guidelines for more information on the feasibility of the different design strategies (http //www.cityofpacificgrove.org/living/green-pg/rainscapes-rebate-program/design-guidelines).

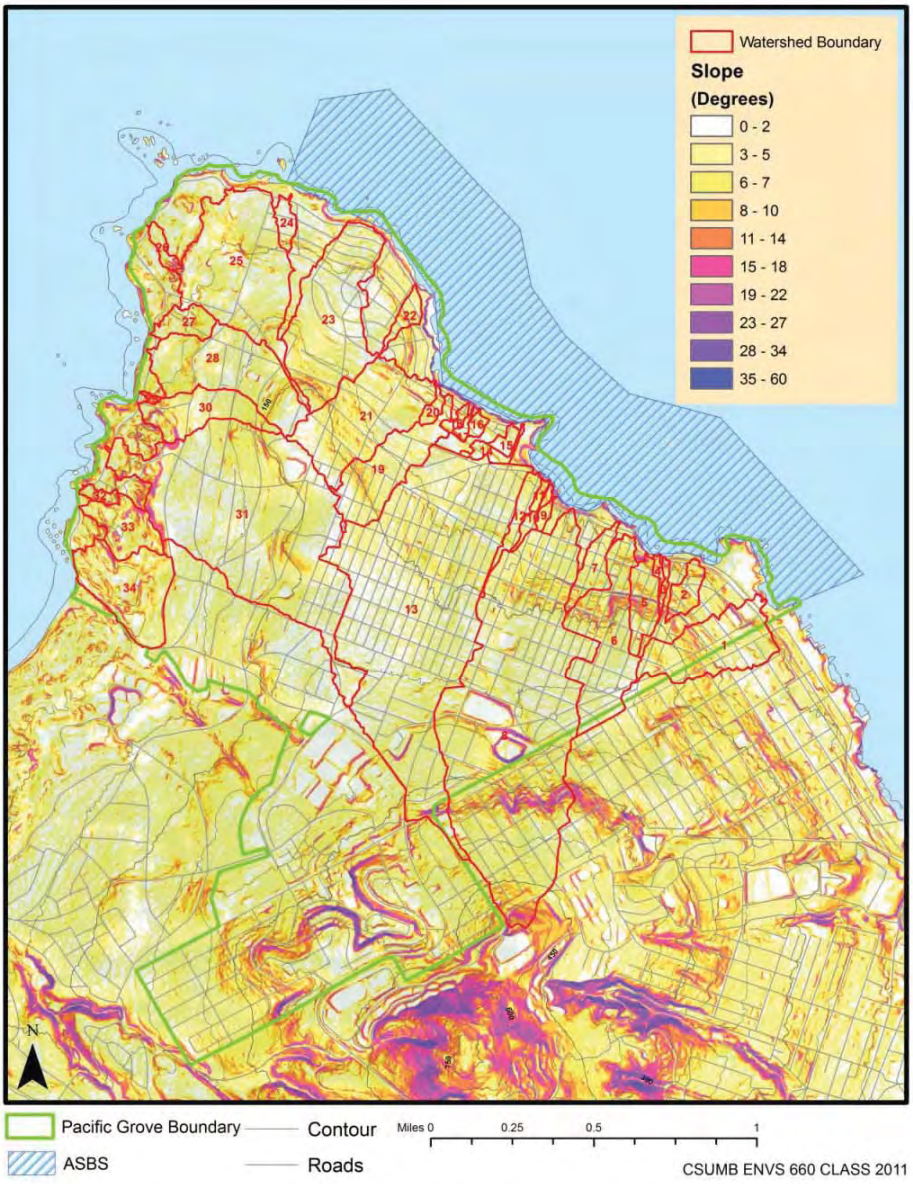


Figure 2.6 - Terrain slope in the City of Pacific Grove, CA, derived from a 3m DEM. Approximately 25% of the land within the Pacific Grove city limits is flat (0-2 degrees). Elevation data source: USGS, NED 2010

2.5. Impervious Surfaces

Figure 2.7 delineates all the impervious surfaces in Pacific Grove. Impervious surfaces are surfaces that do not allow infiltration of stormwater primarily rooftops roads and driveways and as the map indicates they are concentrated in the urbanized downtown areas. Green spaces and green corridors are limited to city par s and open spaces the municipal golf course cemetery school fields and protected coastal areas and beaches. Some neighborhoods in Pacific Grove have larger lots with more landscape areas towards the northwest and southwest. The more impervious surfaces homeowners can remove and replace with pervious surfaces the better for the environment. efer to the ainScapes Design Guidelines for more information on how to design more pervious surfaces in your landscape (http //www.cityofpacificgrove.org/living/green-pg/rainscapes-rebate-program/design-guidelines/replacement-impervious-surfaces-pervious).

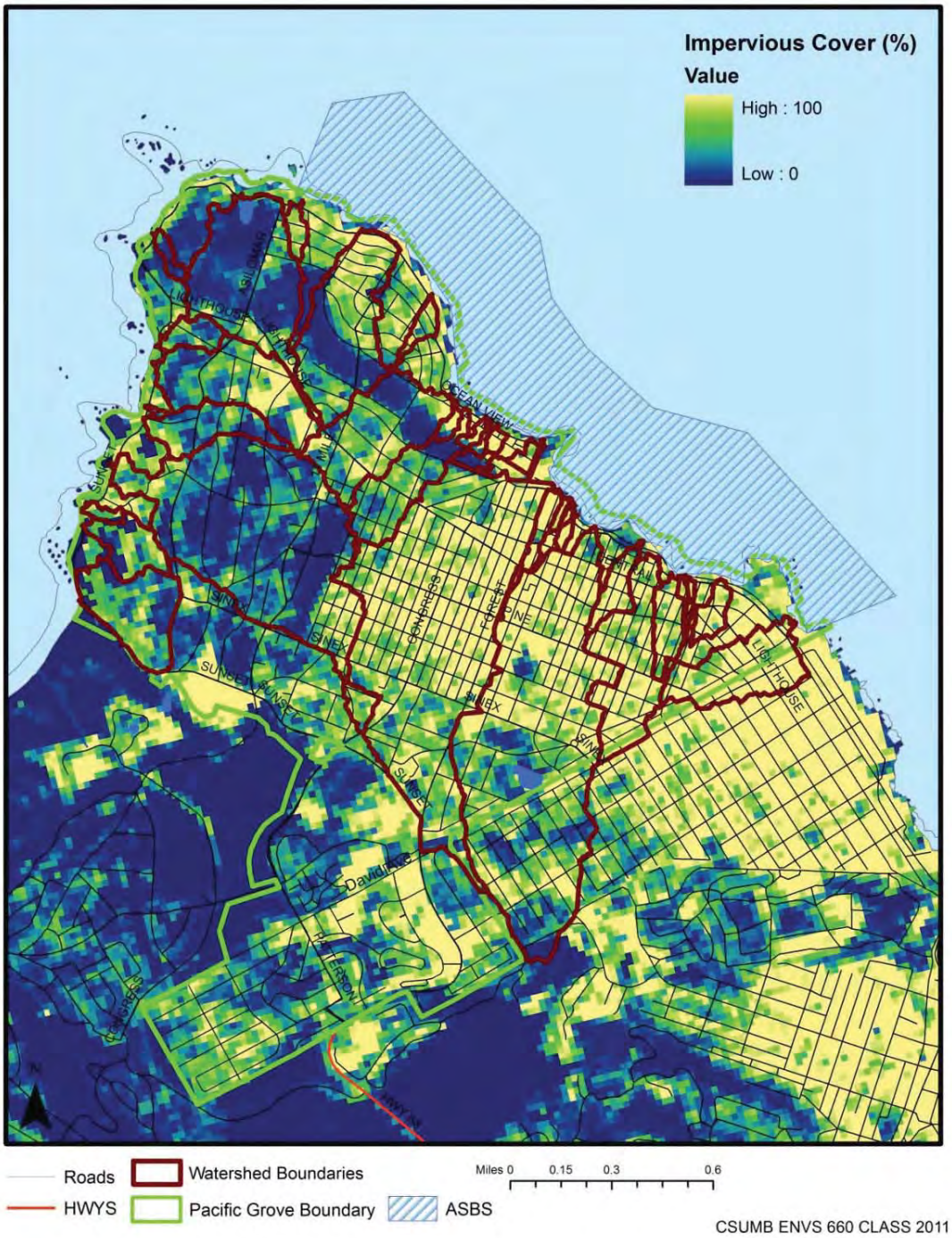


Figure 2.7 - Impervious cover in the City of Pacific Grove, CA. Impervious cover values are higher in areas where urban development is concentrated and are lower towards the northwest and southwest ends of the city. Data source: USGS, NLCD 2006

2.6. Native Plant Communities

There are a variety of native vegetation communities in Pacific Grove. The location of each community depends on soil type proximity to the ocean wind exposure sun aspect as well as elevation. The significant plant communities are Marine Coastal Dune Maritime Chaparral and Monterey Pine and Bishop Pine Woodlands. There are also riparian communities around drainage ways water-loving plants around groundwater seeps and ephemerals ponds throughout watersheds. Each community is briefly described below. If you can relate your residential landscape area to a native plant community you will be able to realize what plants grow perfectly in your environment.

2.6.1. Marine

There is approximately 4.5 miles of coastline where marine plant communities are located within the ocean tidal zones. These plants are special in that they are able to survive in very harsh and exposed conditions along the ocean coast. Furthermore most plants are able to tolerate sea spray and/or inundations of salt water and in the case of seaweed and sea grasses some species are able to survive the inundation of salt water. These areas also provide habitat for marine biological communities within tide pools harbor seals and various birds.

The coastal area waters are protected with the following designations listed below. efer to Figure 2.8

- **A S S** (ASBS) 3.2 miles of Pacific Grove shoreline between the Monterey Bay Aquarium and Point Pinos (at Asilomar Avenue) as defined in the California Ocean Plan. This is California State ASBS 19 or the Pacific Grove ASBS.
- **L P S M R** Marine waters of Monterey Bay ad acent to the shoreline between the Monterey Bay Aquarium and Lovers Point as defined by the California Department of Fish & Game during the first phase of the Marine Life Protection Act Initiative. It covers 0.30 square miles.
- **P G M G S M C A** Marine waters of Monterey Bay and the Pacific Ocean ad acent to the shoreline from Lovers Point to Point Pinos as defined by the California Department of Fish & Game during the first phase of the Marine Life Protection Act Initiative. It covers 0.93 square miles.
- **A S M R** Marine waters from Point Pinos to Point oe in Pebble Beach as defined by the California Department of Fish & Game during the first phase of the Marine Life Protection Act Initiative. It covers 1.51 square miles.

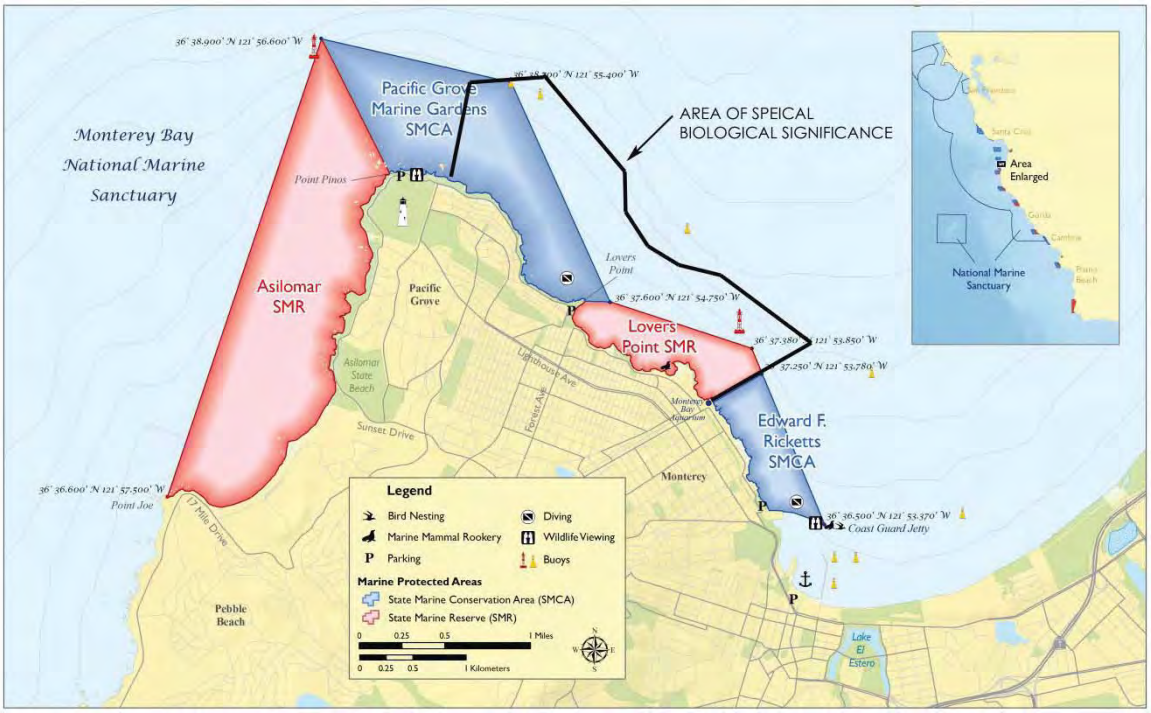


Figure 2.8 - Map of Monterey National Marine Sanctuary and other marine protected areas.

Plants in the marine community are threatened by non-native invasive species. emoving coastal invasive species such as ice plant and replanting with the appropriate native species will help the native marine species establish and thrive. A good example of such efforts can be found along the Asilomar Dunes Natural Preserve across from Asilomar State Beach. For more information visit the California Par s and ecreation website about Asilomar State Beach http //www.par s.ca.gov/ page id 566

This is also the zone where stormwater outfall pipes are located. When rain events occur all stormwater from the suburban areas of Pacific Grove is directly deposited in

the ocean. rban pollutants and sediments deposited in these locations threaten the health of the environment and the health of waters. Section 5.7 of the Planting Guidelines addresses ways to use landscape design to limit stormwater runoff and protect the Monterey Bay.

For more information on Natural esource Areas of Pacific Grove including the Marine environment http //www.pacificgrovelibrary.org/sites/default/files/general-documents/beautification-and-natural-resources-commission/pg-nr-report-w-maps.pdf

2.6.2. Coastal Dune

The dune landscape community is upland from the marine shore and contains sand dune landforms with lower growing plants. These plants are special in that they are able to survive in very harsh and exposed conditions along the ocean coast being able to tolerate sea spray low nutrient availability and the struggle to anchor roots in unstable/moving soil conditions. The Pacific Grove dunes are home to federally endangered Menzies Wallflower and Tidestorm s Lupine and federally threatened Monterey Spineflower. A good example of restoration efforts can be

seen at the Point Pinos eservation Dunes managed by the Pacific Grove Municipal Golf Course the Point Pinos Lighthouse grounds and the Asilomar State Conference Center grounds.

For more information on Natural esource Areas of Pacific Grove including the Coastal Dune environment
http //www.pacificgrovelibrary.org/sites/default/files/general-documents/beautification-and-natural-resources-commission/pg-nr-report-w-maps.pdf

The Monterey Bay Native Plant Society eeps a list of plant species in various par s and open spaces throughout the region. The plants listed in the Point Lobos State eserve and Spanish Bay would be characteristic for the Coastal Dune plant community.

List of plants from Point Lobos State eserve

http //montereybay.cnps.org/documents/plantlists/PlantList_PointLobosState_eserve_2012.pdf

List of plants from Spanish Bay
http //montereybay.cnps.org/documents/plantlists/PlantList_SpanishBay_2012.pdf

2.6.3. Maritime Chaparral

Maritime chaparral is a shrub land plant community lin ing the sea coast to the woodlands. Plants thrive on exposed windy conditions with nutrient poor soils. Arctostaphylos species (Manzanita) are distinctive to this plant community.

The Monterey Bay Native Plant Society eeps a list of plant species in various par s and open spaces throughout the region. The plants listed in the Fort Ord BLM Lands would be characteristic for the Marine Chaparral plant community.

efer to the list of plants from Fort Ord BLM Lands
http //montereybay.cnps.org/documents/plantlists/PlantList_FortOrdBLM_2012.pdf

2.6.4. Monterey Pine Woodlands

The Monterey pine woodland are the forested inland areas overloo ing the coast. The Monterey pine stands can be mixed with other tree species such as Bishop Pine (Pinus muricata) Monterey Cypress (Cupressus macrocarpa) and uercus agrifolia (Coast Live Oa).

Monterey pine woodlands located in the Monterey area exhibit greater species richness and variety than in other populations. Shrubby species such as manzanitas (Arctostaphylos spp.) huc leberry (accinium ovatum) salal (Gaultheria shallon) ceanothus (Ceanothus spp.) moc heather (Ericameria spp.) and coyote brush (Baccharis pilularis) share the understory with native grasses sedges rushes and several special status species of plants in the Monterey population resulting in a diverse and important ecological resource.

Image Top: Monterey Pine
Image Middle: Bishop Pine
Image Bottom: Coast Live Oak

The Monterey pine is susceptible to a wide range of pests and diseases. Most of these pests and diseases have evolved with the native stands of Monterey pine and do not pose serious threats to the overall health and integrity of Monterey pine forest. These native insects and diseases are important in the maintenance of ecological functions in Monterey pine forests due to their roles in processes such as nutrient cycling and provision of coarse woody debris. However a relatively recently introduced pathogen the pitch can er fungus (Fusarium circinatum a a F. subglutinans ssp. pini) has heightened concern for the species.

Source: Biological Resources of the Del Monterey Forest, Monterey Pine and Monterey Pine Forest Habitat, Del Monte Forest Preservation Plan, Prepared by Zander Associates, 2002

The Monterey Bay Native Plant Society eeps a list of plant species in various par s and open spaces throughout the region. The list from the SFB Morse Botanical eserve and ac s Pea County Par would be characteristic for the Monterey Pine & Bishop Pine woodland plant community.

efer to the list of plants from SFB Morse Botanical eserve
http //montereybay.cnps.org/documents/plantlists/PlantList SFB-MorseBotanical eserve 2012.pdf

efer to the list of plants from ac s Pea County Par
http //montereybay.cnps.org/documents/plantlists/PlantList ac sPea CountyPar 2012.pdf

2.7. Wildlife

Pacific Grove provides habitat for a variety of wildlife. It is one of the largest overwintering sites for monarch butterflies which are present from November to March the dunes are home to the rare blac legless lizard and the abundance of shoreline nesting habitat attracts seabird and shorebirds in turn attracting bird watchers and

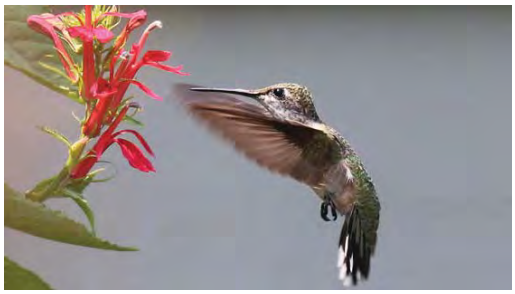
ornithologists from all over the world.

Typical urban wildlife is present in Pacific Grove such as raccoons squirrels and domesticated animals. There are also groups of blac -tailed mule deer that frequent the neighborhoods and eat most landscape plants.

Along with migratory birds there are ays blac birds and Western Gulls. Gulls are most present near the coast perching and nesting on building rooftops. See http //www.par s.ca.gov/pages/566/files/Bird List-Asilomar State Beach and Conference Grounds.pdf for a list of local birds.

Also present are beneficial birds/insects such as hummingbirds butterflies and bees. See http //www.s gov.org/solidwaste/pdf 20folder/10 20Most 20Wanted 20Bugs 20Brochure.pdf for a list of beneficial garden insects.

Pacific Harbor Seals and a rare sighting of Elephant Seals may be found along the coastal beach roc outcroppings or on the beaches at low tide.

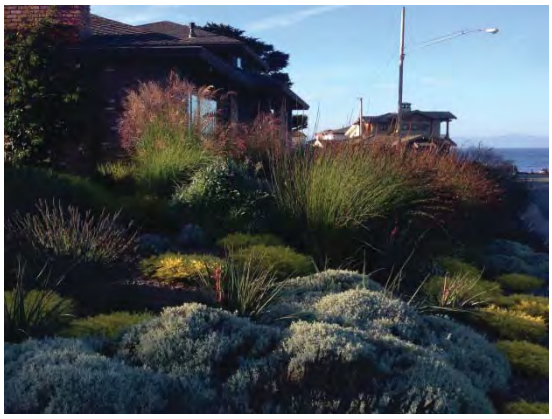


There are rare sightings of blac bears and mountain lions. Coyote uail Wild Boar Wild Tur ey and Bob Cats are typically seen further inland but may also occasionally be found at the coast.

For more information on the urban effects on wildlands please refer to the following web site http //www.par s.ca.gov/pages/23071/files/urbaneffects.pdf

IRRIGATION

3. I IGATION



In California about half of urban water is used for landscape irrigation. Substantial potable water reduction can be gained by proper design and maintenance of landscapes and irrigation systems. Irrigation water should be applied to the root zone of the plants at a rate that can be absorbed into the soil at the right time and in the correct amount for plant health. This section will give an overview of what is needed for an efficient irrigation system and provide pertinent resources for further information.

Irrigation or hand watering will be needed during the first two years of plant establishment. Extra water at the time of planting and for a few months after planting will help the roots adapt from a nursery container condition into the new surrounding soils of your landscape. Once plants are established irrigation and watering can be reduced or limited to the dry seasons of the year.

ey eferences

1. efer to the Monterey County Irrigation section for irrigation design advice
   http //www.montereylandscaping.org/Garden- esources/IrrigationIntro.php
2. efer to the Monterey County Watering Guide for basic watering information tips device types irrigation challenges and sample irrigation schedules
   http //www.montereylandscaping.org/Watering-Guide/
3. The California Department of Water esources has developed the Model Water Efficient Landscape Ordinance to help conserve water in landscapes. The revised ordinance was approved by the California Water Commission on uly 15 2015
   http //www.water.ca.gov/wateruseefficiency/landscapeordinance/docs/Title 2023 20 extract 20- 20Official 20CC 20pages.pdf. The purpose is to
   a. Promote the values and benefits of landscaping practices that integrate and go beyond the conservation and efficient use of water
   b. Establish a structure for planning designing installing maintaining and managing water efficient landscapes in new construction and rehabilitated pro ects by encouraging the use of a watershed approach that requires cross-sector collaboration of industry government and property owners to achieve the many benefits possible

c. Establish provisions for water management practices and water waste prevention for existing landscapes
d. se water efficiently without waste by setting a Maximum Applied Water Allowance as an upper limit for water use and reduce water use to the lowest practical amount
e. Promote the benefits of consistent landscape ordinances with neighboring local and regional agencies
f. Encourage local agencies and water purveyors to use economic incentives that promote the efficient use of water such as implementing a tiered-rate structure
g. Encourage local agencies to designate the necessary authority that implements and enforces the provisions of the Model Water Efficient Landscape Ordinance or its local landscape ordinance

If you choose to install a new irrigation system or a retrofit an existing system and you are unsure how to incorporate an irrigation system into a design consult with an irrigation specialist or licensed landscape contractor.

If you have an existing irrigation system it is recommended it be audited based on the current conditions of your landscape and the conditions of your new landscape design. Auditors can evaluate your system and your landscape to ensure you are using the settings properly and optimize them. Certified Landscape Irrigation Auditors are available in the Monterey area and California American Water and the Monterey Peninsula Water Management District (MPWMD) provide audits and landscape water budgets free of charge to all residential users of California American. efer to website http //www.montereywaterinfo.org/residentialwateruse.html

3.1. Irrigation Types

The most efficient irrigation systems use low-volume or drip irrigation methods that apply water directly to the root zone rather than spraying water into the air where it can evaporate before reaching the soil or runoff along pavements. It is recommended to use subsurface irrigation systems which include drip tube drip emitters or a micro-spray irrigation system. Some drip tube can be buried underground per manufacturer s recommendations. If using drip emitters sta e firmly in place and situate the emitter at the root ball not at the plant stem as it will cause rot.

Different types of plants may require a different type of irrigation system for instance in the case of lawn and trees. efer to the Monterey County Other Types of Irrigation

Systems for additional information http //www.montereylandscaping.org/Garden- esources/IrrigationType.php

3.2. Hydrozones

Hydrozoing is placing plants with similar water needs within the same irrigation zone or valve area. For example lawn areas and trees should be on separate valves from the rest of the landscape. The planting design should ta e this concept into consideration as it helps to conserve water and prevents overwatering of plants.

The Plant Palette in Section 6.0 contains a water use category per the Water se Classification of Landscape Species (W COLS) this category will help identify plants with similar water requirements.

efer to Monterey County Plant Water Needs for additional information http //www.montereylandscaping.org/Garden- esources/WaterNeeds.php

3.3. Controller Scheduling

Inefficient irrigation and incorrect scheduling account for the largest residential potable water waste. It is important to understand your irrigation controller and how to ad ust it as needed. If you need assistance consider having an irrigation auditor evaluate your system. efer to Section 3.0 for more information.

Plants will need extra water to establish. This is called the Establishment Period. Ad ust your irrigation controller to accommodate this growth. Within two growing seasons or earlier upon observation ad ust your controller settings to reduce the amount of irrigation for your plants.

It is important to continue to monitor and observe the plants so you can continue to ad ust the controller settings appropriately. The goal is to achieve plant health with low potable water use.

Monterey County Water estrictions

- In Monterey County it is advised to set watering schedules at night between 5 PM and 9 00 AM. This will prevent water loss through evaporation due to hot dry or windy conditions.
- Watering days are limited to Wednesday and Saturday

Chec the California American Water website for updates or modifications to water restrictions http //www.amwater.com/caaw/page22725.html Monterey

3.4. Other Water Saving Devices

3.4.1. Weather-Based Irrigation Controllers

These special controllers use weather-based data to ad ust irrigation settings to be more efficient.

efer to Monterey County Smart Irrigation Controllers for additional information http //www.montereylandscaping.org/Garden- esources/SmartControllers.php

3.4.2. ain Sensors

A rain sensor is a small device that turns off the automated irrigation system when it is activated by rain. Ma e sure to install the sensor in an area that is clear from overhangs and tree branches.

California American Water and MPWMD offer these devices free of charge. efer to website http //www.montereywaterinfo.org/residentialwateruse.html

3.4.3. Soil Moisture Sensors

A soil moisture sensor can be connected to the irrigation controller. It measures the volumetric water content in soil. It senses when your landscape needs moisture will allow the next scheduled watering cycle. If there is enough moisture it will prevent the irrigation system from running. These devises are useful for lawns.

3.5. Alternate Water Sources

sing available non-potable water sources is an excellent way to supplement potable water use or even replace the use of potable water depending on the design of the system. esidential alternative water sources for landscape irrigation are explained below.

3.5.1. ainwater

ainwater harvesting captures diverts and stores stormwater runoff for later use. Capturing even a small amount of your roof runoff will have environmental benefits including reducing demand on your potable water supply and reducing stormwater runoff flowing into storm drains and surface waters. ainwater can be collected in rain barrels or cisterns and stored for landscape irrigation. The Pacific Grove ainScapes program has design guidelines available for rainwater harvesting systems. efer to the website http //www.cityofpacificgrove.org/living/green-pg/rainscapes-rebate-program/design-guidelines/rainwater-harvesting-rain-barrels-and

3.5.2. Graywater

Graywater is wastewater from laundry machines showers bathtubs and bathroom sin s that can be reused for subsurface irrigation. Graywater irrigation has specific design guidelines to protect public health and environmental health. More information about designing code compliant graywater systems can be found at the Central Coast Greywater Alliance http //centralcoastgreywater.org/

If you are interested in a low-tech solution to collect graywater some ideas are below. Can you thin of other ideas to use wastewater

- Place a basin in the bottom of your bathroom sin and pour in the landscape when it s full.
- Place a basin in the bottom of your itchen sin when washing salad fruits or vegetables and pour in the landscape when it s full.
- While you are waiting for your shower water to heat up place a watering can under the spout and collect the cold water. Water your landscape when it s full.
- The wastewater from your laundry can be routed to your landscape. efer to this video on how to do this http //oasisdesign.net/greywater/laundry/index.htm video

For detailed information regarding required setbac s for greywater tan s greywater irrigation fields and greywater disposal fields see Chapter 16 of the California Plumbing Code http //www.iapmo.org/2013 20California 20Plumbing 20Code/Chapter 2016.pdf

3.6. eferences

- Monterey Water Conservation http //www.montereywaterinfo.org/landscapingWater se.html
- Water se Classification of Landscape Species (W COLS) http //ucanr.edu/sites/W COLS/
- Monterey County Watering Guide http //www.montereylandscaping.org/Watering-Guide/
- Water Smart Gardening in Santa Cruz County http //www.santacruz.watersavingplants.com
- Monterey County Waterwise Landscaping http //www.montereylandscaping.org
- The Irrigation Association https //www.irrigation.org/
- The Irrigation Association Landscape Irrigation Best Management Practices https //www.irrigation.org/uploadedFiles/Standards/BMPDesign-Install-Manage.3-18-14(2).pdf

- Central Coast Greywater Alliance http //centralcoastgreywater.org/
- Drought Tip se of Graywater in rban Landscapes in California http //anrcatalog.ucanr.edu/pdf/8536.pdf
- Smart from the Start (Irrigation Design) http //www.h2ouse.org/tour/smart-from-the-start.cfm
- Irrigation Design Tutorials http //www.irrigationtutorials.com/
- C Guide to Healthy Lawns http //www.ipm.ucdavis.edu/TOOLS/T F/
- California Department of Water esources Landscape Water se Conservation Methods http //www.water.ca.gov/wateruseefficiency/landscape/
- Model Water Efficient Landscape Ordinance (2015) http //www.water.ca.gov/wateruseefficiency/landscapeordinance/docs/Title 2023 20extract 20- 20Official 20CC 20pages.pdf

SOILS SOIL AMENDMENTS & FERTILI ERS

4. SOILS SOIL AMENDMENTS & FE TILIZE S

4.1. Soil Purpose and Benefits

The goal of incorporating amendments into the soil is to develop healthy soils which foster plant growth. However soil science is complex and variable. The best way to begin to understand the importance of soils in our ecosystem is to describe their ma or functions and benefits

1. Soil supports plant growth by providing a medium for plant roots and supplying nutrient elements that are essential to the plant.
2. Properties of soils are a factor in controlling water in the hydrologic system water loss contamination purification etc.
3. Soils provide the function of decomposition nature s recycling system.
4. Soils provide habitat for various organisms microscopic to insects small mammals and reptiles.
5. Soil in an engineering medium in human-built environments.

**The Nature and Properties of Soils*, 11th Edition, Brady, Nyle C. & Weil, Ray R., Prentice-Hall, Inc., 1996

There are a few soil conditions that need to be considered and recognized pertaining specifically to the improvement of landscapes. It becomes useful to understand what ind of soils are in the landscape that you will be wor ing with. This is done by considerations of history location and soil testing for texture pH water-holding capacity and permeability.

4.2. Soils & Testing

nowing the existing structure of the soil will assist you in amending it properly. Two places to start is to understand the historical land use of the landscape site. For instance are the soils fill from construction untouched or native soils or neglected soil from a previous landscape design Is the soil located near the coast where sandy soils are prevalent by a river with roc y or clayey soil or in a coniferous forest where soils tend to be more acidic These facts will give you the proper context of your existing soil structure.

As a goal landscape soils for planting have

1. A uniform texture
2. Neutral pH
3. Good water-holding capacity the ability to hold water for root nourishment
4. Good soil permeability allow access water to drain

**http://www.santacruz.watersavingplants.com/Garden-Resources/soil.php

<u>Soil Laboratory Testing</u>

The most precise way to understand your soil and obtain guidance on how to amend it is to send a sample to a soil testing laboratory. Each lab will have specific instructions on

how to ta e a sample. The lab will evaluate your soil and provide recommendations on how to amend your soil for optimum plant health.

If you prefer not to get your soil tested at a laboratory there are some general methods below on how to measure and/or understand soil texture pH water-holding capacity and permeability. A general remedy is presented for each conclusion.

4.2.1. Soil Texture

nderstanding the three basic types of soils is helpful sand (largest particles) silt/loam (medium sized particles) and clay (the finest particles). A mix of these soils are most common and the composition of the mix determines the soil texture. efer to Figure 4.0.

Figure 4.0 - Soil texture triangle: gives names to various combinations of sand, silt, and clay.

Squeeze Test

A very basic and quic way to understand soil texture is with the squeeze test. Ta e a scoop of soil from the area to be landscaped water it and let it drain and dry. Pic up a handful of that soil and squeeze it firmly in your hand. efer to Figure 4.1. If it forms a tight shape and has a slippery feel it is clayey. If it is gritty and doesn t hold shape and crumbles it is sandy. If is slightly crumbly but still holds the shape of a loose ball or ribbon form it is loamy.

Figure 4.1 - Squeeze test

4.2.2. pH Levels

The pH level controls the chemical and biological reactions of the soil. pH is measured on a scale of 1 to 14. 7 is neutral which is optimum for plant growth. Anything lower than 7 is considered acidic and anything higher than 7 is considered al aline.

pH Meter Test

Testing the pH of your landscape soil can be done with a pH meter which is available as most home/garden stores. Dig a small hole and brea up the soil removing any twigs or debris. Fill the hole with distilled water until there is a muddy pool at the bottom. Insert the pH meter probe into the mud. Hold it there until the reading is ta en.

4.2.3. Water Holding Capacity & Permeability

Properly testing the water holding capacity and permeability of soils is a complex process. A simplified process for landscape soils can be done simply in your landscape.

Pit Test

First dig a hole in your desired landscape improvement area after a dry period of 3-4 days. The hole should be 2 feet wide and 18 deep. Place a ruler/yard stic in the hole. Then fill the hole to the top with water. With a stopwatch start timing as soon as the hole is full of water and observe the water line on the ruler. Allow the hole to drain for exactly one hour and note the drop in the water s height from start to finish along the ruler. The ideal drainage rate is one to two inches per hour. A dense soil will drain slowly and a loose soil will drain quic ly.

4.3. Soil Amendments

Particular amendments and/or practices may be needed to bring your soil bac to health. If you did not choose to have a soil analysis done by a testing lab below are some general remedies and techniques to follow based on the type of landscape soils.

The soil amendments recommended for your soil will be the amended bac fill when planting plants. efer to Section 7.0.

4.3.1. Soil Texture

Based on the hand squeeze test the remedies for improving soil texture are listed below

C S Though clay soils are nutrient rich the fine particles prevent water from draining out of the soil and may not let air into the root zone. The soil also dries very hard. emedy Add 3-4 of organic matter (ie compost aged-manure peat moss sawdust/wood shavings/ground bar redwood soil conditioner) or gypsum and till into the top 9-12 of existing soil to cause the clay particle to clump together. In extreme situations a subsurface underdrain system to carry excess groundwater may need to be constructed.

S L S A mix of clay silt and sand particles. These soils are generally considered ideal for plant growth because they contain the right texture and absorb water well.

S S Coarse particles allow water to drain too fast and the soils to dry out quic ly. emedy Add 3-4 organic matter (ie compost aged-manure peat moss sawdust/wood shavings/ground bar redwood soil conditioner) and till into the top 9-12 of existing soil to act as a sponge which will better retain water in the root zone.

4.3.2. pH Levels

A S If you need to add al alinity to your soil add lime (calcium carbonate) typically in the form of ground limestone (follow manufacturer s recommendations for rate and application).

A S If you need to add acidity to your soil add 3-4 organic matter (ie compost aged-manure peat moss sawdust/wood shavings/ground bar redwood soil conditioner) and till into the top 9-12 of existing soil. Sulfur and ferrous sulfate are also two other alternatives that can be amended to the soil (follow manufacturer s recommendations for rate and application).

Please be aware that different plants can tolerate different acid/al aline conditions. For instance plants in dry regions have less tolerance for soil acidity whereas plants in humid regions prefer acidic soils. hododendrons azaleas and blueberries prefer acidic soils (4-

5). itchen crops such as spinach carrots corn tomatoes prefer moderate to slightly al aline soils (6-7).

4.3.3. Water Holding Capacity & Permeability

If your soils drains faster than 1-2 inches per hour add 3-4 of organic matter (ie compost aged-manure peat moss sawdust/wood shavings/ground bar redwood soil conditioner) and till into the top 9-12 of existing soil.

If your soils drain slower than 1-2 inches per hour spread 2-4 inches of compost over the bed followed by the gypsum (follow manufacturer s recommendations for rate and application). Mix the compost and gypsum in with the existing soil.

4.4. Fertilizers

Soil supplies 13 essential plant nutrients each with a function for plant growth. The most common nutrient deficiencies found in soil are Nitrogen (N) Phosphorus (P) and Potassium ( ). Plants can only ta e up nutrients in a solution meaning dissolved in soil water. Fertilizers can supplement the nutrients soils need. There are a few different inds of fertilizers available. Follow the manufacturer s recommendations for proper rate and application.

O F Made from natural materials including plant animal and/or mineral materials. Once in the soil nutrients are released as the plant needs them by heat water from rain and irrigation and the general decomposition process from soil microbes. Compared with synthetic/processed fertilizers organic fertilizers usually have a lower concentration of nutrients and release them more slowly. More organic fertilizer is usually required however the effect lasts longer. This type of fertilizer is encouraged.

S R S F Similar to organic fertilizers but made from synthetic materials and nutrients are mainly released by soil microbial activity rather than temperature and water. They are typically available in a granular form.

S F uic release processed fertilizers frequently wash through the soil before they are ta en up by the plants roots. They can also damage soil microbes. These types of fertilizers are not encouraged.

4.5. eferences

- Boo *The Nature and Properties of Soils* 11th Edition Brady Nyle C. & Weil ay . Prentice-Hall Inc. 1996
- Water-Smart Gardening in Santa Cruz County http //www.santacruz.watersavingplants.com/Garden- esources/soil.php
- A Home Gardener s Guide to Soils and Fertilizers Washington State niversity Extension EM063E http //cru.cahe.wsu.edu/CEPublications/EM063E/EM063E.pdf.
- Organic Materials Exchange (source for reusable organic materials on the Central Coast) http //www.omexchange.org/
- Bay-Friendly Guide to Mulch https //www.bayfriendlycoalition.org/publications.shtml

PLANTING GUIDELINES AND DESIGN CONSIDERATIONS

5. PLANTING G IDELINES AND DESIGN CONSIDE ATIONS

5.1. Environmentally Friendly Landscapes

An environmentally friendly landscape fits into the climatic conditions it is grown in and gives bac to its environment. The goals and ob ectives for an environmentally friendly landscape in Pacific Grove are listed below.

Goals and Ob ectives

7. Encourage Landscapes That Fit With the Natural Conditions of Pacific Grove
    a. se coastal California native plants to promote sense of place
    b. se plants that are within the native plant community where you live
    c. Let plants ta e their own natural form meaning little to no pruning
8. Conserve Potable Water
    a. Choose to plant coastal California native plants and/or drought tolerant plants
    b. Get your current irrigation system audited by an irrigation professional
    c. Install a high efficiency irrigation system
        i. Install an automatic controller or evapotranspiration (ET) controller
        ii. Install a rain and/or soil moisture sensor to your irrigation system
        iii. se drip or subsurface irrigation
        iv. Hydrozone similar water needs of plants
    d. Capture and harvest rainwater and/or graywater and reuse it in your landscape
    e. eep a layer of mulch on your exposed soil and landscape planting areas to prevent evaporation
9. Promote Healthy Soils
    a. Add compost to promote healthy soils
    b. Maintain a layer of mulch on your exposed soil and landscape planting areas
    c. se organic fertilizers
    d. Aerate compacted soils
10. se Integrated Pest Management
    a. Choose to plant coastal California native plants that use no/little of herbicides and pesticides
    b. se non chemical methods first to address infestation problems
    c. Choose environmentally-friendly herbicides and pesticides
11. educe Stormwater Flows and Pollutants
    a. Increase opportunities for stormwater to infiltrate into the soil by providing more planting areas

b. eplace impervious hardscape surfaces with pervious surfaces
c. Harvest the rain water
d. Create rain gardens and vegetated swales to receive stormwater runoff
e. Disconnect roof downspouts and redirect roof runoff into the soil
f. eep a layer of mulch on your exposed soil and landscape planting areas

12. Protect and Enhance Native Plant and Wildlife Habitat and Diversity
    a. Create biodiversity in your landscape by planting a variety of species
        i. Tubular-shaped flowers attract hummingbirds
        ii. Provide plants that will supply honey bees and butterflies with pollen and nectar year round
        iii. Allow seeds to ripen for birds to eat
    b. Do not plant invasive plants

5.1.1. Landscape ecognition Programs

There are a few landscape certification programs that recognize and award sustainable landscapes in Pacific Grove based on the completion of specific program requirements. These types of programs are encouraged for your landscape design. Details about the programs are in the web site lin s below.

Monterey Bay Friendly Landscaping http //green-gardener.org/portfolio/landscape certification/

Ocean Friendly Gardens
http //www.surfrider.org/programs/entry/ocean-friendly-gardens

5.2. Landscape Design Principles and Existing Site Conditions

With the environmentally friendly landscape goals and ob ectives in your mind. The next step is to design and plan out your landscape area. Evaluate your site conditions first to

determine your plant species composition and other site features you may want to include. Section 2.0 has information about environmental conditions in Pacific Grove.

- How much sun and shade will each areas of your landscape receive
- How are the natural drainage patterns on your property wor ing Where does the runoff go Where does the runoff from other hardscape surfaces go (i.e. driveway patios)
- Is your home located near the coast within a Coast Live Oa stand or upland in the Monterey Pine Forest nderstand the plant community you are living in. efer to Section 2.0.
- Is there a function you want your landscape to provide such as to shield wind control erosion obscure a view frame or preserve a view provide a certain color or texture provide shade
- Are there other landscape features you want to include such as a rain garden water harvesting system patio or gathering space itchen garden etc.

It helps to have an existing conditions plan or a site plan which is a scalable map of your property so you can layout your design intentions and compare it with the actual space you have available. This can be done my hand with a ruler/scale or by computer design software. It is a good way to brainstorm your design intentions.

On your site plan annotate the property lines any built features on your property the location of the first level windows and entryways the location of utilities meters or other infrastructure as well as utilities above ground and underground.

Clear and Grub is the process of clearing all site vegetation prior to site wor . A clear and grub plan indicates what landscape plants and features will be removed or altered based on the new landscape design. Figure 5.0 is an example of a simple existing conditions plan.

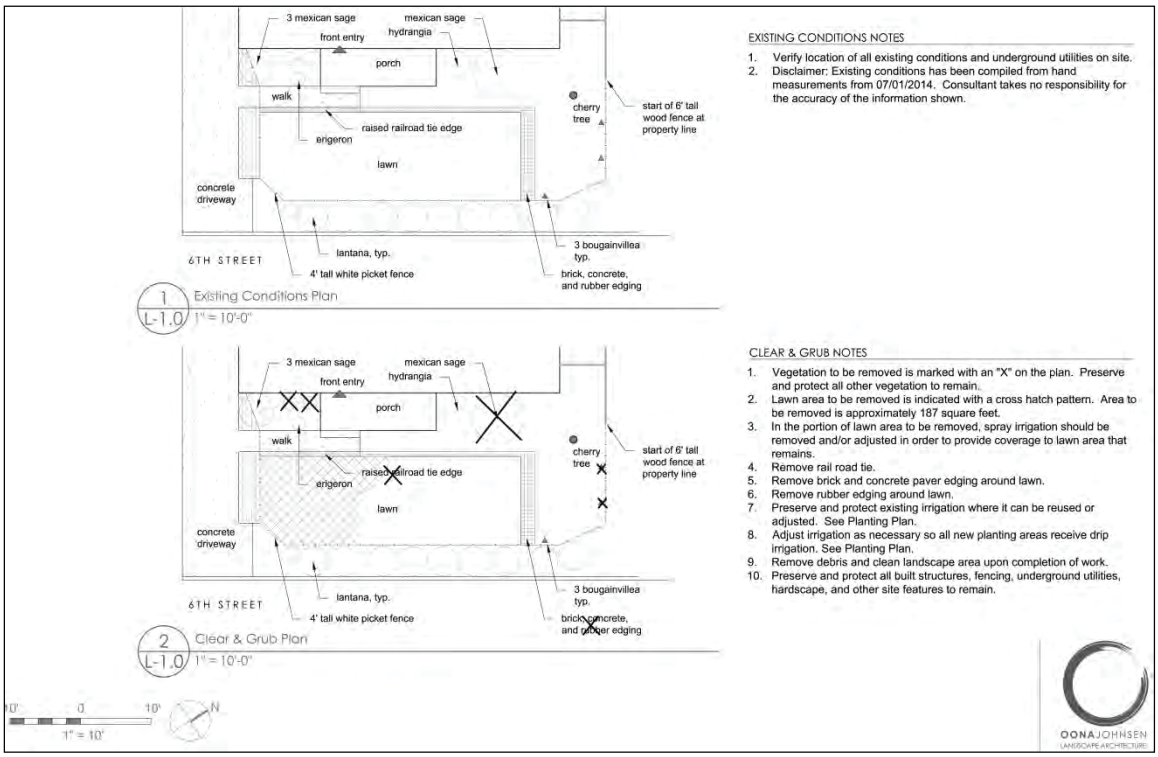


Figure 5.0 - Existing Conditions Plan and Clear & Grub Plan: These simple plan graphics show examples of a simple existing conditions plan and a clear and grub plan. Refer to Figures 5.1 and 5.2 for the associated planting plan and plant legend.

- Dispose of materials properly. Contact the Monterey Peninsula Waste Management District for questions regarding disposal and recycling of materials (831) 384-5313 http //www.mrwmd.org/contact-us/.
- If you plan on removing trees contact the City of Pacific Grove Planning Office to see if a permit is required 831-648-3190 located at 300 Forest Avenue 2nd Floor Pacific Grove.
- If you plan on doing some ma or excavation wor it is the homeowner s responsibility to find out were underground utilities are located. Contact PG&E call 811 before you dig . Call 811 at least two wor ing days before starting any pro ect that involves digging to have PG&E gas pipelines and other underground utility lines located and mar ed for free.

If you plan on wor ing with a landscape design professional or a landscape contractor Monterey County provides some guidance in the documents listed below

Wor ing with Landscape Architects Landscape Designers Landscape Contractors Horticulturalists and Arborists

http //www.montereylandscaping.org/Garden- esources/GardenGallery.php

5.3. Plant Species Choice

In your landscape replace plants that require regular watering with drought tolerant and California native plants. It is recommended that 100 of all new planting or replacement planting should be with drought tolerant and native plants. The more variety of plants in your landscape the more biodiversity you are promoting enhancing the habitat pollen and nectar sources for beneficial insects including butterflies honey bees and hummingbirds. In additions these efforts will reduce your potable water consumption lower your water bills and in return you will have an easy to maintain beautiful landscape.

It is important to consider using appropriate Central Coast California native plants in your design because they provide so many benefits. The more native species in your landscape the better They provide

- Food and shelter for beneficial birds and insects
- Already adapted to the local climate conditions
- Low to no irrigation after establishment
- Less susceptible to infection/insect damage
- Low maintenance with little to no fertilizer needed
- Adds to a sense of place enhancing the native character of where you live

Plants that are considered drought tolerant are typically California native Mediterranean Australian and South African plants. A short-list of recommended native and drought tolerant plants are listed in Section 6.0. Also refer to Section 5.9 for recommended references referring to plants and planting design.

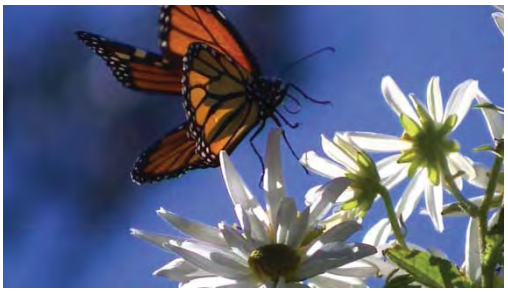
The *Water Use Classification of Landscape Species* (W COLS) is a document provided by the California Department of Water esources that classifies the water needs of individual plant species based on region (Pacific Grove is egion 1 North-Central Coastal).

The water use designations are

L very low
L low
M medium
H high

It is encouraged that plants in the L and L designation are primarily used it will be listed in the plant palette in Section 6.0. The full document is found at this web site http //ucanr.edu/sites/W COLS/

5.3.1. Mil weed



Mil weed is the only plant monarchs can lay its eggs on. The lac of mil weed is a concern since the monarch population has been in decline. However the erces Society has informed the Pacific Grove Museum of Natural History that mil weed plants should NOT be planted within 10 miles of an overwintering site. Since Pacific Grove has an overwintering site mil weed should NOT be planted. Instead include flowering plants in your landscape that provide nectar to monarchs during their overwintering stay in November to late February early March.

equest free nectar plant seeds from the Pacific Grove Museum of Natural History. http //www.pgmuseum.org/free-seed-distributions/

If you currently have mil weed plants in your landscape prune them bac to the ground every November while the monarchs are overwintering. The mil weed will grow bac in spring and provide pollen and nectar to other beneficial insects.

5.4. Developing a Planting Plan

Once you have plant choices in mind which provide the plant characteristics you wish research the plant s mature size (height & width) to ensure that it will not outgrow the intended space. It is easy to overplant since when you purchase the plant from the nursery it appears small in the container it comes in. ou may thin you need more plants in your designated space but you will not. If you have considered the plant s growth habits the plant will grow into its intended space within a few growing seasons. The species selected with sufficient plant spacing will allow it to grow to its natural size and shape and reduce the need for regular pruning.

After you have developed your planting area locations annotate your site plan with the specific plants in your design by referencing the species. This is called a Planting Plan. Do this by drawing a circle that is equal to the mature width of the plant. Don t forget to ta e into consideration the height of the plant be sure you are not bloc ing windows utility meters or infrastructure overhead power lines or other structures. Also draw in any new landscape features such as elevated berms depressed features such as rain gardens and gathering spaces. efer to Figures 3.1 and 3.3 for a planting plan and plant legend example.

Below are some tips to planting design

- Place trees on your plan first. efer to the Pacific Grove tree planting guidelines and recommended tree list. These lin s can be found in Section 1.4 Pacific Grove Planning eferences.
- Next place large shrubs and foundation plants in the positions you thin are appropriate. eep the taller plants in the bac ground and the lower growing plants in the foreground so you can ta e full advantage of the planting design composition you have created.
- Place lower growing accent plants groundcovers and vines next.
- Consider bloom times of species. ou may want to alternate bloom times for interest and habitat value.
- Minimize your lawn and use lawn alternatives Section 5.6. For groundcover plant alternatives refer to plant palette in Section 6.0. Other non-plant alternatives are a layer of bar or decorative gravel or a permeable hardscape patio.
- Double chec you have chosen the correct plant species that can receive the amount of sun or shade you want to place it in.
- Do not plant too close to the house foundation. It is recommended to have the mature width of the plant to be within 18-24 of the house wall. ou may want to consider mulch or roc in this 18-24 setbac to protect the foundation and provides ease of house maintenance when needed.
- Consider is grouping plants with similar water requirements called hydrozones. This is addressed in Section 3.0. Essentially if you plan on installing an automated irrigation system hydrozoning helps to conserve water and prevents overwatering of plants that don t require it.

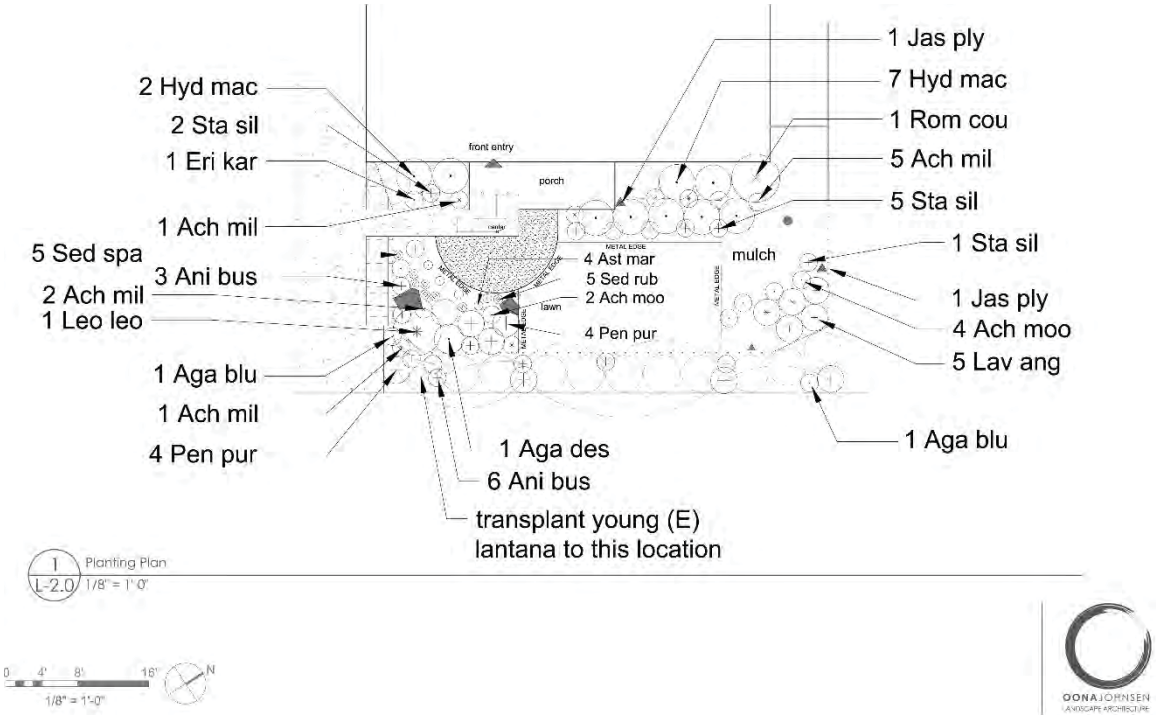


Figure 5.1 – Planting Plan: This is an example of a planting plan, indicating the mature size, location, species, and quantity of the plants as well as other landscape features like the crushed aggregate patio, boulders, metal edging, and mulch.

Crushed Aggregate: 1/4" crushed granite. Available from Seaside GraniteRock. Install a 3" layer under permeable weed mat. Finished grade of aggregate to be flush with adjacent concrete hardscape surfaces.

Boulders: Golden granite boulders, Available from Seaside GraniteRock. (1) 36x36x24 size and (1) 24x24x24 size

Metal Edging: Steel Edging, Available from Ewing Irrigation, choose product that can bend to radius as shown on plan, follow manufacturers instruction for installation and use all products associated with the manufacturer. Top of metal edge should be at grade with no portion sticking out from the surface.

Mulch: Walk-on bark, Available by Seaside GraniteRock. Apply a 2" layer of mulch around all planting areas and in areas shown in plan.

PLANT LEGEND

Qty.		SYM./ABBREV.	BOTANICAL NAME	COMMON NAME	SIZE
	Shrubs				
9		Hyd mac	Hydrangea macrophylla	Garden Hydrangea	5 Gal.
1		Leo leo	Leonotis leonurus	Lion's Tail Shrub	5 Gal.
1		Rom cou	Romneya coulteri	Matilija Poppy	5 Gal.
	Groundcovers				
9		Ach mil	Achillea millefolium	Common Yarrow	1 Gal.
6		Ach moo	Achillea 'Moonshine'	Yellow Yarrow	1 Gal.
2		Aga blu	Agave 'Blue Glow'	Blue Glow Agave	1 Gal.
1		Aga des	Agave desmettiana variegata	Variegated Smooth Agave	5 Gal.
9		Ani bus	Anigozanthos 'Bush Dawn'	Bush Dawn Kangaroo Paw	1 Gal.
4	m	Ast mar	Asteriscus maritimus	Gold Coin Daisy	1 Gal.
1		Eri kar	Erigeron karvinskianus	Santa Barbara Daisy	1 Gal.
5		Lav ang	Lavandula angustifolia	English Lavender	1 Gal.
8		Pen pur	Penstemon 'Purple Passion'	Purple Penstemon	1 Gal.
5		Sed rub	Sedum rubrotinctum	Pork and Beans	4" Pot
5		Sed spa	Sedum spathulifolium	Stonecrop	4" Pot
8		Sta sil	Stachys byzantina 'Silver Carpet'	Silver Carpet Lamb's Ears	1 Gal.
	Vines				
		VINES: Vines to be mounted to existing wood trellis, fastened with soft vine ties.			
2	▲	Jas pol	Jasminum polyanthum	Pink Jasmine	1 Gal.

1 L-3.0 Plant Legend

DONA JOHNSEN

Figure 5.2 – Plant Legend: This is an example of a planting legend. It is a key to the planting plan which lists and describes the abbreviated plant labels; their botanical name, their common name, the plant container size, and total quantity of each species needed. Also, it describes the materials for the aggregate patio, boulders and metal edging, and mulch.

On your plan you will be able to calculate the amount of landscape materials you need to purchase. If you choose to hire out your landscape installation it is recommended to hire a California licensed contractor.

Please note that plant nurseries carry different plant species at different times of year. Call ahead to find out plant availability so you can determine any plant substitutions that may be needed.

5.5. Invasive Plants

Do not use invasive plant species in your landscape design and remove any invasive plants already existing in your landscape. Invasive plants aggressively spread reducing biodiversity invade existing ecosystems and prevent native habitat environments from establishing.

A comprehensive list of invasive plants from the California Invasive Plant Council (Cal-IPC)

can be found on their website http //www.cal-ipc.org/.

Also a concise brochure geared towards the Central Coast titled Don t Plant a Pest is available from Cal-IPC at http //www.cal-ipc.org/landscaping/dpp/pdf/CCoastDPP.pdf.

5.6. Minimize Turf/Lawn

It is recommended to reduce the amount of turf/lawn in your landscape due to its high water requirements fertilization requirements and other maintenance needs. If your lawn is watered from a rainwater harvesting system or gray water system it can be ustified in your landscape. Otherwise follow the recommended lawn reductions measures below

- educe the amount of turf on your property to equal or no more than 25 of the total landscape area. Consider alternative groundcovers or alternative plant species for lawn-li e areas. efer to the plant palette in Section 6.0.
- Do not use turf under trees.
- Do not use turf under densely shaded areas.
- Do not use turf in areas exceeding a slope of 10 (4 1).
- Do not use turf in landscape areas s less than 8 feet wide.
- Do not use turf in medians.

5.7. Stormwater Management Landscape Techniques

The drainage systems of Pacific Grove are engineered to move stormwater to the drainage system and into the nearest water body as quic ly as possible. Stormwater pic s up pollutants as it travels and enters the drainage system then it is discharged into the Monterey Bay. These waters are harmful to the natural ecology of the Marine Sanctuary. Though there are city-wide efforts to improve infrastructure and improve the stormwater diversion system there are landscape design techniques homeowners can install to help clean the stormwater before it discharges into the Monterey Bay.

Landscape areas absorb the stormwater and the soil and root systems filter stormwater pollutants. These areas also slow down and retain the water before it enters the drainage systems so the more landscape areas the better. Even permeable hardscapes special hard surfaces that allow stormwater to infiltrate into the ground can be integrated into the landscape design to assist in this cleansing process.

There are some suggested stormwater management techniques that you can integrate into your landscape. Design guidelines for the techniques listed below can be found through the City of Pacific Grove s ainScapes program.

At least one stormwater management practice should be used in your landscape.

ainScapes Program http //www.cityofpacificgrove.org/living/green-pg/rainscapes-rebate-program

Design Guidelines for

1. oof Downspout Direction
2. Creating ain Gardens
3. ain Water Harvesting
4. eplacement of Impervious Surfaces with Pervious Surfaces
5. New Tree Planting
6. Gull ooftop Deterrents

5.8. Fire Zone Planting

There are specific areas in the City of Pacific Grove are designated as wildfire zones per CAL FI E. See Figure 5.3.

Percentage of the City that is within the CalFire Severity Zones

ery High	24.55
High	13.39
Moderate	10.56

If your landscape is located within the wildfire zone please provide a fire-safe landscape for your property. The lin s in this section provide specific information on how to create a fire safe landscape. Basic considerations are explained below .

Create a 100 foot defensible space around your home.

- emove all flammable vegetation and combustible materials within 30 feet immediately surrounding your home.
  - eep trees trimmed at least 10 feet from chimneys and remove dead branches hanging over structures.
  - emove build-up of needles and leaves from roof and gutters.

- emove dead and dying plants fallen leaves needles twigs bar cones pods small branches etc.
- egular maintenance (pruning weed control adequate irrigation) is necessary to maintain the fire resistance of your landscape.
- Increase spacing between plants.
- Landscape with fire resistant plans low growing open structures and less resinous.
- When clearing vegetation use care in operating equipment such as lawnmowers.

- Create a educed Fuel Zone that extends at least an additional 70 feet or to your property line. An even greater defensible zone width is necessary when home are located on a slope or in a windswept area.
  - Maintain open space between plants and trees to improve the chance of stopping a wildfire. There are two options
    1. Create horizontal and vertical spacing between plants. The amount of space will depend on how steep the slope is and the size of the plants.
    2. Large trees do not have to be cut and removed but plants growing beneath them that are greater than 4 inches in height should be removed. emove lower limbs of trees to at least 6 feet up to 15 feet (or the lower 1/3 branches on smaller trees).

*University of California, Division of Agriculture and Natural Resources, *The California Garden Web, Landscaping for Fire Protection*, 2015. Retrieved from http://cagardenweb.ucanr.edu/General/Landscaping_for_Fire_Protection/.

The Monterey County Fire Safe Council has put together fire-safe and fire-unsafe plant lists http //www.firesafemonterey.org/plant-lists.html.

For more information on landscaping for fire protection visit http //cagardenweb.ucanr.edu/General/Landscaping for Fire Protection/

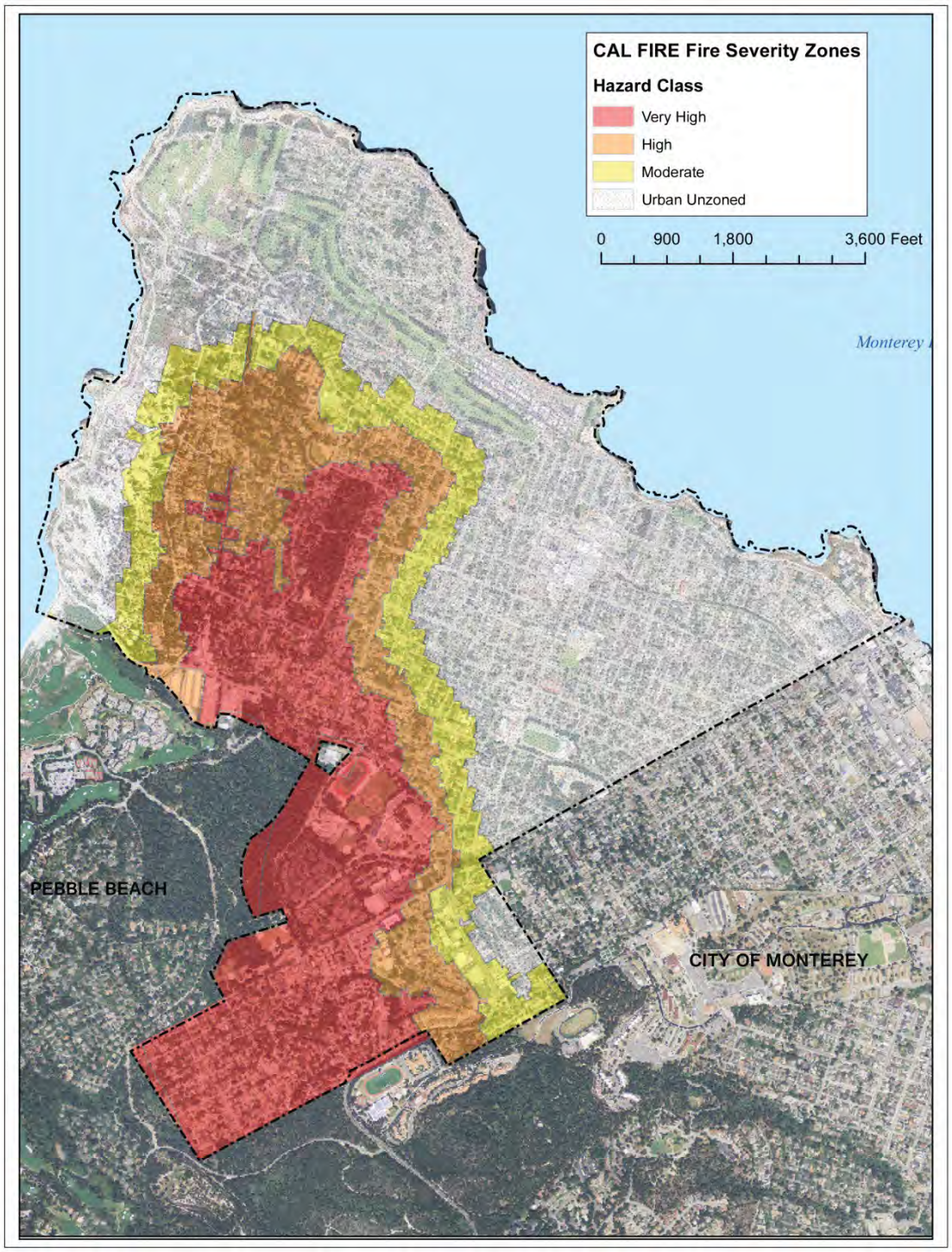


Figure 5.3: Cal-fire designated wildfire severity zones in Pacific Grove - http://www.fire.ca.gov/fire_prevention/fhsz_maps/FHSZ/monterey/FHSZL_c27_PacificGrove.pdf

5.9. eferences

- Monterey Bay Master Gardeners
  Gardening Hotline (9am noon Mon Wed Fri) 831-763-8007
  Email hotmail mbmgs.org
  Website http //mbmg.ucanr.edu/
- Pacific Grove Museum of Natural History Native Plant Garden Plant List
  http //www.pgmuseum.org/museums-native-plant-garden/
- Monterey Bay Chapter of the Native Plant Society Local Plants
  http //montereybay.cnps.org/local-plan
- California Native Plant Society Hummingbird Habitat Gardening
  http //www.cnps.org/cnps/grownative/habitat/hummingbirds.php
- California Native Plant Society Bee-friendly Gardening

  http //grownatives.cnps.org/2010/03/31/bee-friendly-gardening/
- Central Coast Low Impact Development Initiative LID Plant Guidance for Bioretention and Plant List http //centralcoastlidi.org/uploads/LIDlPlantList 2015.03.11.pdf
- California Oa Foundation Compatible Plants nder & Around Oa s
  http //www.californiaoa s.org/ExtAssets/CompatiblePlants nder&AroundOa s.pdf
- California Invasive Plant Council http //www.cal-ipc.org/
- California Invasive Plant Council Don t Plant a Pest
  http //www.cal-ipc.org/landscaping/dpp/pdf/CCoastDPP.pdf
- Water se Classification of Landscape Species (W COLS)
  http //ucanr.edu/sites/W COLS/
- Water Smart Gardening in Santa Cruz County
  http //www.santacruz.watersavingplants.com
- Monterey County Waterwise Landscaping http //www.montereylandscaping.org
- Slow it Spread it Sin it A Homeowner s Guide to Greening Stormwater unoff
  http //www.rcdsantacruz.org/images/brochures/pdf/HomeDrainageGuide.v25.pdf
- Boo *Sunset Western Garden Book*
- Boo *Plants and Landscapes for Summer-Dry* Climates by East Bay Municipal tility District
- Boo *California Native Plants for the Garden* by Carol Bornstein David Fross Bart O Brian
- Boo *Reimagining the California Lawn* by Carol Bornstein David Fross Bart O Brian
- Boo *The American Meadow Garden* by ohn Greenlee
- Boo *California Bees & Blooms* by Gordon W. an e obbin W. Thorp ollin E. Coveille and Barbara Ertter

PLANT PALETTE

6. PLANT PALETTE

The list of plants located in Appendix A are recommendations for plant species suitable for Pacific Grove which follow the goals of an environmentally friendly landscape. Please note that this does not guarantee plant success as plants need to be situated in appropriate locations with suitable conditions and require proper landscape maintenance practices. efer to Section 5.0 for Planting Guidelines and Design Considerations. In addition Section 5.8 provides a list of planting references for additional resources.

This palette does not include trees as a list is already developed and can be found in the Section 1.4 Introduction / City Planning eferences.

PLANTING PROCEDURE

7. PLANTING P OCED E

After your landscape design has been completed. It is time to prepare the site. Below is a possible order of events when constructing a landscape.

Landscape Construction Process

1) Develop the Landscape and Planting Design Plans and documents to construct your landscape improvements with your vision.

Alternative 1

Obtain construction bids from landscape contractors. They can typically give you a bid if your design plans and documents are somewhat thorough. The rest of the wor from this point will be carried out by the contractor per your contract with them.

Alternative 2

Proceed with the planting procedure yourself.

2) Estimate quantities of plants soil mulch fertilizer gopher/deer repellent and other materials needed to construct other landscape features.
3) Prepare a cost estimate. This is a good time to refine the design if necessary.
4) Clear and grub your property of unwanted plants or hardscape features. Dispose of materials properly. Clear and Grub is the process of clearing all site vegetation prior to site wor .
5) Purchase all the materials you need and deliver to your site as needed in the construction timeline. This is a good time to source plant materials from nurseries. However it is important to deliver the plants as close to the time of planting as possible.
6) Install all underground infrastructure/utilities needed such as irrigation mainline drainage features.
7) Grading of soils stormwater retention features grading for walls addition of berms etc. Ensure runoff is contained property and overflow situations are properly installed.
8) Install all hardscape features patios retaining walls dec s fences etc.
9) Install the irrigation system and all the associated componentry.
10) Prepare your soil in the planting areas per the research you have done in Section 4.0.
11) Purchase and deliver plants ma e sure containerized plants are stored in a shady spot if you do not intend to plant immediately and eep them watered and protected from deer.
12) Before planting commences position the location of each plant while in its container. This is the chance to accurately visualize what the planting design you created on

paper will loo li e in the ground. ou can ad ust placement if necessary. Please eep in mind the full mature form of the plant as you visualize at this point. Plants are small when purchased in containers. As mentioned in Section 5.0 you may thin you need more plants in your designated space but you will not. If you have considered the plant s growth habits the plant will grow into its intended space within a few growing seasons. The species selected with sufficient plant spacing will allow it to grow to its natural size and shape and reduce the need for regular pruning.

13) Prepare your amended bac fill.
14) Plant each plant its location per your layout and refer to Figure 7.0 which shows a cross section of how to plant a plant.
15) Install a gopher bas et if necessary.
16) Add fertilizer if necessary.
17) Hand-pac the soil around the plant after placing it in the hole as to remove any air poc ets.
18) emove excess soil from around the stem.
19) Apply a 2-3 mulch layer to all planting areas.
20) Hand water each plant thoroughly after planting.
21) Apply deer deterrent if necessary.
22) Learn how to use your irrigation controller. Initially set a watering schedule to help establish the plants and their roots. Monitor plants as once they are established the watering schedule should be reduced.

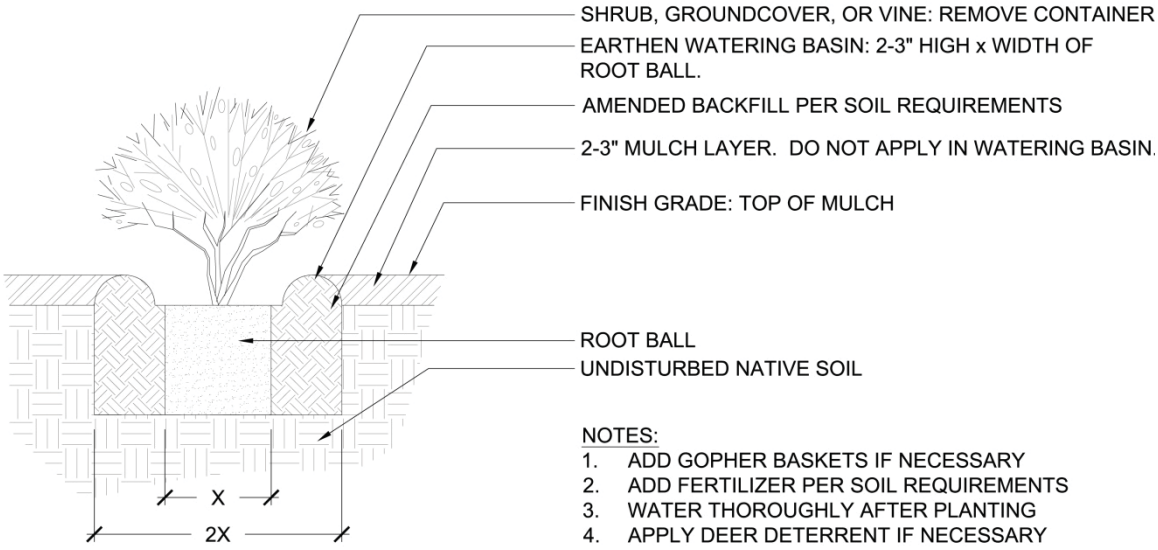


Figure 7.0 - Planting detail: not to scale

MULC

8. M LCH

8.1. Purpose and benefits

In general mulch is a protective layer of material spread on the top soil. In nature leaves needles and branches fall to the ground creating an organic layer that protects and builds the soil. This layer is called duff . Creating this layer in your landscape has various benefits and is a simple way to enhance a landscape.

Mulch

- eeps the soil moist by preventing evaporation of applied water thus helping in conserving water
- eplenishes organic material in the soil which is beneficial to soil organisms and creates healthy soil
- Prevents erosion as a result of wind and heavy rain events carrying away soil particles/sediment
- educes stormwater runoff velocity
- Insulates plant roots from temperature extremes
- Discourages weeds which reduces weed competition for landscape plants and requires less maintenance
- Provides a finished loo to new planting designs
- Mulching under trees to the drip line minimizes competition for water and nutrients from grass or other plants. efer to Figure 8.0.

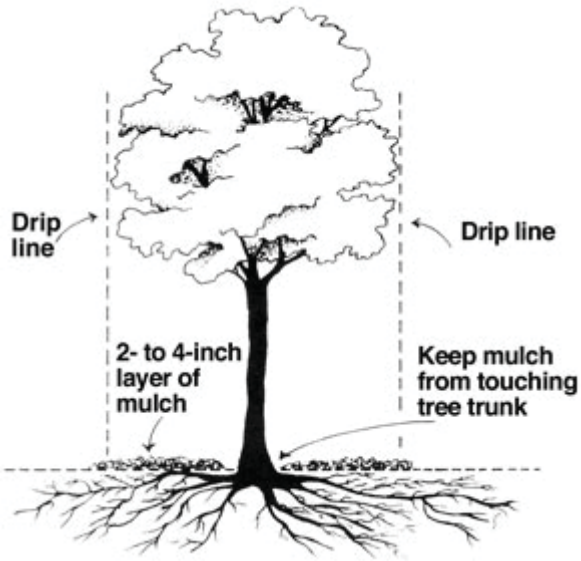


Figure 8.0 – Tree Drip Line: A tree drip line is the outermost circumference of a tree canopy where water drips from onto the ground.

8.2. Types of mulch

There are many inds of organic mulches. Two recommended inds are recycled mulch and bar .

ecycled Mulch Grass clippings leaves and tree branches/stumps that have been chipped and shredded. This ind of mulch can come from your own yard waste or obtained from arborists utility companies or par s. Ma e sure these mulches are weed free.

Bar Bar or wood chips come from lumber and paper mill by products. They can be chipped or shredded in different coarseness and can come in different colors (red blac brown). Bar is readily available at most plant nurseries and home improvement stores with garden centers. The Monterey egional Waste Management District has wood chip mulch for sale which comes from untreated unpainted construction lumber http //www.mrwmd.org/green-products/

8.3. How to apply

Before applying mulch remove weeds from the bare soil. Spread at a minimum a 2 (2 inch) layer of mulch around planting areas or any other area with bare soil.

eep mulch 6-12 away from tree trun s and away from the base of shrubs. Tree trun s and woody shrub stems area not suited to wet conditions. eeping mulch away from the base of trun s and shrub stems will eep the area dry reducing the ris of rot disease and insects.

In order to determine how much mulch you need you need to calculate the volume by multiplying the area (in square feet) depth of mulch desired (in feet i.e. 2 mulch equals 0.167 feet) and then dividing by 27 (conversion to get cubic yards) the total cubic yards needed.

For instance a planting area of 450 square feet with a 3 layer of mulch will need ust over 4 cubic feet of mulch. See equation below

450 x 0.25 / 27 4.16 cubic feet of mulch

eapply mulch as needed once a year or every other year depending on your landscape conditions.

LANDSCAPE MAINTENANCE

9. LANDSCAPE MAINTENANCE

The final element to a sustainable landscape is ensuring environmentally friendly landscape maintenance practices are in place. nfortunately there is no such thing as a maintenance-free landscape. eeping the landscape thriving in changing conditions is an important tas and there are proper maintenance principles to consider. This section will give an overview of environmentally friendly maintenance tas s and considerations that you can implement in your landscape.

9.1. Integrated Pest Management

A ma or concept included in sustainable landscape maintenance is Integrated Pest Management (IPM). It is an ecosystem-based strategy that focuses on long-term prevention of pests or their damage through a combination of techniques such as biological control habitat manipulation modification of cultural practices and use of resistant varieties. IPM is important for our area as pesticides and herbicides when used incorrectly can flow directly into the Monterey Bay providing detrimental effects to marine wildlife due to poor water quality. Pesticides are used only after monitoring indicates they are needed according to established guidelines and treatments are made with the goal of removing only the target organism. Pest control materials are selected and applied in a manner that minimizes ris s to human health beneficial and non-target organisms and the environment (definition from University of California IPM).

A good resource for IPM practices is the niversity of California Integrated Pest Management Program http //www.ipm.ucdavis.edu/GENE AL/whatisipm.html

9.2. Weed Management

After planting chec garden for weeds and pull immediately. Eventually as the plants grow less weeding will be required. Installing new plants with close spacing where the mature width of the plant will overlap with the next plant 6-12 will cover more bare ground and will provide less room and provide less light for weeds to grow.

To help with the identification of weeds in your landscape a weed photo gallery is available from C IPM http //www.ipm.ucdavis.edu/PMG/weeds intro.html

Pulling weeds by hand is best but can be a difficult tas if there are large areas to weed. Environmentally friendly herbicides can then be an option. A list of some not all products that are considered less toxic alternatives to more conventional herbicides are listed in the document from Our Water Our World under the Weeds chapter http //www.ourwaterourworld.org/Portals/0/2015 20OWOW 20Less-Toxic 20Product 20List 20- 20by 20pest revised 20final 20 2002-22-15.pdf

Also http //www.ipm.ucdavis.edu/GENE AL/pesticides urban.html

9.3. Insects & Disease

Similar to weed management insect and disease management should be attempted by non-chemical methods first. Depending on the pest and disease there are alternatives to pesticides. Below are some tactics that might wor . A comprehensive list can be found http //www.ipm.ucdavis.edu/GENE AL/pesticides alternatives.html

- As a first resort remove larger insects by hand such as snails slugs and caterpillars.
- Prune and destroy leave or branches infested with pest or diseases.
- Hose off pests from plants with a et nozzle.
- Place barriers around seedling such as plant cages or collars can protect them from pests.
- Introduce an appropriate predator such as ladybugs to eat the pest.

- Ad ust your watering schedule as some plant diseases are brought on by overwatering plants

If the pest or disease if out of control even after you have tried non-chemical IMP methods environmentally friendly pesticides can then be an option. A list of some not all products that are considered less toxic alternatives to more conventional pesticides are listed in the document from Our Water Our World
http //www.ourwaterourworld.org/Portals/0/2015 20OWOW 20Less-Toxic 20Product 20List 20- 20by 20pest revised 20final 20 2002-22-15.pdf

Also C IPM provides resources for less toxic pesticides
http //www.ipm.ucdavis.edu/GENE AL/pesticides urban.html

9.4. Deer

If you don t have deer fencing around your property you may want to consider a deterrent method to eep deer from eating your newly installed plants. When plants come from a nursery they are lush and extremely appealing to deer even if the plant is nown to be deer resistant . If you chose deer resistant plants in your landscape planting design as they grow larger and more woody they will become less tempting to deer. However if deer are hungry and have a difficult time finding food especially in times of drought deer are most li ely going to nibble on your landscape plants.

The preferred methods to deter deer are

- Temporary fencing at least 8 tall
- Long term fencing at least 8 tall. efer to image.
- Environmentally friendly deer repellents are recommended at the time of planting and during times of drought

9.5. Gophers

Gophers are burrowing rodents that eat the roots of plants and damage plants and lawns by burrowing underground upheaving roots and soil. Gophers have also been nown to gnaw on plastic water lines and irrigation tube.

The preferred methods to deter gophers include

- Plant your plants within a gopher bas et wire cages that protect the main root systems of plants. efer to photo.
- There are other trap-contraptions that you can place down the gopher holes which will trap or ill the gophers.

- Sometimes a good hunting cat will eep gophers at bay.

9.6. Pruning & emoval of Plants

Prune shrubs to achieve natural growth patterns to reduce green waste. Achieving a natural form should mean that pruning should be minimal or unnecessary especially if the plant was chosen based on the mature size of plant growth.

Other pruning/thinning activities include

- Seasonal deadheading or thinning of spent flower/grass stal s
- Trimming for access along sidewal s and driveways
- Pruning to improve form with the goal to eep a natural form (no shearing)
- emoving dead or diseased branches

ecommended resources for landscape maintenance of native plants include

- Boo *California Native Gardening, A Month-By-Month Guide* by Helen Popper
- Boo *Care and Maintenance of Southern California Native Plant Gardens* by Bart O Brien Betsey Landis and Ellen Mac ey

9.7. Mulch

eeping a 2-3 layer of mulch and/or around planting areas and bare soils is beneficial. efer to Section 8.0 Mulch for more information. eapplication can vary from once a year or every other year depending on your landscape conditions.

9.8. Fertilizing

Fertilize only if needed and avoid over fertilizing. Applying fertilizer is typically done in the autumn months but it depends on the type of fertilizer used. Organic fertilizers are encouraged to be used over synthetic fertilizers in order to support biologically active soils. efer to Section 4.0 Soils for more information.

9.9. Composting

Composting is a great way to create your own mulch and soil amendment from your own green waste right on your property. Adding compost to your landscape helps build healthy soil and reduces household waste. It is made with landscape trimmings (referred to as brown waste) and food scraps (referred to as green waste). A list of appropriate browns and greens for composting can be found in the EPA Compost Guide http //www.epa.gov/waste/conserve/tools/greenscapes/pubs/compost-guide.pdf

In general you start by designating an area for your compost bin or pile. See Figure 9.0 for various types of compost bins. Then mix three parts brown waste to one part green waste. Over time you turn/mix the pile and once you see the material at the bottom is dar and rich in color with no remnants of your food or yard waste your compost is ready to use. The EPA offers more complete information about composting http //www2.epa.gov/recycle/composting-home.

In addition the Monterey egional Waste Management District often has free wor shops on how to compost at home. efer to their website for more information http //www.mrwmd.org/.

Grasscycling can be used to supplement your compost pile. Grasscycling refers to leaving grass clippings on the lawn after mowing. The clippings then decompose and release nutrients into the soil. These clippings can also be used in the compost pile. More information on grasscycling is available from Bay Friendly Landscaping Coalition https //www.bayfriendlycoalition.org/download/grasscycle2009.pdf

Figure 9.0 – Types of Compost Bins, image from www.unclejimswormfarm.com

9.10. Irrigation Maintenance

Monitoring your irrigation system should be a regular habit. This will help you identify lea s emitters that have moved out of place clogged emitters and other bro en equipment helping you save water and optimize plant health before it becomes a ma or issue.

Chec also for the following

- Test your system to see that it is operating correctly
- Observe plants and ad ust schedule for less watering as plants mature
- Ad ust spray heads or emitter to eliminate overspray or runoff
- Chec for overly dry or wet spots in your landscape and ad ust accordingly
- Audit your irrigation system to reduce water usage. efer to Section 3.0 Irrigation.

Other useful resources on irrigation maintenance

- Monterey County Irrigation Maintenance http //www.montereylandscaping.org/Garden- esources/IrrigationMaintenance.php
- C Maintenance of Microirrigaiton Systems http //micromaintain.ucanr.edu/

9.11. eferences

- Boo *California Native Gardening, A Month-By-Month Guide* by Helen Popper
- Boo *Care and Maintenance of Southern California Native Plant Gardens* by Bart O Brien Betsey Landis and Ellen Mac ey
- C Pesticide Information http //www.ipm.ucdavis.edu/GENE AL/pesticides.html

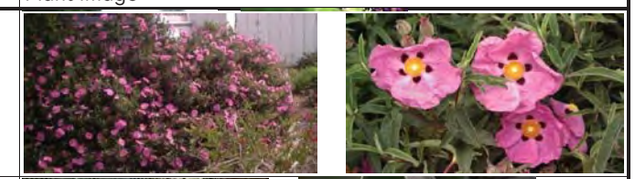
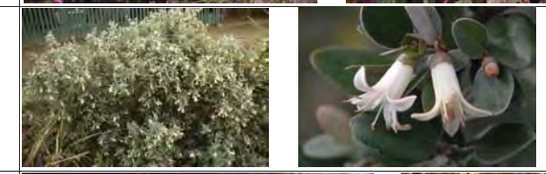
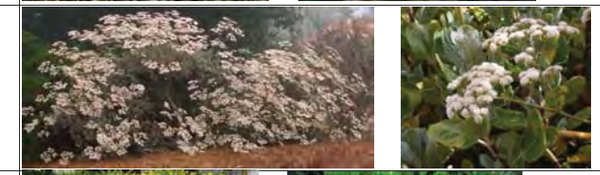
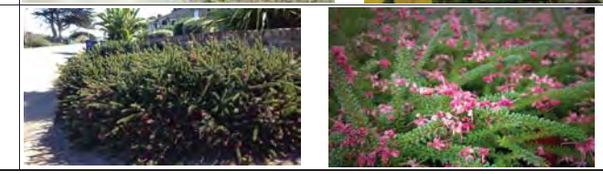
- C IMP Home Garden Turf and Landscape Pests
  http //www.ipm.ucdavis.edu/PMG/menu.homegarden.html
- Our Water Our World http //www.ourwaterourworld.org/
- Monterey egional Stormwater Management Program
  http //www.montereysea.org/
- Monterey County Irrigation Maintenance
  http //www.montereylandscaping.org/Garden- esources/IrrigationMaintenance.php
- Monterey County Maintenance Tips for Each Month

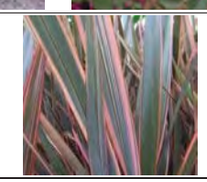
  http //www.montereylandscaping.org/Garden- esources/MaintainingGarden.php
- C Maintenance of Microirrigaiton Systems http //micromaintain.ucanr.edu/

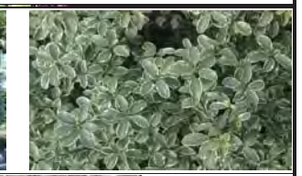
APPENDI A

PLANT PALETTE

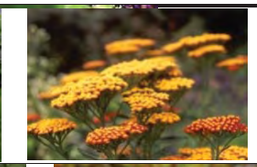
	Botanical Name	Common name	Mature Height & Width	Evergreen / Deciduous	Sun / Shade Tolerance	CA Native Plant / Pollinator Species	*Water Use per WUCOLS (Zone 1)	Plant Image
SHRUBS: over 4' in height	Buddleja davidii Hybrids: 'Black Knight', 'Lochinich'	Butterfly Bush	6-8' x 4-6'	semi-			M	
	Callistemon viminalis 'Little John'	Dwarf Bottlebrush	3-6' x 4-5'				L	
	Carpenteria californica 'Elizabeth'	Elizabeth Bush Anemone	4-6' x 4-6'				M	
	Ceanothus Hybrids: 'Dark Star', 'Julia Phelps'	California Lilac	4-8' x 8-12'				L	
	Choisya ternata	Mexican Mock Orange	6-' x 8'				M	
	Cistus pulverulentus 'Sunset'	Sunset Rockrose	3' x 5'				L	

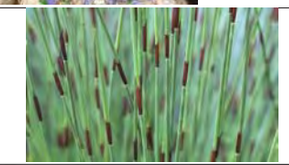
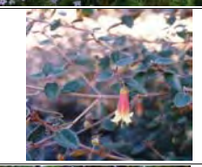
	Botanical Name	Common name	Mature Height & Width	Evergreen / Deciduous	Sun / Shade Tolerance	CA Native Plant / Pollinator Species	*Water Use per WUCOLS (Zone 1)	Plant Image
SHRUBS: over 4' in height	Cistus x purpureus	Orchid Rockrose	4-6' x 4-6'				L	
	Correa 'Ivory Bells'	White Australian Fuchsia	5' x 5'				L	
	Eriogonum giganteum	St. Catherine's Lace	4-8' x 6-8'				VL	
	Euryops pectinatus 'Viridis'	Shrub Daiy	5' x 5'				L	
	Fremontodendron californicum 'Ken Taylor'	Ken Taylor Flannel Bush	5' x 8'				VL	
	Grevillea lanigera	Wooley Grevillea	5' x 5'				L	

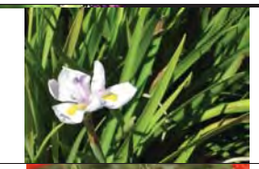
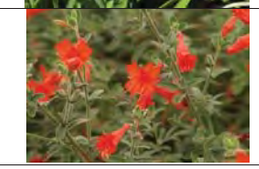
	Botanical Name	Common name	Mature Height & Width	Evergreen / Deciduous	Sun / Shade Tolerance	CA Native Plant / Pollinator Species	*Water Use per WUCOLS (Zone 1)	Plant Image
SHRUBS: over 4' in height	Heteromeles arbutifolia	Toyon	10' x 8'				L	
	Leonotis leonurus	Lion's Tail	6' x 5'				L	
	Leucadendron Hybrid: 'Safari Sunset', 'Rising Sun'	Conebush	8-10' x 6-8'				L	
	Leucospermum 'Scarlet Ribbon'	Nodding Pincushion	4-5' x 4-5'				L	
	Loropetalum chinese var rubrum 'Blush'	Chinese Fringe Plant	4-6' x 4-5'				L	
	Phormium 'Maori Chief'	Maori Chief New Zealand Flax	5-6' x 5-6'				L	

	Botanical Name	Common name	Mature Height & Width	Evergreen / Deciduous	Sun / Shade Tolerance	CA Native Plant / Pollinator Species	*Water Use per WUCOLS (Zone 1)	Plant Image
SHRUBS: over 4' in height	Pittosporum tenuifolium 'Marjorie Channon'	Variegated Kohuhu	7-8' x 5-6'				M	
	Pittosporum tobira 'Variegata'	Mock Orange	4' x 4'				L	
	Rhamnus californica 'Eve Case'	Coffeeberry	8' x 8'				L	
	Ribes sanguinium	Flowering Red Currant	6' x 6'				L	
	Romneya coulteri	Matilija Poppy	3-5' x 6-8'				VL	
	Rosmarinus 'Tuscan Blue	Tuscan Blue Rosemary	4-6' x 3-5'				L	

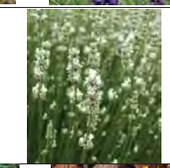
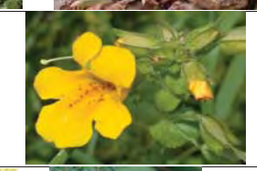
	Botanical Name	Common name	Mature Height & Width	Evergreen / Deciduous	Sun / Shade Tolerance	CA Native Plant / Pollinator Species	*Water Use per WUCOLS (Zone 1)	Plant Image
SHRUBS: over 4' in height	Salvia apiana	White Sage	4' x 5'				VL	
	Saliva leucophylla	Purple Sage	5' x' 5'				L	
	Tecomaria capensis	Red Cape Honeysuckle	12-16' x 6-8'				M	
	Vaccinium ovatum	Evergreen Huckleberry	6' x 4'				M	
	Woodwardia fimbriata	Giant Chain Fern	4-6' x 4-6'				M	
PERENNIALS & GROUNDCOVERS: 6" - 4' in height	Acanthus mollis	Bear's Breech	2-4' x 3-4'				M	

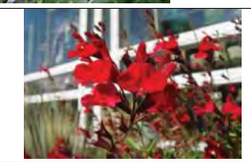
	Botanical Name	Common name	Mature Height & Width	Evergreen / Deciduous	Sun / Shade Tolerance	CA Native Plant / Pollinator Species	*Water Use per WUCOLS (Zone 1)	Plant Image
PERENNIALS & GROUNDCOVERS: 6" - 4' in height	Achillea millefolium Hybrids: "Orange", "Moonshine"	Common Yarrow (White, Orange, Yellow, Pink, Light Purple)	2' x 18"				L - native M - hybrids	
	Anigozanthos Hybrids: 'Big Red' ; 'Bush Dawn'	Kangaroo Paw (Red, Yellow, Orange)	2' x 2' (flw stalks 18" to 6' tall)				M	
	Arctostaphylos 'Emerald Carpet'	Manzanita	12" x 3-6'				M	
	Armeria maritima	Sea Thrift	1' x 1'				M	
	Artemisia 'Powis Castle'		3' x 6'				L	
	Aster chilensis	Coast Aster	3' x 3'				M	
	Baccharis pilularis 'Pigeon Point'	Dwarf Coyote Brush	18" x 10'				L	

	Botanical Name	Common name	Mature Height & Width	Evergreen / Deciduous	Sun / Shade Tolerance	CA Native Plant / Pollinator Species	*Water Use per WUCOLS (Zone 1)	Plant Image
PERENNIALS & GROUNDCOVERS: 6" - 4' in height	Bergenia crassifolia	Winter Blooming Bergenia	2' x 2'				M	
	Ceanothus 'Centennial'	Centennial Ceanothus	1' x 4-6'				L	
	Chondropetalum tectorum	Small Cape Rush	2-3' x 3-4'				L	
	Clivia miniata	Clivia	2' x 2'				M	
	Coleonema pulchrum 'Compacta'	Dwarf Breath of Heaven	2' x 5'				M	
	Correa Hybrids: 'Dusky Bells', 'Ray's Tangerine'	Austrailian Fuchsia	2' x 3'				L	
	Cynara scolymus	Globe Artichoke	3-5' x 2-3'				N/A	

	Botanical Name	Common name	Mature Height & Width	Evergreen / Deciduous	Sun / Shade Tolerance	CA Native Plant / Pollinator Species	*Water Use per WUCOLS (Zone 1)	Plant Image
PERENNIALS & GROUNDCOVERS: 6" - 4' in height	Dietes iridioides	Fortnight Lily	3' x 3'				L	
	Epilobium canum 'Catalina'	Catalina California Fuchsia	2.5' x 4.5'	semi-			L	
	Erigeron glaucus	Seaside Daisy	1' x 2'				L	
	Eriogonum fasciculatum	California Buckwheat	4' x 7'				L	
	Eriogonum grande var. rubescens	Red Buckwheat	2' x 2-3'				L	
	Euphorbia characias 'Wulfenii'	Wulfenii Euphorbia	3-4' x 2-3'				L	
	Francoa ramosa	Maiden's Wreath	1' x 2'				M	

	Botanical Name	Common name	Mature Height & Width	Evergreen / Deciduous	Sun / Shade Tolerance	CA Native Plant / Pollinator Species	*Water Use per WUCOLS (Zone 1)	Plant Image
PERENNIALS & GROUNDCOVERS: 6" - 4' in height	Gaura lindheimeri	Gaura	3-4' x 3'				M	
	Grevillea lanigera 'Coastal Gem'	Coastal Gem Grevillea	1' x 4-5'				L	
	Huechera maxima	Island Alum Root	1' x 1.5'				M	
	Heuchera micrantha 'Palace Purple', Santa Ana Cardinal	Coral Bells	2' x 2'				M	
	Iris douglasiana	Douglas Iris	12" x 12"				L	
	Lantana camara 'New Gold'	New Gold Lantana	1' x 3'				L	
	Lantana montevidensis 'Alba'	Trailing Lantana	2' x 10'				L	

	Botanical Name	Common name	Mature Height & Width	Evergreen / Deciduous	Sun / Shade Tolerance	CA Native Plant / Pollinator Species	*Water Use per WUCOLS (Zone 1)	Plant Image
PERENNIALS & GROUNDCOVERS: 6" - 4' in height	Lavandula angustifolia 'Munstead'	Munstead English Lavender	1.5' x 2'				L	
	Lavandula x intermedia 'Alba'	White Lavandin	3' x 3'				L	
	Mimulus auranticus Hybrids: 'Georgie Tanderine', 'Jack', 'Paynes Yellow', 'Trish', Verity White'	Sticky Monkeyflower	2-3' x 3'				VL - native L - hybrids	
	Mimulus guttatus	Seep Monkey Flower	1-2' x 1-2'				H	
	Monardella villosa	Coyote Mint	2' x 2'				VL	
	Nepeta x faassenii	Cat Mint	1' x 4'				L	
	Penstemon Hybrids: 'Purple Passion', 'Firebird', 'Holly's White'	Beard Tongue	3' x 3'				M	

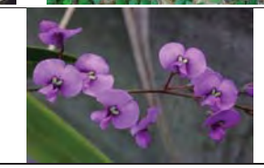
	Botanical Name	Common name	Mature Height & Width	Evergreen / Deciduous	Sun / Shade Tolerance	CA Native Plant / Pollinator Species	*Water Use per WUCOLS (Zone 1)	Plant Image
PERENNIALS & GROUNDCOVERS: 6" - 4' in height	Phormium 'Yellow Wave'	Yellow Wave New Zealand Flax	3-4' x 3-4'				L	
	Salvia 'Allen Chickering'	Allen Chickering Sage	3' x 4'				L	
	Salivia Hybrids: 'Bee's Bliss', 'Mrs Beard'	Creeping Sage	2' x 8'				L	
	Salvia greggii Hybrids: 'Alba', 'Furman's Red', 'Playa Rosa'	Texas Sage	3-4' x 3-4'				L	
	Salvia leucantha 'Midnight'	Mexican Sage	3-4' x 5-6'				L	
	Saliva spathacea	Hummingbird Sage	2' x 4'				L	
	Santolina chamaecyparissus	Santolina	2-3' x 2-3'				L	

	Botanical Name	Common name	Mature Height & Width	Evergreen / Deciduous	Sun / Shade Tolerance	CA Native Plant / Pollinator Species	*Water Use per WUCOLS (Zone 1)	Plant Image
PERENNIALS & GROUNDCOVERS: 6" - 4' in height	Senecio cineraria	Dusty Miller	2-3' x 2-3'				L	
	Sisyrinchium bellum	Blue-Eyed Grass	1' x 1'			CA	VL	
	Stachys byzantina	Lamb's Ears	6" x 4-5'				L	
	Teucrium fruticans 'Azureum'	Bush Germander	3-4' x 4-5'				L	
	Tulbaghia violacea 'Silver Lace'	Siliver Lace Society Garlic	1' x 1'				L	
ORNAMENTAL GRASSES	Calamagrostis x acutiflora 'Karl Foerster'	Feather Reed Grass	3' x 5'	semi-			M	
	Carex buchananii	Leatherleaf Sedge	18"-2' x 12-18"				M	

	Botanical Name	Common name	Mature Height & Width	Evergreen / Deciduous	Sun / Shade Tolerance	CA Native Plant / Pollinator Species	*Water Use per WUCOLS (Zone 1)	Plant Image
ORNAMENTAL GRASSES	Carex divulsa	Berkeley Sedge	1-2' x 1-2'				L	
	Deschampsia cespitosa holciformis	Pacific Hair Grass	3' x 3'				L	
	Festuca 'Siskiyou Blue'	Siskiyou Blue Fescue	18" x 18"				M	
	Helictotrichon sempervirens	Blue Oat Grass	2' x 3'				L	
	Juncus patens 'Elk Blue'	Elk Blue California Rush	1-2' x 1-2'				L	
	Leymus condensatus 'Canyon Prince'	Canyon Prince Wild Rye	2-3' x 2-3'				L	
	Muhlenbergia rigens	Deer Grass	4' x' 4'				L	

	Botanical Name	Common name	Mature Height & Width	Evergreen / Deciduous	Sun / Shade Tolerance	CA Native Plant / Pollinator Species	*Water Use per WUCOLS (Zone 1)	Plant Image
ORNAMENTAL GRASSES	Muhlenergia lindheimeri	Lindheimer's Muhly	4' x 4-6'				L	
	Pennisetum setaceum 'Rubrum'	Purple Fountain Grass	2-4' x 2-3'				L	
SUCCULENTS	Aeonium arboreum 'Zwartkop'	Zwartkop Aeonium	2' x 12"				L	
	Aeonium 'Mint Saucer'	Mint Saucer Aeonium	2-3' x 2-3'				L	
	Agave attenuata 'Nova'	Nova Agave	3.5' x 3.5'				L	
	Agave 'Blue Glow'	Blue Glow Agave	2' x 3'				L	
	Agave desmettiana 'Variegata'	Variegated Smooth Agave	2.5' x 3.5'				L	

	Botanical Name	Common name	Mature Height & Width	Evergreen / Deciduous	Sun / Shade Tolerance	CA Native Plant / Pollinator Species	*Water Use per WUCOLS (Zone 1)	Plant Image
SUCCULENTS	Agave parryi truncata	Artichoke Agave	2.5' x 3.5'				L	
	Agave 'Sharkskin'	Sharkskin Agave	2.5' x 3.5'				L	
	Crassula multicava	Fairy Crassula	1' x 5'				L	
	Dudleya pulverulenta	Chalk Dudleya	12" x 12"				L	
	Echeveria elegans	Mexican Snowball	6" x 12"				L	
	Fascicularia pitcairnifolia var bicolor	(No Common Name)	2' x 2'				L	
	Hesperaloe parviflora	Red Yucca	2-4' x 3-4'				L	

	Botanical Name	Common name	Mature Height & Width	Evergreen / Deciduous	Sun / Shade Tolerance	CA Native Plant / Pollinator Species	*Water Use per WUCOLS (Zone 1)	Plant Image
SUCCULENTS	Sedum spectabile 'Autumn Joy'	Showy Stonecrop	2' x 2'				L	
	Sempervivum tectorum	Hens and Chickens	6" x 1'				L	
VINES	Akebia quinata	Five-Leaf Akebia	climbing, spreading	semi-			M	
	Bougainvillea hybrids 'Barbara Karst', 'San Diego Red', specatbilis	Bougainvillea	climbing, spreading				L	
	Distictis buccinatoria	Red Trumpet Vine	climbing, spreading				M	
	Ficus pumila	Creeping Fig	climbing, spreading				M	
	Hardenbergia violacea	Purple Lilac Vine	climbing, spreading				M	

	Botanical Name	Common name	Mature Height & Width	Evergreen / Deciduous	Sun / Shade Tolerance	CA Native Plant / Pollinator Species	*Water Use per WUCOLS (Zone 1)	Plant Image
VINES	Ipomoena indica	Blue Morning Glory	climbing, spreading				L	
	Jasminum polyanthum	Pink Jasmine	climbing, spreading				M	
	Rosa banksiae 'Lutea'	Lady Bank's Yellow Rose	climbing, spreading				L	
	Solanum laxum	Potato Vine	climbing, spreading				M	
	Thunbergia alata	Black-Eyed Susan Vine	climbing, spreading				M	
	Vitus californica 'Roger's Red'	California Grape	climbing, spreading				L	
LAWN ALTERNATIVES	Achillea x kellereri	Yarrow	8" x 12"				M	

	Botanical Name	Common name	Mature Height & Width	Evergreen / Deciduous	Sun / Shade Tolerance	CA Native Plant / Pollinator Species	*Water Use per WUCOLS (Zone 1)	Plant Image
LAWN ALTERNATIVES	Arctostaphylos uva-ursi	Manzanita	6" x 12'				L	
	Mix: Baccharis pilularis 'Pigeon Point' & Asteriscus maritimus	Mix: Pigeon Point Coyote Bush & Gold Coin Daisy	18" x10 & 12" x 4'				L & M	
	Mix: Carex divulsa & Sisyrinchium bellum	Mix: Berkeley Sedge & Blue-Eyed Grass	18" x 2' & 12" x 12"				L & VL	
	Carex pansa	California Meadow Sedge	10" x 6"				M	
	Ceanothos gloriousus 'Anchor Bay'	Anchor Bay Ceonothus	2.5' x 5'				L	
	Dymondia margaretae	Silver Carpet	2" x 2'				L	
	Epilobium canum 'Everett's Choice'	Everett's California Fuchsia	10" x 4-5'	semi-			L	

	Botanical Name	Common name	Mature Height & Width	Evergreen / Deciduous	Sun / Shade Tolerance	CA Native Plant / Pollinator Species	*Water Use per WUCOLS (Zone 1)	Plant Image
LAWN ALTERNATIVES	Festuca rubra 'Molate'	Creeping Red Fescue	12-18" x spreading				L	
	Fragaria chiloensis	Beach Strawberry	6" x 2'				M	
	Myoporum parvifolium	Myoporum	12" x 10-15'				L	
	Mix: Nassella pulchra & Escholzia californica	Mix: Purple Needlegrass & Calfornia Poppy	18" x 12" & 12" x 12"	semi-			VL & VL	
	Mix: Savlia sonomensis & Eschscholzia californica	Mix: Creeping Sage & California Poppy	24" x 8' & 12" x 12"				L	

WATERSHED MODELING

Stormflow Monitoring and Modeling at Pacific Grove, California (2016) was completed by staff and students at the Watershed Institute at California State University Monterey Bay (CSUMB) under the direction of Associate Professor Dr. Fred Watson. The purpose of the report was to measure stormflow within diverse watersheds, specifically within Greenwood Park and at 8th Street and Pico Avenue, and to use a data-driven modeling approach to make stormwater flow predictions about proposed stormwater control measures.

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Publication No. WI-2016-07

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Stormflow monitoring and modelling at Pacific Grove, California, 2012 and 2015

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Project data:
http://ccows.csumb.edu/pubs/proj_pubs/2016/CityOfPG_Stormwater/index.htm

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1 Overview

This report describes work done by staff and students at the Watershed Institute (CSUMB) for the City of Pacific Grove.

The overall scope of work was to measure stormwater flow in the City of Pacific Grove within diverse watersheds, and to use a data-driven modeling approach to estimate current stormflow and predict future stormflow under specific stormwater control measures (SCMs).

1.1 Background

The work extends previous work done at CSUMB including:

- ENVS 660 (2011) – which included an inventory of outfalls, delineation of watersheds, and GIS characterization of watersheds
- Watson et al. (2012) – which included measurement of stormflow at Greenwood Park during early 2012
- ENVS 660 (2013) – which included a water balance model for the watersheds that drain into the ASBS, and model-based exploration of future scenarios including general LID expansion and a major diversion and storage project

1.2 Work done & summary of results

The work done is summarized below. Details appear in the following sections of this report.

- Section 2 – Study area and weather
- **Section 3 – Updated flow rating curves for Greenwood Park**
  Two new rating curves were designed. These curves enable flow to be estimated from either a staff plate reading or an automatic time series recorded by a logging pressure transducer. The difference from previous curves (Watson et al. 2012) occur at high flows, and were prompted by the observation of water levels following a very high precipitation event and subsequent high flows leading to substantial backwatering at the Greenwood Park culvert.
- **Section 4 – Additional & updated flow data for Greenwood Park**
  Spreadsheets are provided online with an additional winter of flow data (2014-15) for Greenwood Park, and event-based data for 8th St and Pico Ave. These

data update and supplement the existing flow data provided for early 2012 by Watson et al. (2012).

- **Section 5 – Watershed stormflow model**
  A simple stormflow model is described and calibrated against Greenwood Park flow data. The accuracy of the model is illustrated using hydrographs from 12 storm events of varying sizes.
- **Section 6 – Stormflow data for additional sites using dye-dilution gaging**
  A dye-dilution stormflow monitoring technique was developed for use in coastal urban watersheds with outfalls that drop directly into the ocean without any open-channel flow. The technique is portable and intended to be applicable to multiple watersheds without the need for fixed installation of equipment in outfalls, or the risk of fixed equipment leading to blockages in stormwater flow. After a substantial development period, the technique was successfully applied to individual storm events at Greenwood Park, 8th St, and Pico Ave. Pico Ave was shown to have an order of magnitude less flow per unit watershed area than the more urbanized watersheds. This underscores the need to focus stormwater management on the most urbanized watersheds, despite these presenting some of the greatest challenges to management.
- **Section 7 – Design & modeling of a stormwater control measure on Pine Avenue**
  An in-street stormwater control measure (SCM) was conceptually designed and located in Pine Ave below a subwatershed with existing drainage that is completely above ground. A model was developed and applied for predicting the performance of the SCM. The model was used to predict that the SCM could substantially reduce the runoff from an 85th percentile storm event, with certain caveats. Further , it was estimated that ten such SCMs could substantially reduce the 85th percentile runoff in the Greenwood Park watershed as a whole.

2 Study area and weather

The study area included three major watersheds within the City of Pacific Grove: the Greenwood Park watershed, the 8th St watershed, and the Pico Ave watershed. Outfall infrastructure for each of these watersheds is shown in Figures 2-1 to 2-3.

Daily precipitation at Lovers Point (a private Wunderground.com station) is summarized in Fig. 2-4. Most of the monitoring for the present report occurred in early 2015, a period in which substantial storms were scarce – despite the wet fall of 2014 and the very large rainfall event of 11 Dec 2014.

Figure 2-1. Greenwood Park – Entrance to culvert that leads to ocean outfall

Figure 2-2. 8th St – ocean outfall

Figure 2-3. Pico Ave – ocean outfall

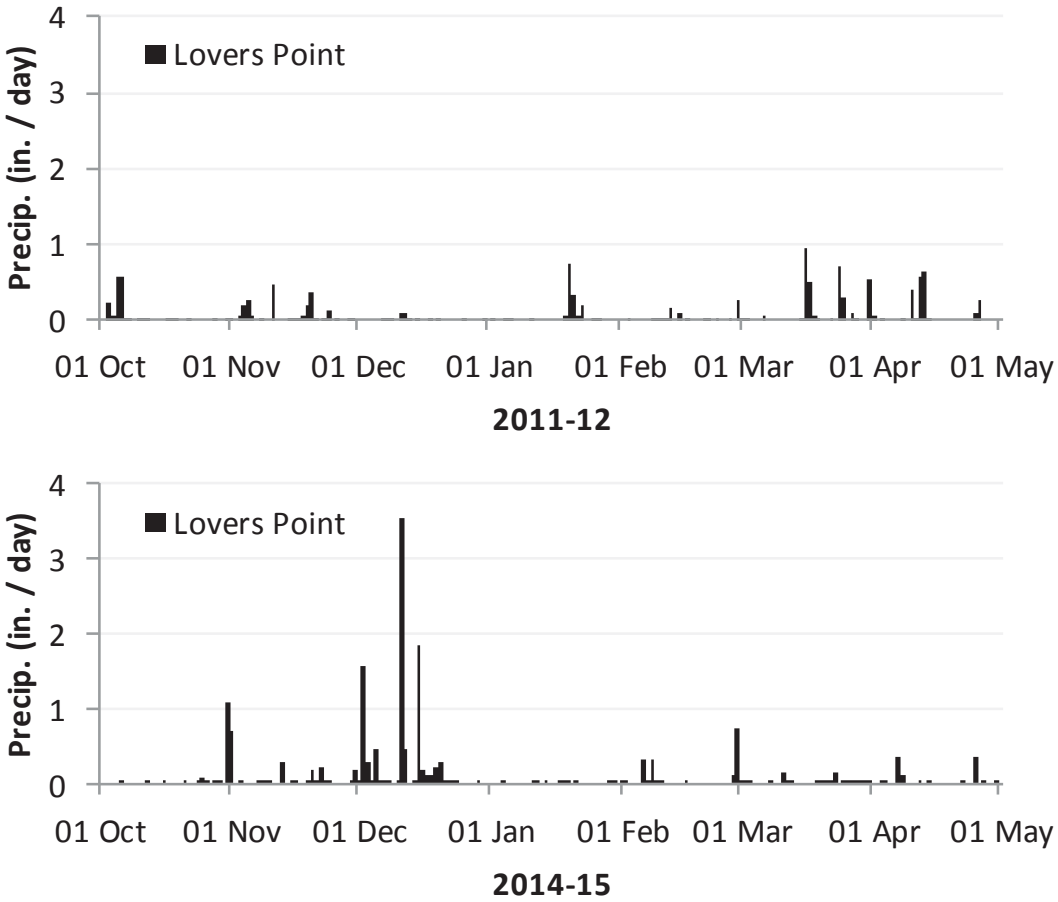

Figure 2-4. Daily precipitation record for "Lovers Point" (a private Wundeground.com station in a residential neighborhood between Lovers Point and Greenwood Park), during the two periods for which Greenwood Park flow data were recorded.

3 Updated flow rating curves for Greenwood Park

A very large rainfall event occurred on 11 Dec 2014, providing an opportunity to revisit and refine the rating curves for Greenwood Park. These rating curves allow estimation of flow rate (CFS) given either a manual staff plate reading (Site C) or an automatic pressure transducer data set (Site D).

The 11-Dec-2014 event involved 3.65 inches of rainfall in a 24-hour period (6:00 AM to 6:00 AM), falling at a maximum rate of 1.92 inches per hour, resulting in an estimate peak stormflow of 177 CFS, from a watershed draining just 256 acres. The water was 8.51 feet deep at peak flow, resulting in the lower portion of Greenwood Park becoming a small pond, backed up behind a rapidly flowing but flooded 4.27-foot culvert.

Flow hydraulics under filled-culvert conditions are readily estimated using established modeling software, and we took advantage of this to simulate a number of additional rating curve points using a simple HEC-HMS model as summarized in Table 4-1. The new points fell lower than expected given the previous rating curve. This was explained by changing the roughness assumptions behind the highest four points of the previous curve, which had been estimated using surface floats a channel roughness assumption that was apparently too low. The final curve is fit to the same points as the 2012 curve, except that the four highest points are 85% lower, and the new model-derived filled-culvert-flow points are incorporated.

The curve for Site D (pressure transducer) is illustrated in Figure 4-1 and defined by the equation:

$$Q = \begin{Bmatrix} 0.0000275 \times (D-4)^{2.4} & D < 118 \\ 0.37 \times \sqrt{D-75} & D \geq 118 \end{Bmatrix}$$

where Q (m^3/s) is flow and D (cm) is water pressure at Site D (atmospherically corrected). The curve for Site C (manual stage) was also updated to match the Site D curve, but the additional accommodation above filled-culvert flow has not yet been made. The equation is:

$$Q = 0.0009 \times (C - 10.7)^{1.6}$$

where C (cm) is stage at Site C.

Table 3-1. HEC-HMS model parameters used to estimate flow rates for filled-culvert-flow at Greenwood Park.

Greenwood "reservoir" for modeling backwater against culvert and headwall

Method	Outflow Structures		
Storage Method	Elevation-Area	Elev-Area Function	
		Elev (ft)	Area (ac)
		0	0.01
		20	0.1
Initial condition	Inflow=Outflow		
Time Step Method	Automatic		
Outlets	1		

"Reservoir" outlet

Method	Culvert Outlet
Solution Method	Inlet Control
Shape	Circular
Chart	Concrete Pipe Culvert
Scale	Square edge entrance with headwall
Length (ft)	80
Diameter (ft)	4.27
Inlet Elevation (ft)	0.25
Entrance Coefficient	0.2
Outlet Elevation (ft)	0
Exit Coefficient	1
Manning's N	0.02

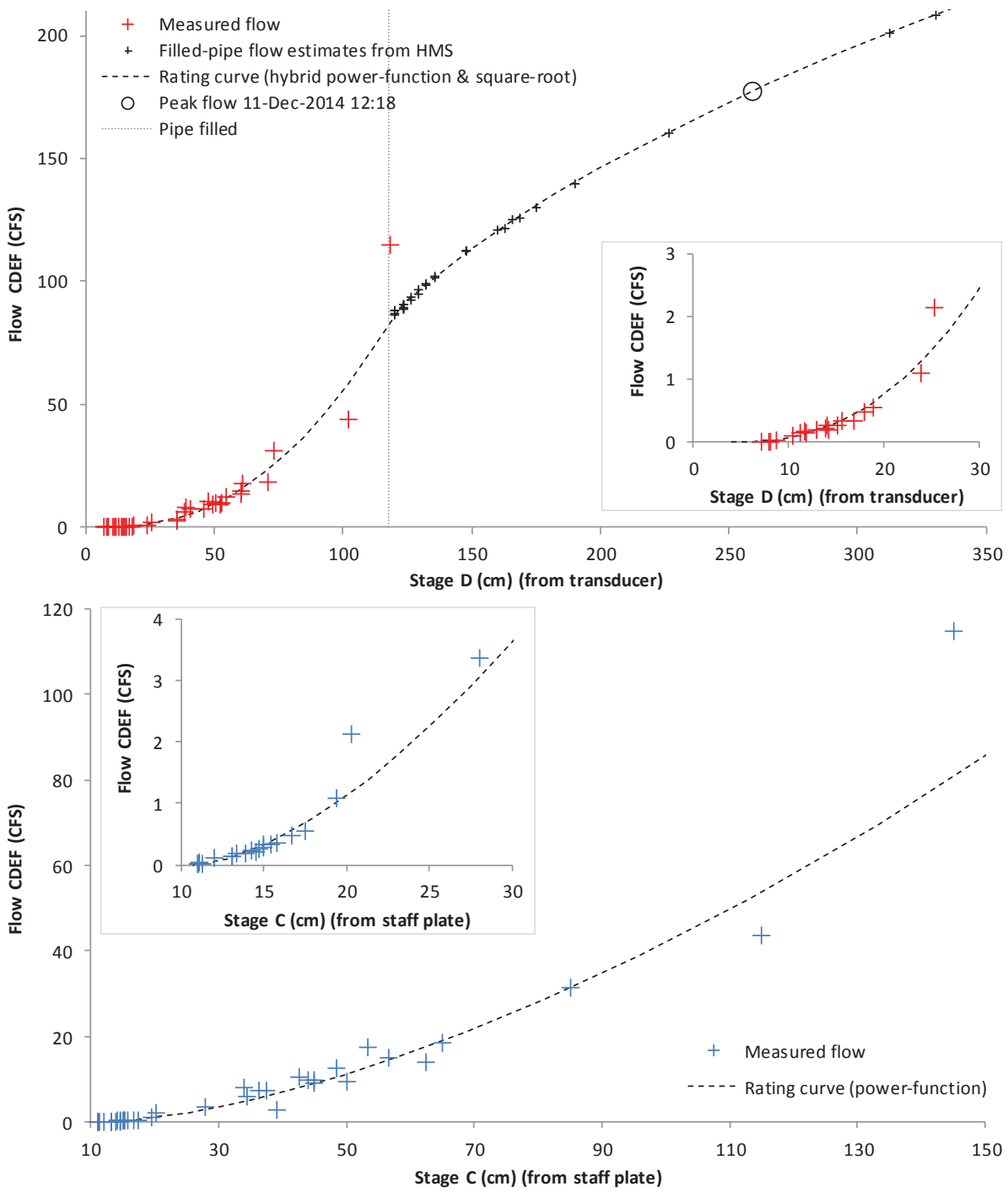

Figure 3-1. Updated rating curves for estimating flow from stage and pressure at Greenwood Park.

4 Additional & updated flow data for Greenwood Park

We deployed pressure transducers at Greenwood Park for 7 months of 2014-15. In combination with the update rating curves for Greenwood Park, this substantially expanded the stormflow record for the City's greatest stormflow-producing watershed. The logging interval was 6-minutes.

The flow data are available at the following URL, and are summarized in Figure 3-1.

http://ccows.csumb.edu/pubs/proj_pubs/2016/CityOfPG_Stormwater/index.htm

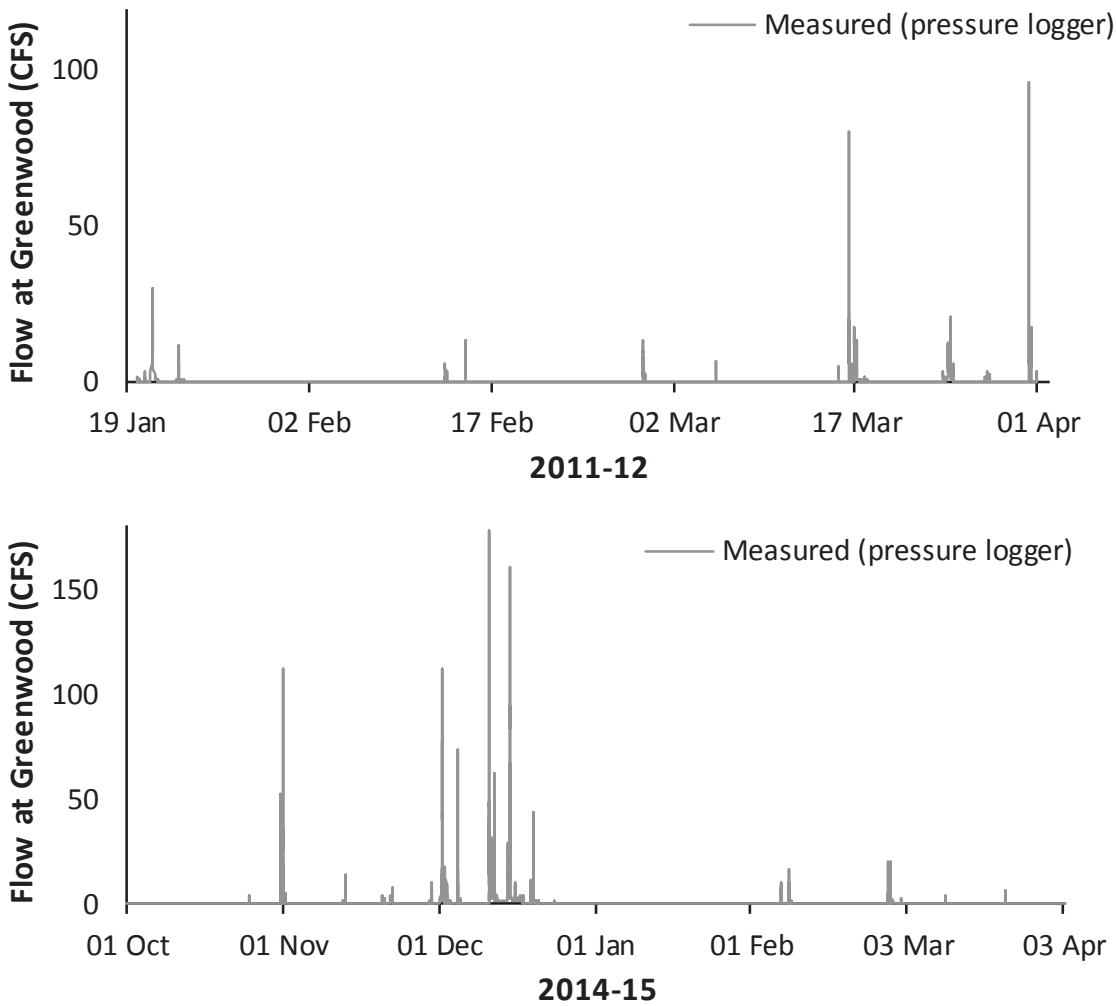

Figure 4-1. Updated and expanded stormflow monitoring record for Greenwood Park.

5 Watershed stormflow model

Given the relative abundance of stormflow data, we found that stormflow within the City can be reasonably predicted by a simple runoff coefficient and lag flow model. (A more-complex model would be required to estimate lower flows such as baseflow and the later parts of stormflow recessions). We implemented such a model using HEC-HMS software (Version 4.1). We utilized the "Impervious %" parameter to express runoff coefficient, and we calibrated the values of this parameter against observed flows (Table 5-1), rather than specifying the values based on mapped impervious cover. For convenience, we implemented this approach within the "Curve Number" (CN) method in HMS, but we set the CN to 1 to completely switch off the generation of runoff via curve numbers. In an alternative approach, curve numbers could be used, but in the present case, we found they were of limited utility when compared to the simplicity of interpretation of a simple runoff coefficient.

Figures 5-1 to 5-9 illustrate the accuracy of the model for 9 representative storms in 2012, 2014, and 2015. In each case, two model runs are shown for 20% and 40% runoff coefficient values, respectively. This illustrates the range of uncertainty of the runoff coefficient ("imperviousness") parameter. Overall, the model is remarkably accurate, given its simplicity. This indicates precipitation at the Lovers Point gage is representative of the watershed as a whole, and that the dominant runoff-producing processes are very direct and simple. Most wet-season flow at the ocean outfall arises from rain falling on impervious surfaces flowing directly through the stormwater system to the outfall. Only a relatively small amount of runoff is generated by indirect means, e.g. by rain percolating into the ground and then re-emerging as throughflow or baseflow. Percolation does occur of course, and probably to a substantial degree; but the fate of most percolated water is apparently something other than eventual discharge at an ocean outfall.

The propensity of the watershed to generate runoff is quantified by the runoff coefficient, which in turn is indirectly measured through the process of matching measured flow and predicted flow corresponding to a particular runoff coefficient. There appears to be a general tendency for the watershed to have a greater propensity to generate runoff (40% runoff coefficient) after a sequence of prior storms (moist antecedent conditions) and/or during the larger rainfall events, and to generate relatively less runoff (20% runoff coefficient) after dry periods (dry antecedent conditions) and/or during the smaller rainfall events (see Figures 5-1 to 5-9).

Table 5-1. HMS model parameters for estimating stormflow in three watersheds in the City of Pacific Grove. See later sections of this report for calibration flows and explanation of the SCM.

Parameter / Option			Current			Hypothetical	
			Greenwood	8th St	Pico Ave	Pine above SCM	Greenwood minus Pine SCM
Area (mi2)			0.40082	0.08651	0.27806	0.01221	0.38861
Model time step		5 minutes					
Loss	Method (nominal)	SCS Curve Number					
	Method (functional)	Rational method					
	Initial abstraction	0					
	Curve Number	1					
	Impervious %		20-40 (low-high)	25	1.8	30	30
Transform	Method (nominal)	SCS Unit Hydrograph					
	Graph Type	Standard (PRF 484)					
	Lag Time (min)		10	8	25	5	10
Canopy	Method	None					
Surface	Method	None					
Baseflow	Method	None					

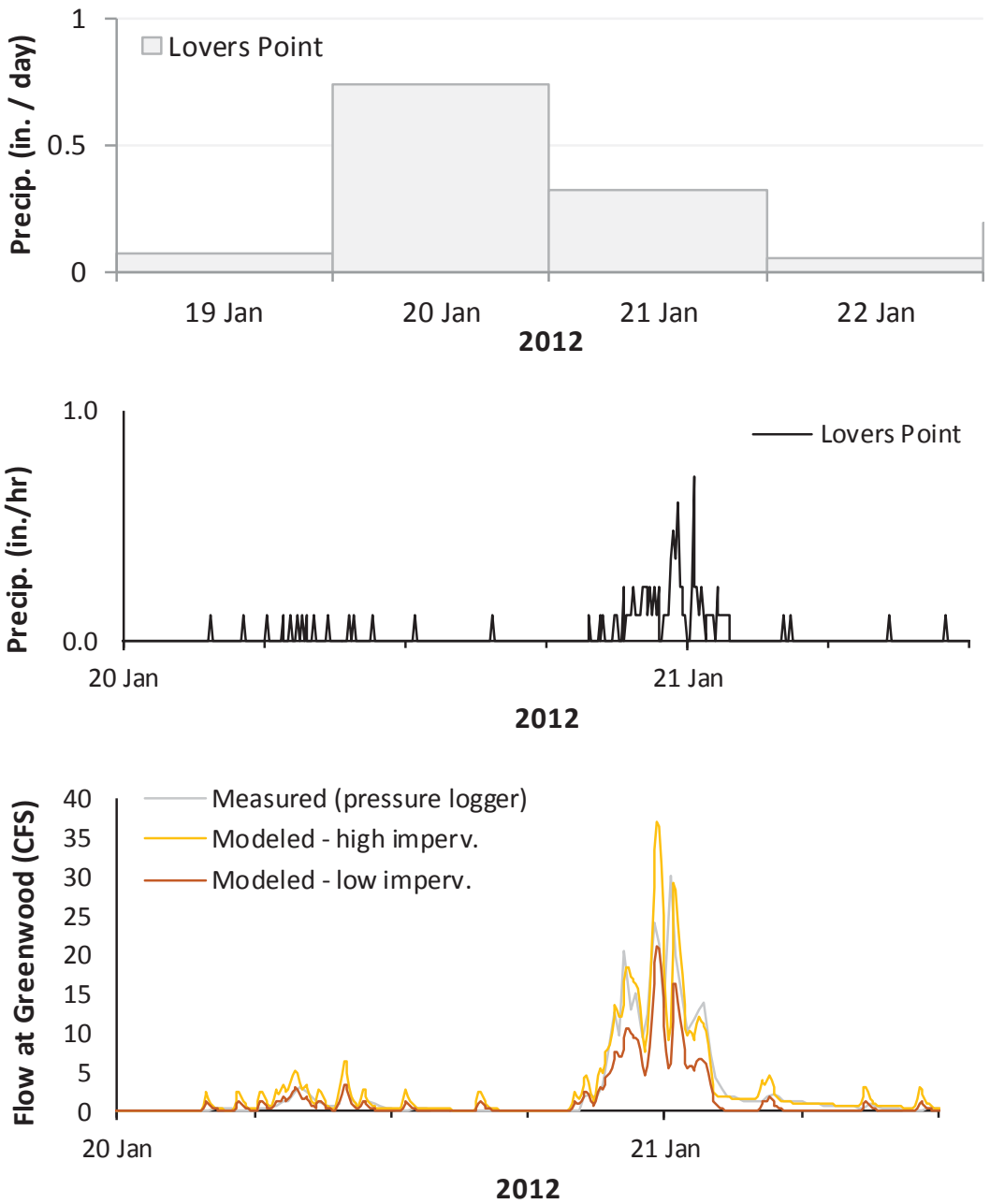

Figure 5-1. Assessment of model accuracy for Greenwood Park during 20-21 Jan 2012 event.

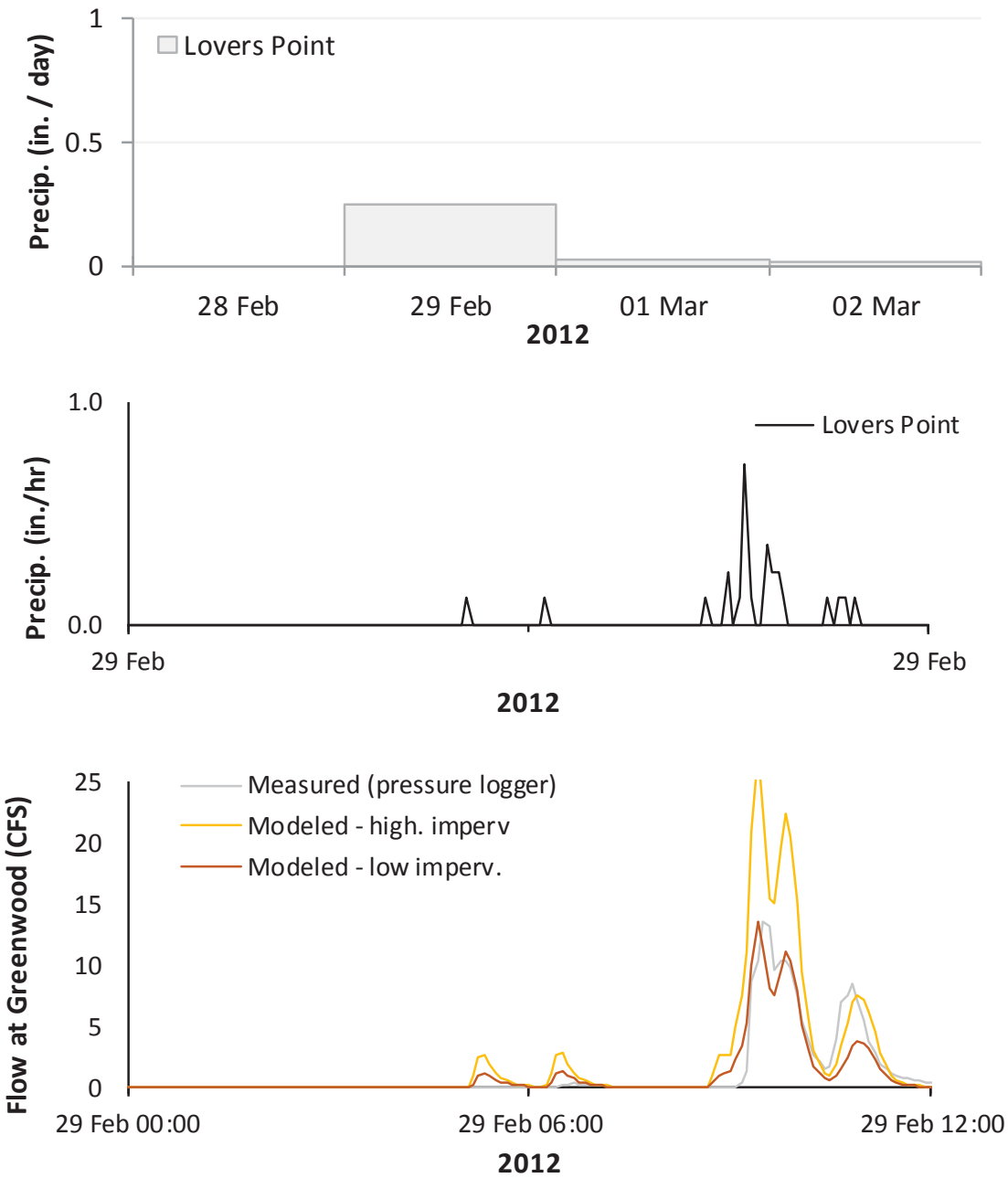

Figure 5-2. Assessment of model accuracy for Greenwood Park during 29 Feb 2012 event.

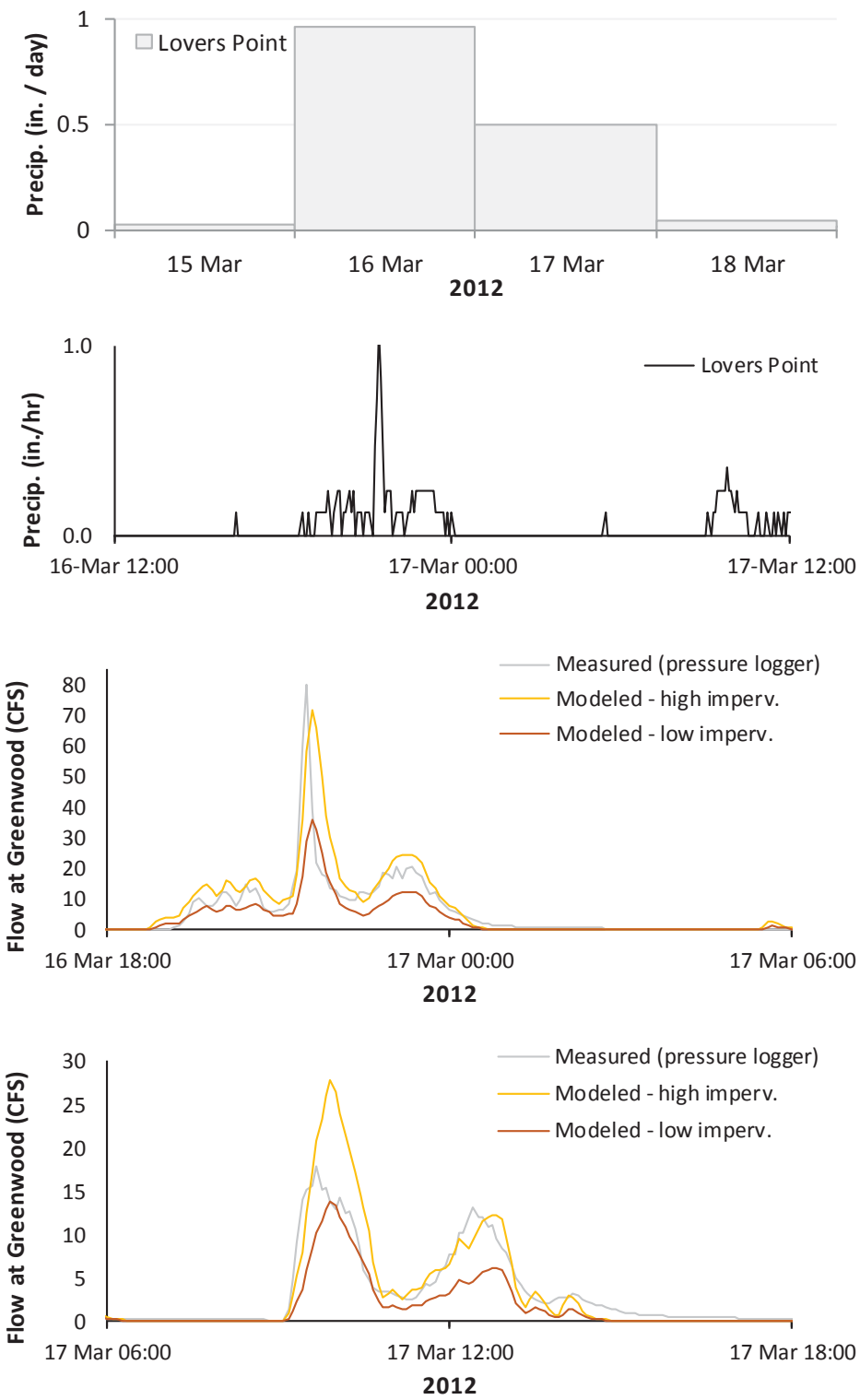

Figure 5-3. Assessment of model accuracy for Greenwood Park during 16 & 17 Mar 2012 events.

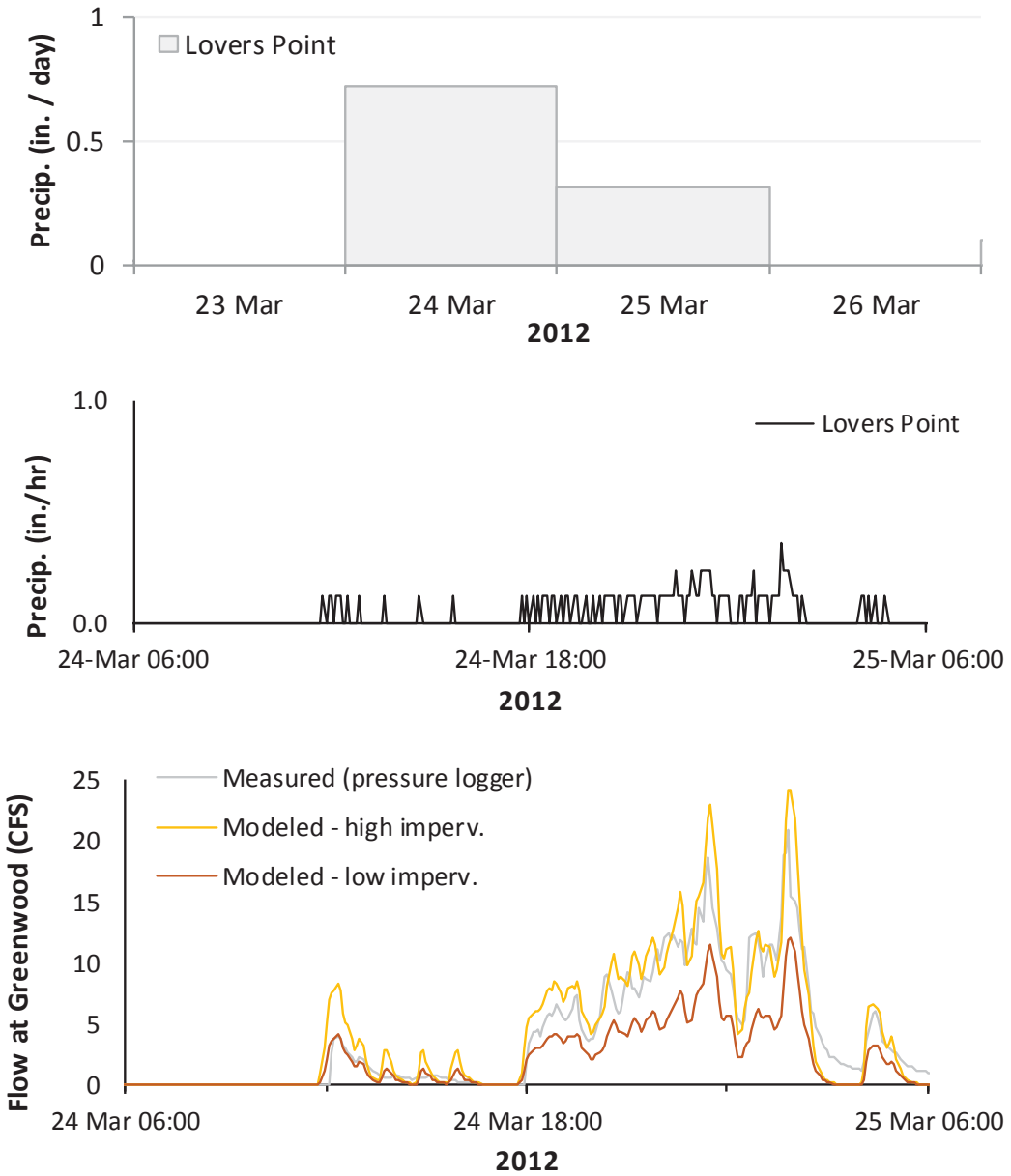

Figure 5-4. Assessment of model accuracy for Greenwood Park during 24 Mar 2012 event.

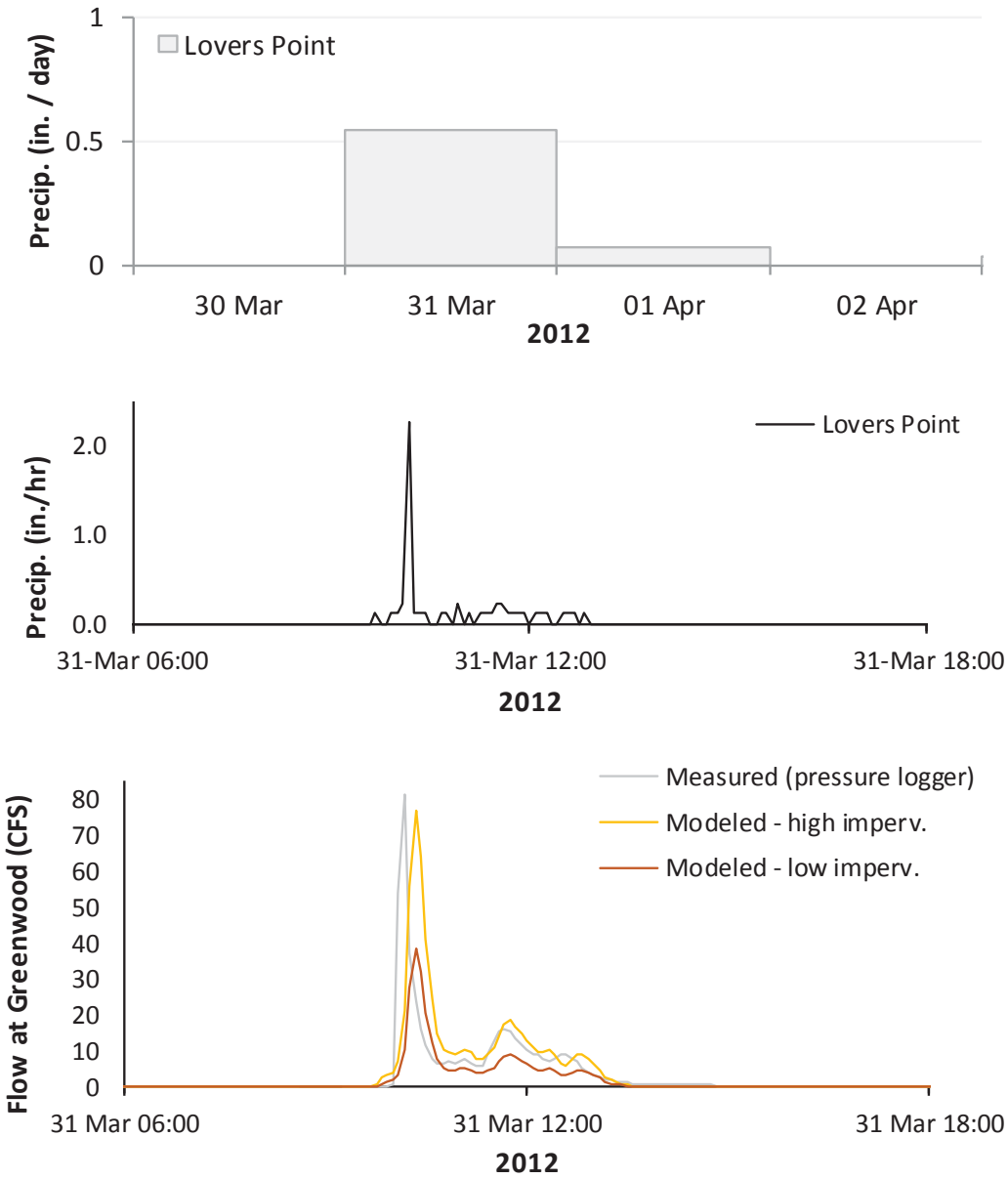

Figure 5-5. Assessment of model accuracy for Greenwood Park during 31 Mar 2012 event.

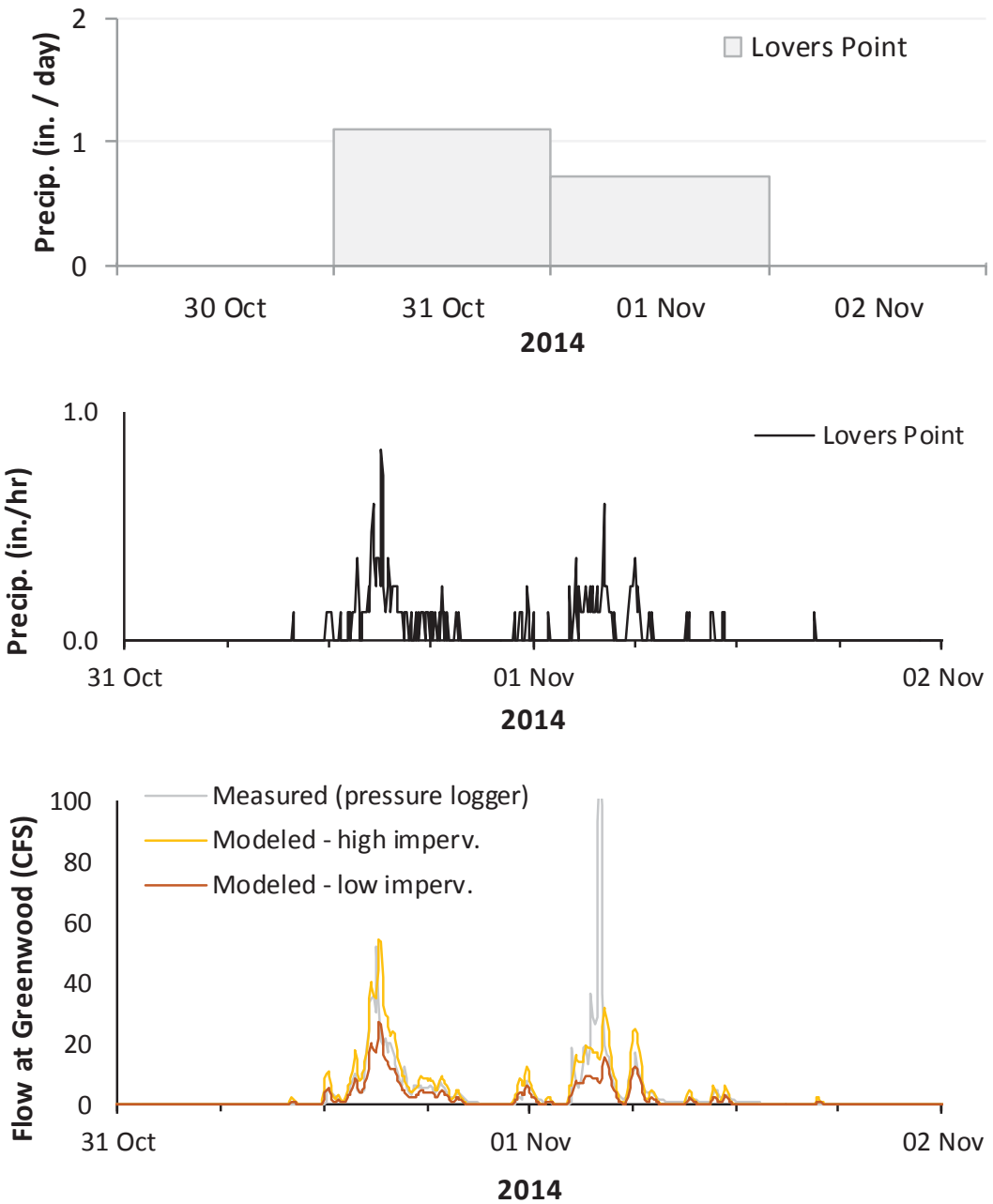

Figure 5-6. Assessment of model accuracy for Greenwood Park during 31 Oct – 1 Nov 2014 events.

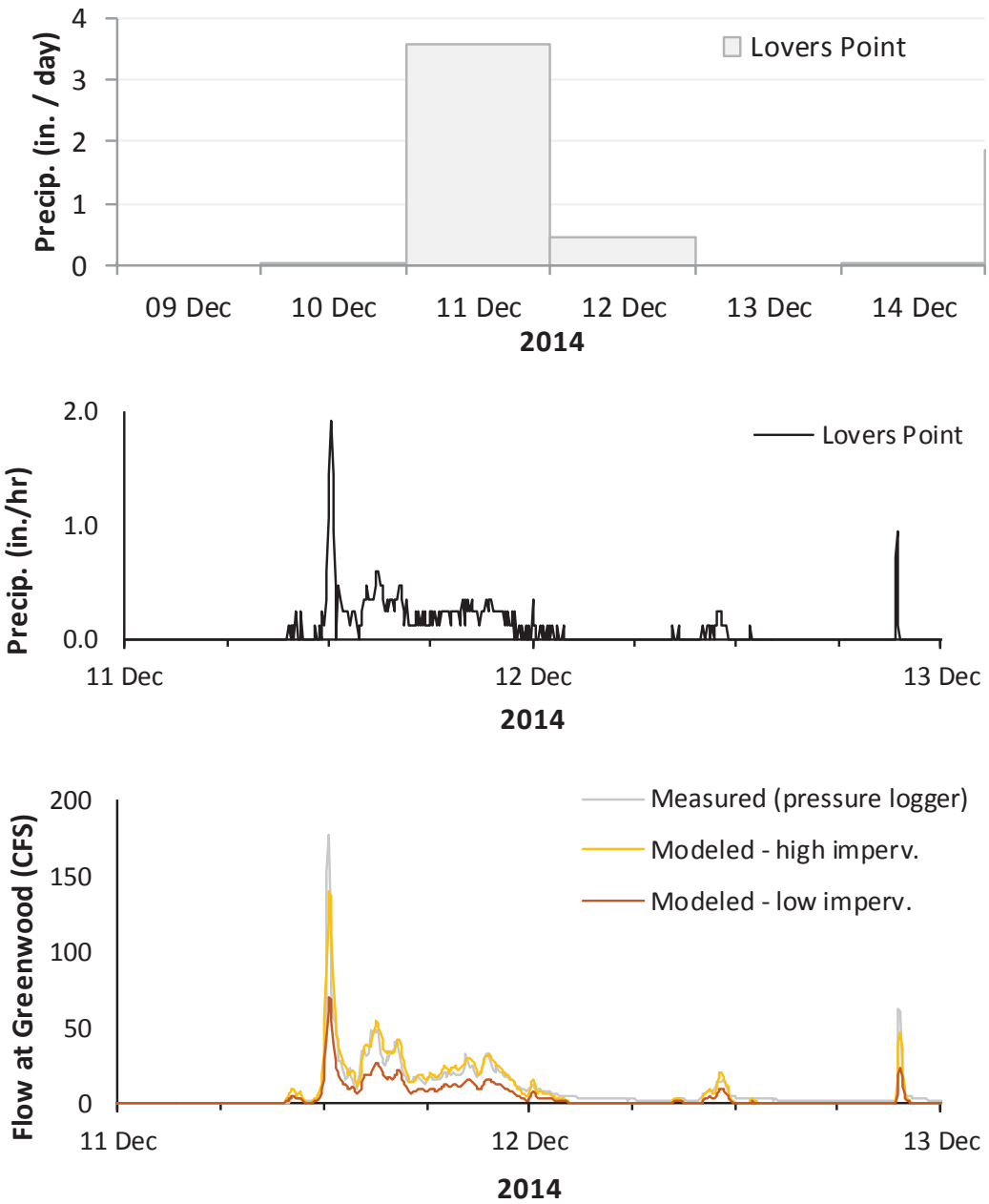

Figure 5-7. Assessment of model accuracy for Greenwood Park during 11-12 Dec 2014 event.

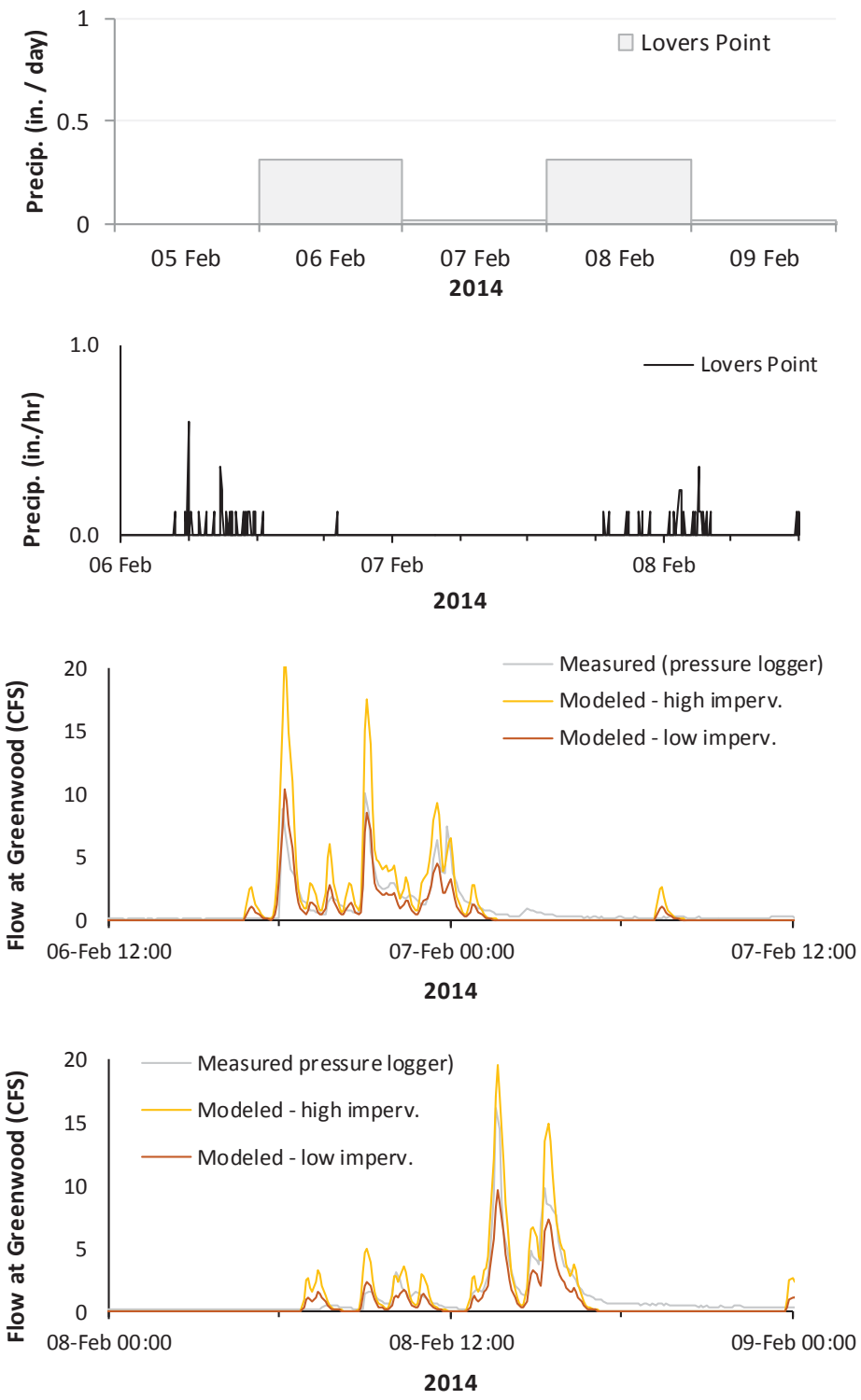

Figure 5-8. Assessment of model accuracy for Greenwood Park during 6-9 Feb 2015 event.

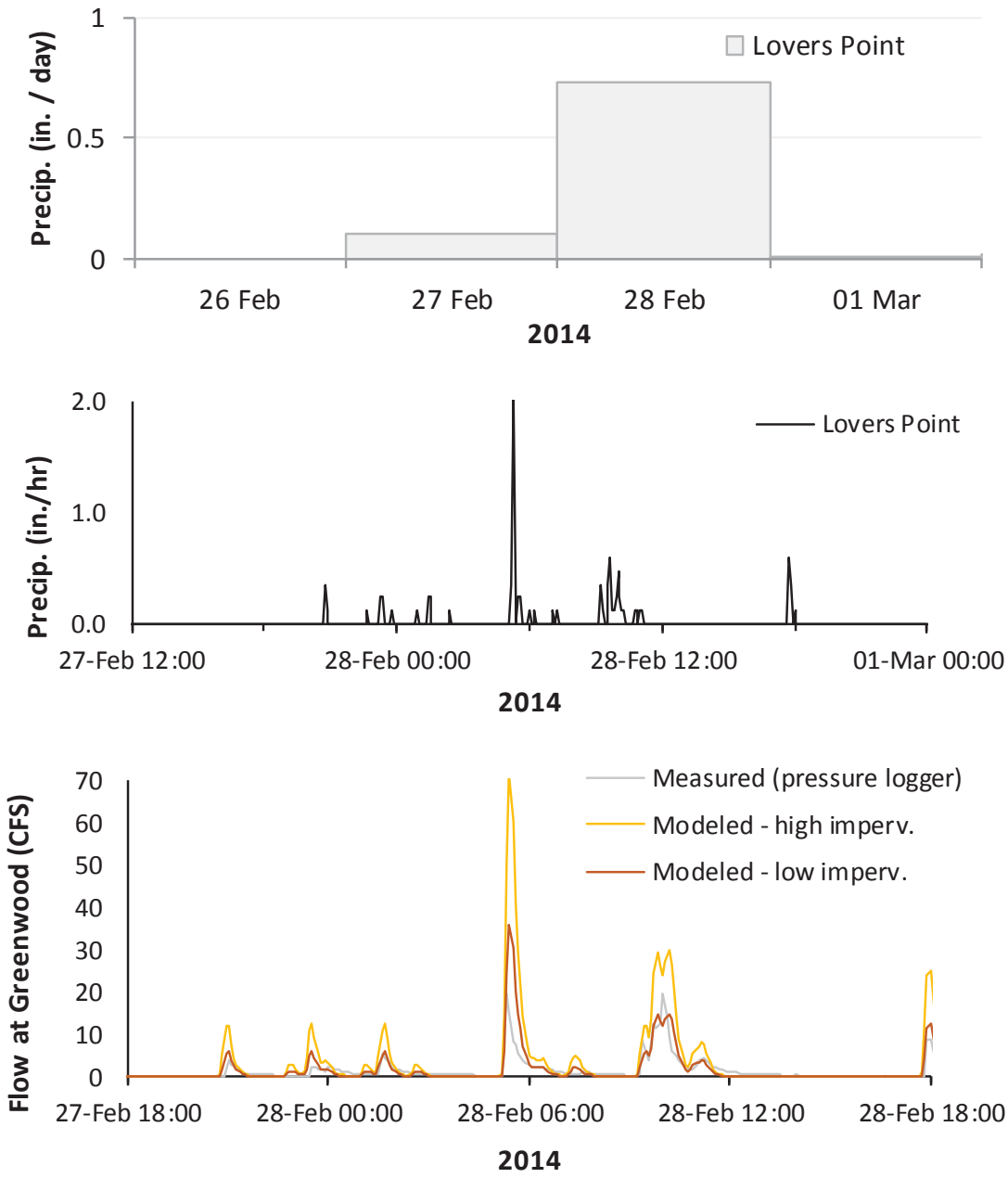

Figure 5-9. Assessment of model accuracy for Greenwood Park during 27-28 Feb 2015 event.

6 Stormflow data for additional sites using dye-dilution gaging

6.1 Dye-dilution development

We developed a variant of the dye-dilution flow measurement technique (Duerk 1983; Kilpatrick & Cobb, 1985; Kilpatrick & Wilson, 1989; Clow & Fleming, 2008) for application to stormflow at coastal outfalls. The essential features of our technique included:

- Dye type: Rhodamine WT
- Dye injection method: Continuous flow maintained using a Mariotte bottle, with periodic manual adjustments to the injection rate to track variations in flow rate and maintain downstream dye concentrations within the target range of dye measurement equipment.
- Dye sampling method: Continuous flow extracted from the stream using a battery-powered pump pulling water through a suction hose terminated by a screened inlet nozzle.
- Dye measurement method: Turner Designs Cylcops Fluorometer connected to a light-excluding through-flow adapter fed by the water pump, and monitored by a Turner Data Bank logger.

We tested a variety of alternate configurations prior to the adoption of the above features. Some ultimately non-adopted design elements included:

- Pulse injection (instead of continuous injection)
- Continuous injection using a peristaltic pump (instead of a Mariotte bottle).
- Direct measurement by placing the fluorometer in the water stream (as opposed to pumping it out of the water stream up to the fluorometer at a separate location)
- Extraction pump systems with either insufficient battery power, or insufficient cooling

Figures 6-1 to 6-8 summarize the field and laboratory trails that led to the eventual successful application of the technique to three different watersheds at Pacific Grove.

(Text is continued after Figure 6-8)

Date	Location	Personnel	Outcome	Dosing	Sampling	Flow
10-Jul-14	Laboratory F	JU, FW	Experience with dye-gaging	P	Direct	Lab
20-Jul-14	Laboratory A	AT, JU	Experience with dye-gaging	P	Direct	Lab
20-Aug-14	Laboratory A?	AT	Experience with dye-gaging	NA	NA	NA
4-Sep-14	Various in PG	AT, JU	Site visits	NA	NA	NA
9-Sep-14	Greenwood Park	AT, JU	Experience with dye-gaging	P	Direct	Low
19-Oct-14	Greenwood Park	AT	Experience with dye-gaging	P	Direct	Low
25-Oct-14	Greenwood Park	AT	Experience with dye-gaging	P	Direct	Storm
27-Oct-14	Salinas Rec Ditch	AT, JU, AB	Experience with dye-gaging	P	Direct	Low
31-Oct-14	Salinas Rec Ditch	AT, SN, AH	Experience with dye-gaging	P	Direct	Storm
31-Oct-14	Greenwood Park	AT	Experience with dye-gaging	P	Direct	Storm
13-Nov-14	Salinas Rec Ditch	AT	Experience with dye-gaging	P	Direct	Post-storm
22-Nov-14	Greenwood Park	AT	Experience with dye-gaging	P	Direct	Post-storm
2-Dec-14	Greenwood Park	AT	Experience with dye-gaging	P	Direct	Storm
11-Dec-14	Greenwood Park	AT	Experience with dye-gaging	P	Direct	Storm
19-Jan-15	Greenwood Park	AT, SN, AB	Experience with dye-gaging	CP	Direct	Low
5-Feb-15	Laboratory F?	AT, FW	Experience with dye-gaging	CM	NA	NA
7-Feb-15	Greenwood Park	AT, SN, AB	Experience with dye-gaging	CM	Direct	Low
8-Feb-15	Laboratory F	FW	Experience with dye-gaging	CM	NA	NA
8-Feb-15	Greenwood Park	AT, SN	Experience with dye-gaging	CM	Direct	Storm
16-Feb-15	Laboratory	AT	Experience with dye-gaging	CM	NA	NA
19-Feb-15	Pico	AT, SN, AB	Experience with dye-gaging. Some steady-flow data.	CM	Pumped & direct	Low
25-Feb-15	8th St	AT, SN	Experience with dye-gaging	CM		
27-Feb-15	8th St	SN, JU, AT	Experience with dye-gaging. Data: low flow.	CM	Pumped & direct	Low
28-Feb-15	8th St	SN, AB, AT	Data: stormflow (8th).	CM	Pumped & direct	Storm
7-Apr-15	Pico & Greenwood	AT, FW	Data: stormflow (GW). Data: low flow (Pico).	CM	Pumped	Storm
25-Apr-15	Pico & Greenwood	AT, JU, SN	Data at **Greenwood?** Data: stormflow (Pico)	CM	Pumped	Storm

Figure 6-1. Summary of field and laboratory effort during development of the dye-dilution flow gaging technique. (P = Pulse; CP = Continuous peristaltic; CM = Continuous, Mariotte)

Figure 6-2. Continuous dye injection using Mariotte bottle – Pico Ave

Figure 6-3. Measuring dye injection rate – Greenwood Park

Figure 6-4. Remote dye measurement using fluorometer, logger, and a water pumped from stream into flow-through adapter for fluorometer – Pico Ave

Figure 6-5. Remote dye measurement, showing screened suction hose drawing sample water from stream up to sensor – Greenwood Park

Figure 6-6. Heat-vented rain-resistant housing for water pump used to remotely sample stream water

Figure 6-7. Direct dye measurement, with fluorometer inserted directly into stream. This approach yielded inconsistent readings.

Figure 6-8. Continuous dye injection using a peristaltic pump. This approach yielded inconsistent injection rates.

6.2 Dye-dilution technique validation

An opportunity to validate the dye-dilution flow measurement technique arose at Greenwood Park on 7-Apr-2015. We obtained concurrent time-series of flow measurements using both the staff-plate/rating-curve technique and the dye-dilution technique. The measurements compared well with each other (Fig. 6-9), and also to model predictions with relatively a low runoff coefficient (as would be expected given the relatively small size of the event, and the dry antecedent conditions - see Fig 2-4 for reference).

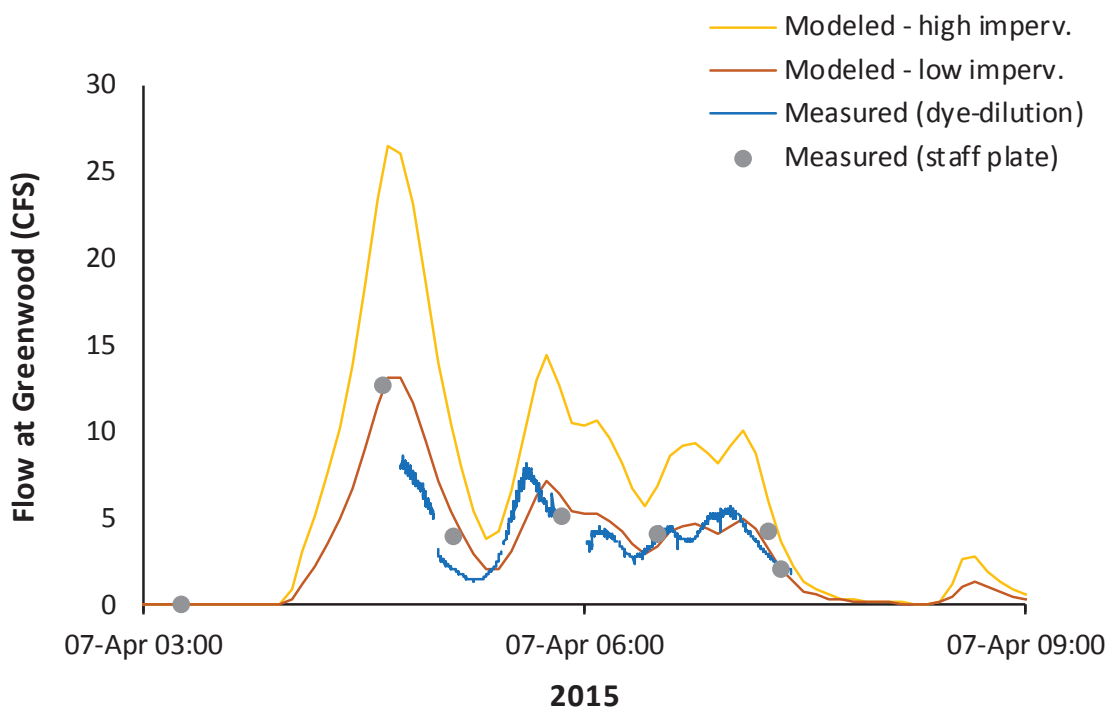

Figure 6-9. Validation of dye-dilution flow measurements against staff-plate/rating-curve flow measurements at Greenwood Park.

6.3 Dye-dilution technique application

The goal of using the dye-dilution technique for flow gaging was to be able to measure storm flow safely with using fixed instrumentation mounted in storm drains or outfalls, in order to obtain support for our postulate that different watersheds in the City of Pacific Grove might yield very different flow rates per unit of watershed area, depending on their watershed characteristics.

In addition to the technique-validation measurements at Greenwood Park, we were able to obtain dye-dilution stormflow measurements at two other watersheds: the 8th St watershed, and the Pico Ave watershed.

Measurements at 8th St were obtained between 25-Feb-2015 and 28-Feb-2015 during two low-flow periods and a storm event. Figure 6-10 illustrates the general context of these measurements, and Figure 6-11 provides a more-detailed examination of flow during the 28-Feb storm event. A good match was observed between the timing of precipitation, measured runoff, and modeled runoff.

The flow measurements imply a 25% runoff coefficient for the watershed during the 28-Feb event, because this was the runoff coefficient required to achieve good match between magnitude of measured and modeled flow (Fig. 6-11). Antecedent conditions were dry (Fig 2-4); the average runoff coefficient for 8th St under non-drought conditions may be higher than 25% e.g. approximately 30%.

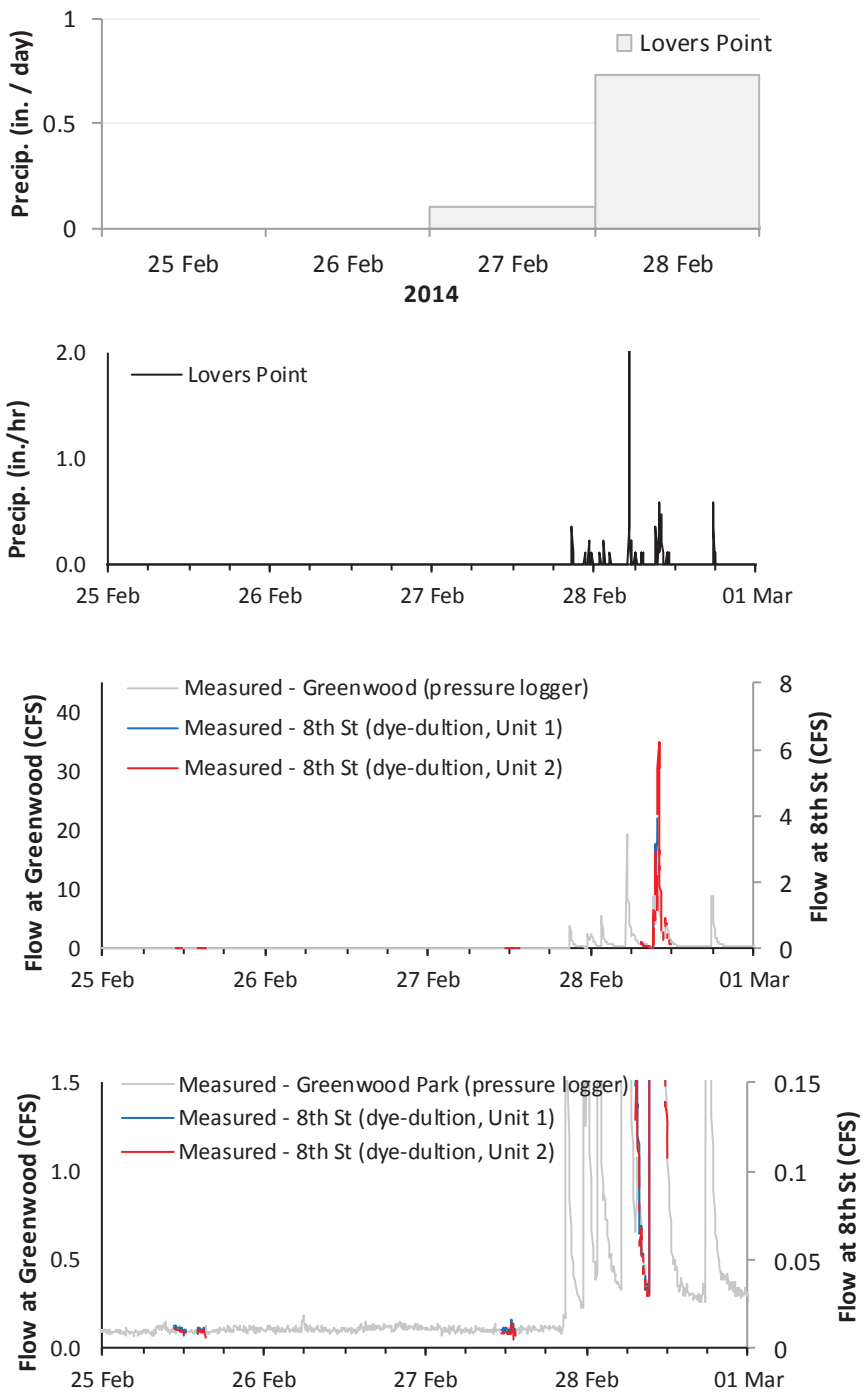

Figure 6-10. Dye-dilution flow measurements at 8th St, with overall context provided by the inclusion of pressure-based data from the adjacent Greenwod Park watershed. Two independent sets of dye-dilution measurements were obtained, using two different fluorometers ("Unit 1" and "Unit 2"). Greenwood Park data are included to clarify low-flow versus storm-event conditions. More detail appears in Figure 6-11.

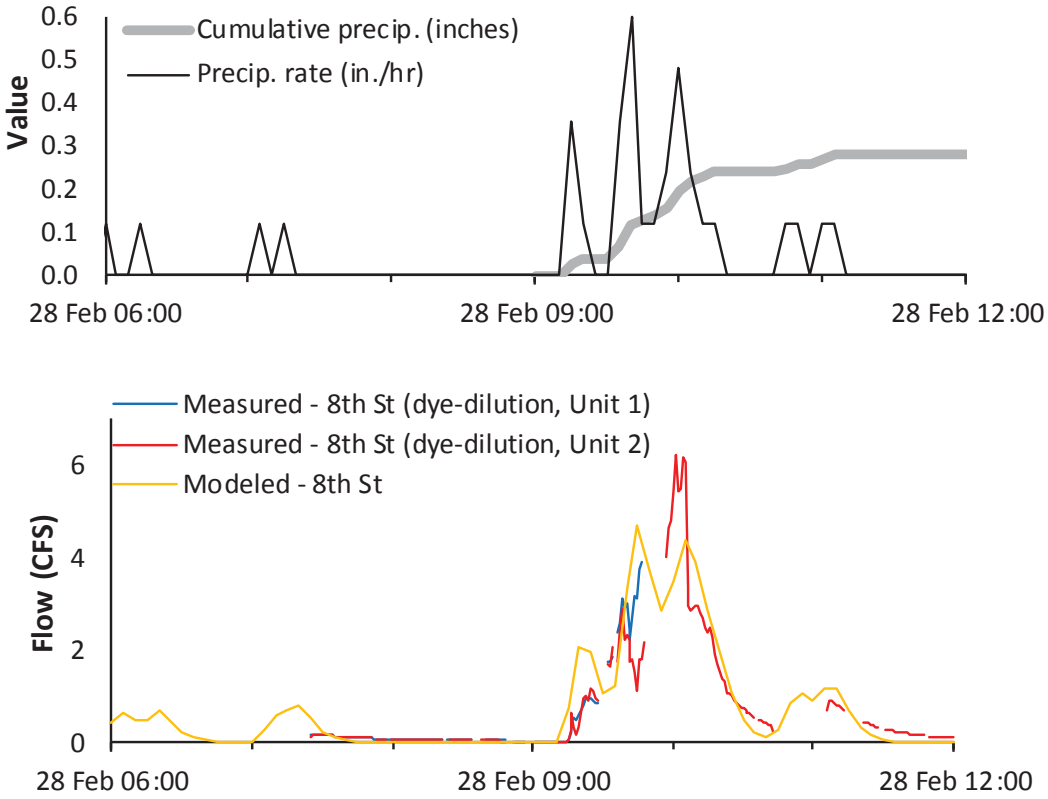

Figure 6-11. Dye-dilution flow measurements at 8th St, and calibration of stormflow model to the dye-dilution measurements.

Dye-dilution flow measurements were obtained for the Pico Ave watershed during low flow before a storm on 7-Apr-2015 and during a storm event on 25-Apr-2015 (Figs 6-12 and 6-13).

A good match was observed in the timing of precipitation, measured runoff, and modeled runoff during the 25-Apr storm event.

The runoff coefficient required to achieve a good match in the magnitude of measured and modeled flow was only 1.8%. The storm was relatively small, and the antecedent conditions were dry; so the average runoff coefficient for the watershed is likely to be higher, but still much less than the runoff coefficients indirectly observed for the more urbanized watersheds like Greenwood Park (20-40%) and 8th St (at least 25%). This supports our initial postulate that some watersheds (like Pico Ave) generate much less runoff (per unit watershed area) than other watersheds in the City.

Several watershed characteristics may lead to lower flow per unit watershed area in watersheds like that of Pico Ave. These include, for example, lower impervious cover, higher tree canopy cover, and higher proportion of sandy soils (derived from sand dunes).

Impervious cover is perhaps the most obvious metric to summarize the runoff-generating propensity of different watersheds within the City. Figure 6-14 briefly explores the relationship between mapped impervious cover (based on satellite remote sensing, ENVS 660 (2011)) and runoff coefficients indirectly measured through calibration of watershed models to measured flows. A positive relationship is evident.

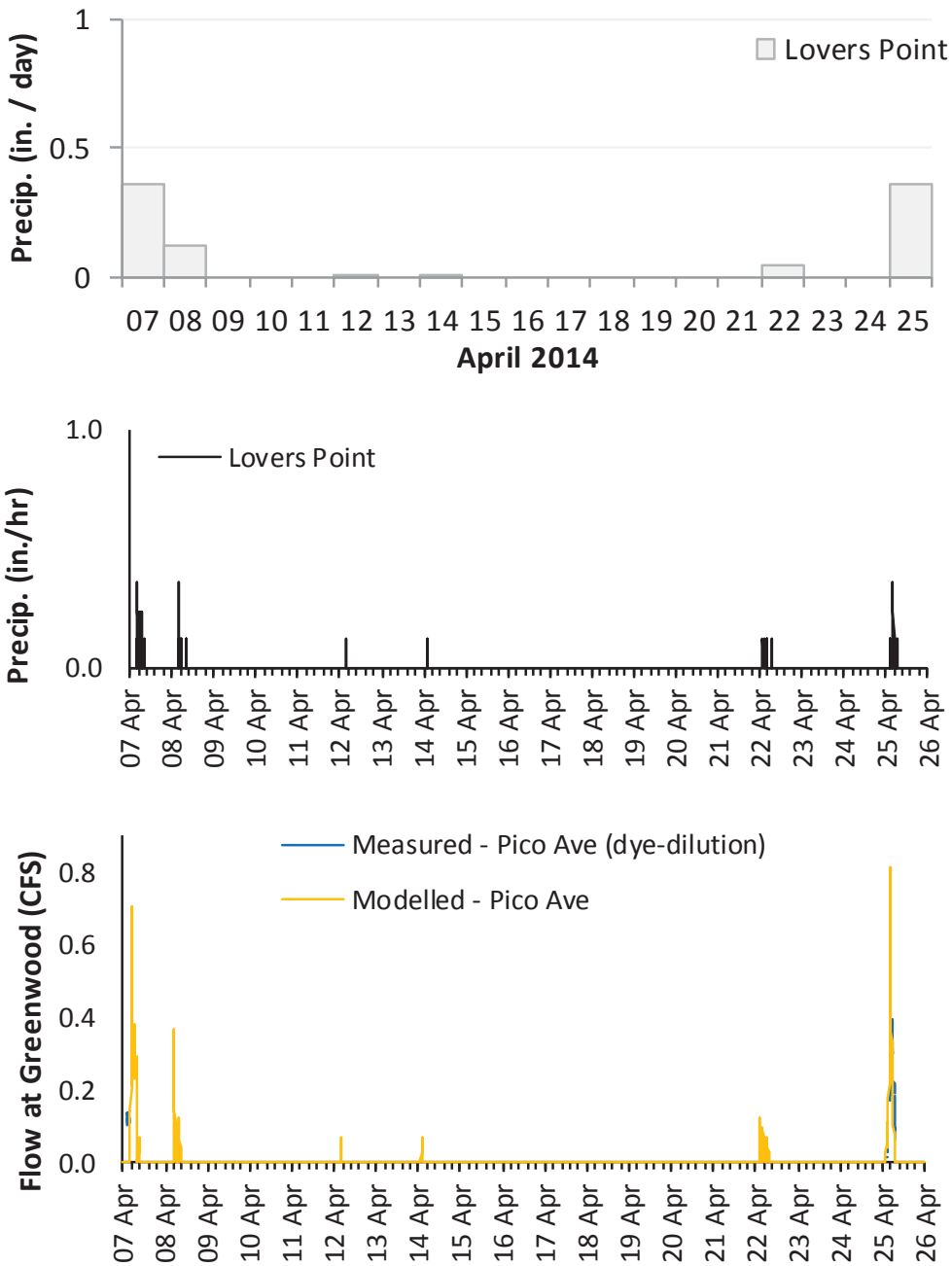

Figure 6-12. Dye-dilution flow measurements at Pico Ave – overall context (more detail in next figure).

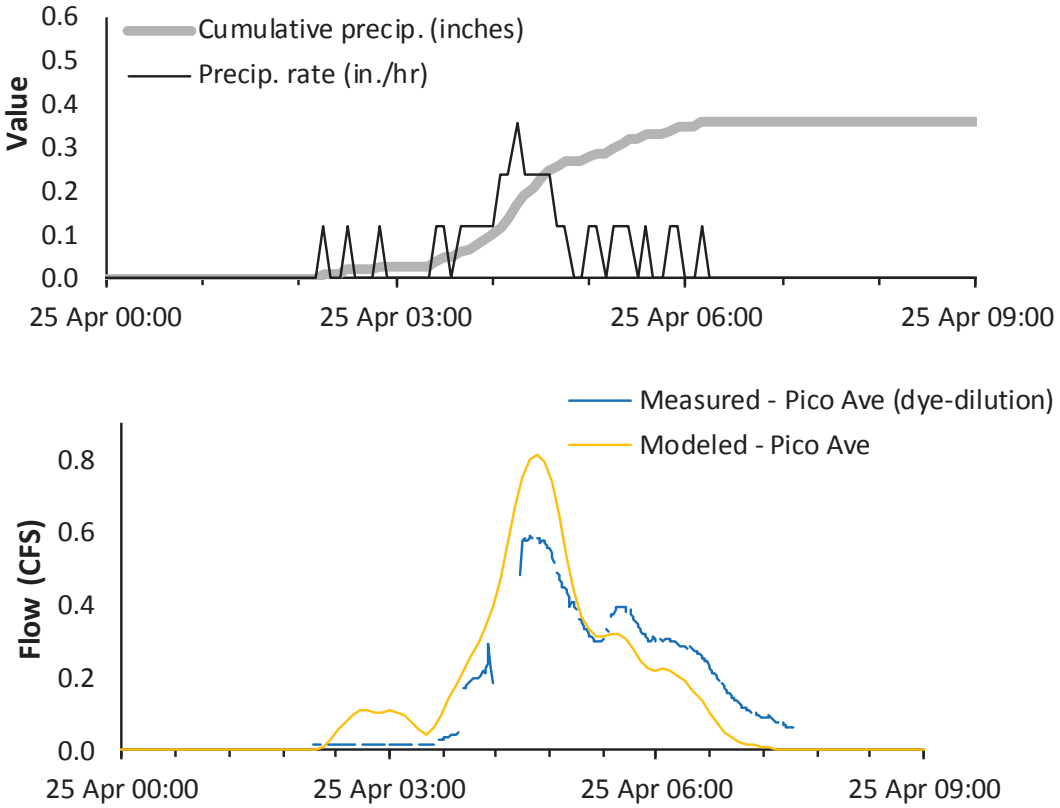

Figure 6-13. Dye-dilution flow measurements at Pico Ave, and calibration of stormflow model to the dye-dilution measurements.

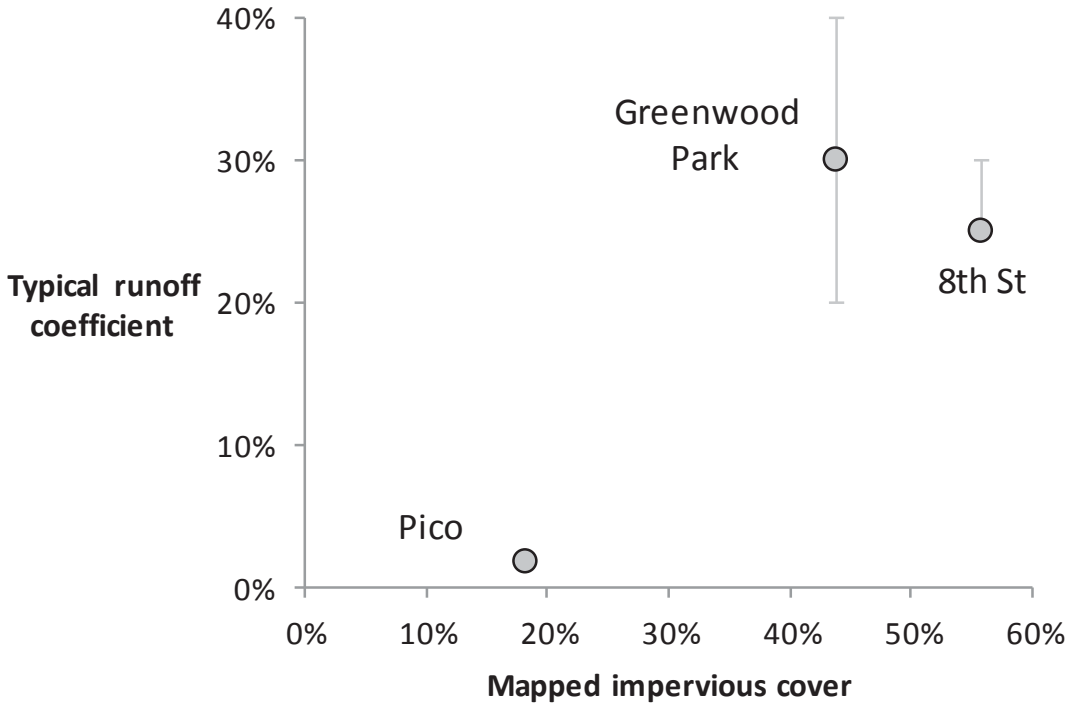

Figure 6-14. Relationship between runoff coefficient (inferred from model calibration to flow measured using dye-diltion gaging) to impervious area (estimated using satellite remote sensing).

7 Design & modeling of a stormwater control measure on Pine Avenue

The City can implement and has implemented a variety of watershed management strategies to reduce runoff, ultimately as a component of reducing pollutant load to managed receiving waters such as the ASBS and the National Marine Sanctuary.

One such strategy is to intercept and detain stormflow once it has entered the street system but before it has entered the subsurface storm drain system. The efficacy of such a strategy requires:

- Identification of relatively large subwatersheds with substantial on-street drainage and no sub-surface drains, ideally within high-priority outfall watersheds like Greenwood Park and 8th Street. The this surface-drained criterion is more likely to lead to potential SCM sites where all drainage occurs under gravity without the need to pump water or to re-route subsurface drains to the surface.
- Identification of sites where existing land use can be replaced or supplemented with use as a stormwater interception and detention site, ideally on public land where land use modifications are potentially more feasible and manageable by the City
- Location of such sites in areas with relatively high percolation potential. This requires careful investigation in the geomorphic and geologic setting of Pacific Grove, where bedrock is commonly very close to the surface, but where a sequence of marine terraces and relatively permeable recent sediments also exist (ENVS 660, 2014)

We sought to quantify the potential efficacy of an in-street stormwater interception and detention system (i.e. a stormwater control measure (SCM)), designing and locating this system primarily with reference to the first two requirements above (a suitable subwatershed, and a suitable public site).

We identified a suitable watershed by mapping drainage patterns throughout the entire City and looking for large areas where stormwater drainage was entirely at the surface (e.g. in gutters) and not in subsurface drains (Fig 7-1). The map of drainage patterns was created using the ENVS 660 (2011) approach of "burning" storm drain data into a digital elevation model with 3-meter horizontal resolution. An area just uphill of Pine Avenue between 7th St and Carmel St was revealed as relatively large but without

subsurface drainage. Figure 7-1 shows the drainage pathways (in pink shades) and the lack of stormwater infrastructure (storm drains or catch basins) in this area. We confirmed the accuracy of the mapped surface drainage pathways through field observations of water flow in gutters and across streets during rain events.

We located a hypothetical SCM on Pine Ave just downstream of this subwatershed (Fig. 7-1). Pine Ave is a very wide, arguably over-sized street on public land. The SCM concept was based on designs specified by LIDI (2013). It could be described as a "street bioretention facility" approximately 85 feet long and 30 feet wide, excavated at least 4 feet down and filled with permeable gravel and soil. All water that now flows from the above-described watershed down the street along the gutter on the south side of Pine Ave would be routed into the SCM. The nominal dry-weather water table would be at least 4-feet deep. Any water entering the SCM would be allowed to percolate beneath the SCM and laterally into the surrounding subsurface areas (soil, fractured rock, etc.). We assumed a percolation rate of 0.05 inches/hr (1.2 inches/day). Stormwater would typically enter the SCM much faster than could be dispersed through percolation, and so the water level would rise upwards during storms, about twice as fast as if it were surface basin, assuming the gravel and soil of the SCM itself had a porosity of approximately 50%. Once the water level reached the surface, it could exit the SCM via a small spillway 4-feet wide, and thereafter re-enter the gutter, or be directed by a subsurface drain to the nearby stormwater mains. The spillway would be notched into a surrounding confinement (e.g. a curb) to prevent uncontrolled flow out of the SCM.

This hypothetical SCM would reduce net runoff to the downstream stormwater system to a degree that would be controlled by high percolation rates, high SCM volume relative to upstream sub-watershed area, small storm size, and large intervals between successive storms.

To obtain a point of reference along this continuum of multiple influences on SCM efficacy we made some simple assumptions about percolation rate, and simulated the amount of runoff that would be detained during an actual 85th percentile storm (approximately 1-inch) that occurred on 31-Oct-2014. Tables 5-1 and 7-1 detail the relevant HMS parameters. Figure 7-2 describes the dynamics of the event through time series of rainfall, stormflow input, stormflow output, percolation, and depletion of available SCM storage. Table 7-2 summarize the total diversion, and the components of this total.

The SCM was estimated to detain 63% of the stormflow from the target sub-watershed during the simulated event. If this storm were followed by a dry period, the detention could be expected to be permanent, and the efficacy of the SCM could be considered substantial. If the storm was followed quickly by subsequent events, or the percolation rate was lower than assumed, the expected efficacy of the SCM would be reduced accordingly.

Scaling up, we Figure 7-3 illustrates the effect that ten similar SCMs might have on the overall Greenwood Park hydrograph, assuming it was possibly to identify a sufficient number of candidate subwatersheds above suitable SCM sites. Again, the potential effect is substantial, but heavily conditioned on assumed percolation rates and the timing of successive storm events.

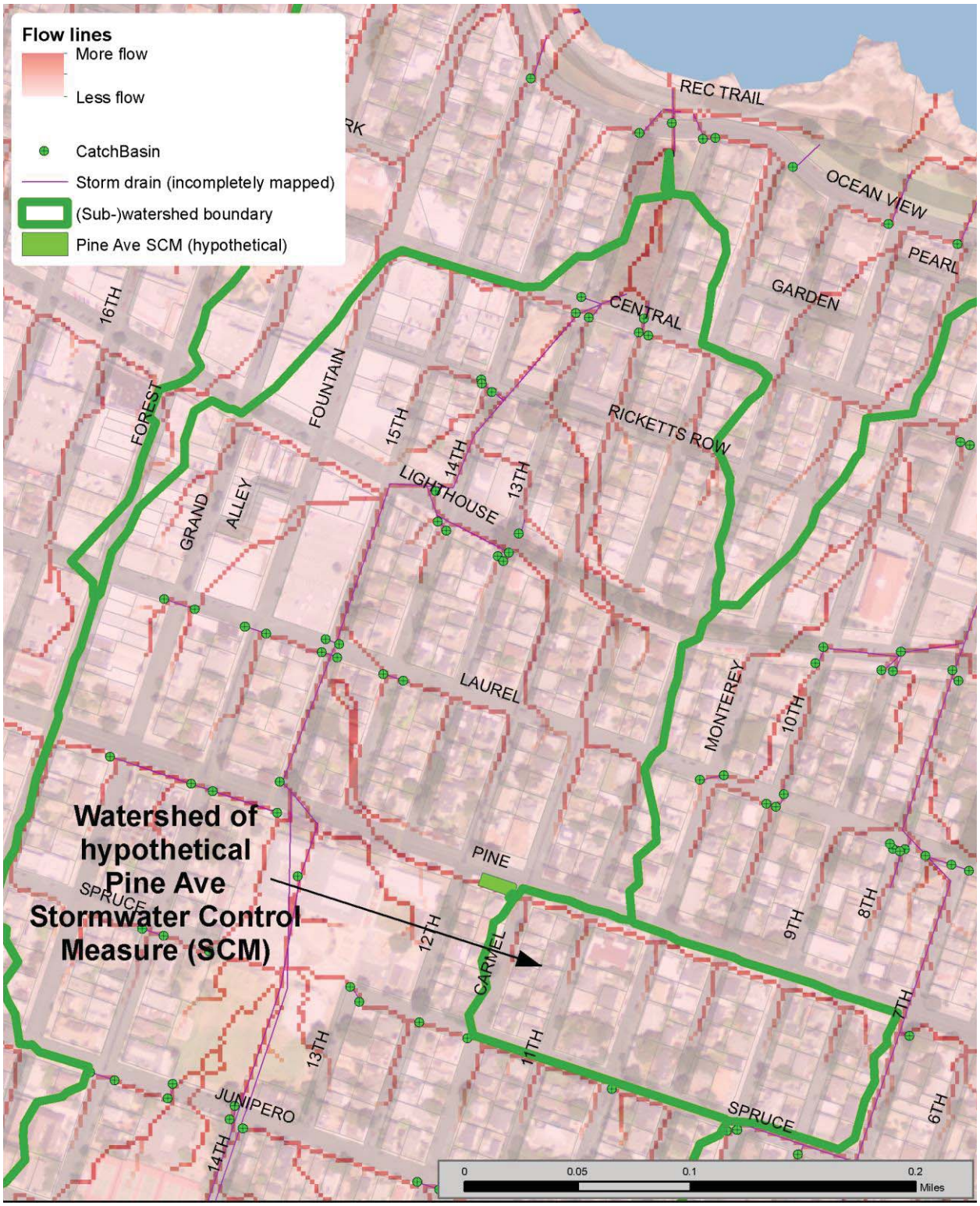

Figure 7-1. Location of a potential stormwater control measure (SCM) on Pine Ave, and the watershed that would drain into this SCM.

Table 7–1. HMS model parameters for potential future stormwater control measure (SCM) on Pine Ave.

Element	**PineSCM**		
Element type	Reservoir		
Method	Outflow Structures		
Storage Method	Elevation Area	*Elevation-Area Function*	
		Elevation (ft)	Area (ac)
		0	0
		0.1	0.06285
		10	0.06285
Initial Elevation (ft)	0		
Auxillary	Sink-1		
Spillways	2		
Spillway 1			
Method	Specified Spillway		
Direction	Auxillary		
Rating Curve	PinePerc	*Elevation-Discharge Function*	
		Elevation (ft)	Discharge (CFS)
		-100	0
		0	0
		0.1	0.0032
		1	0.0032
		10	0.0032
Spillway 2			
Method	Broad-Crested Spillway		
Direction	Main		
Elevation (ft)	2		
Length (ft)	4		
Coefficient (ft^0.5/s)	3		
Gates	0		

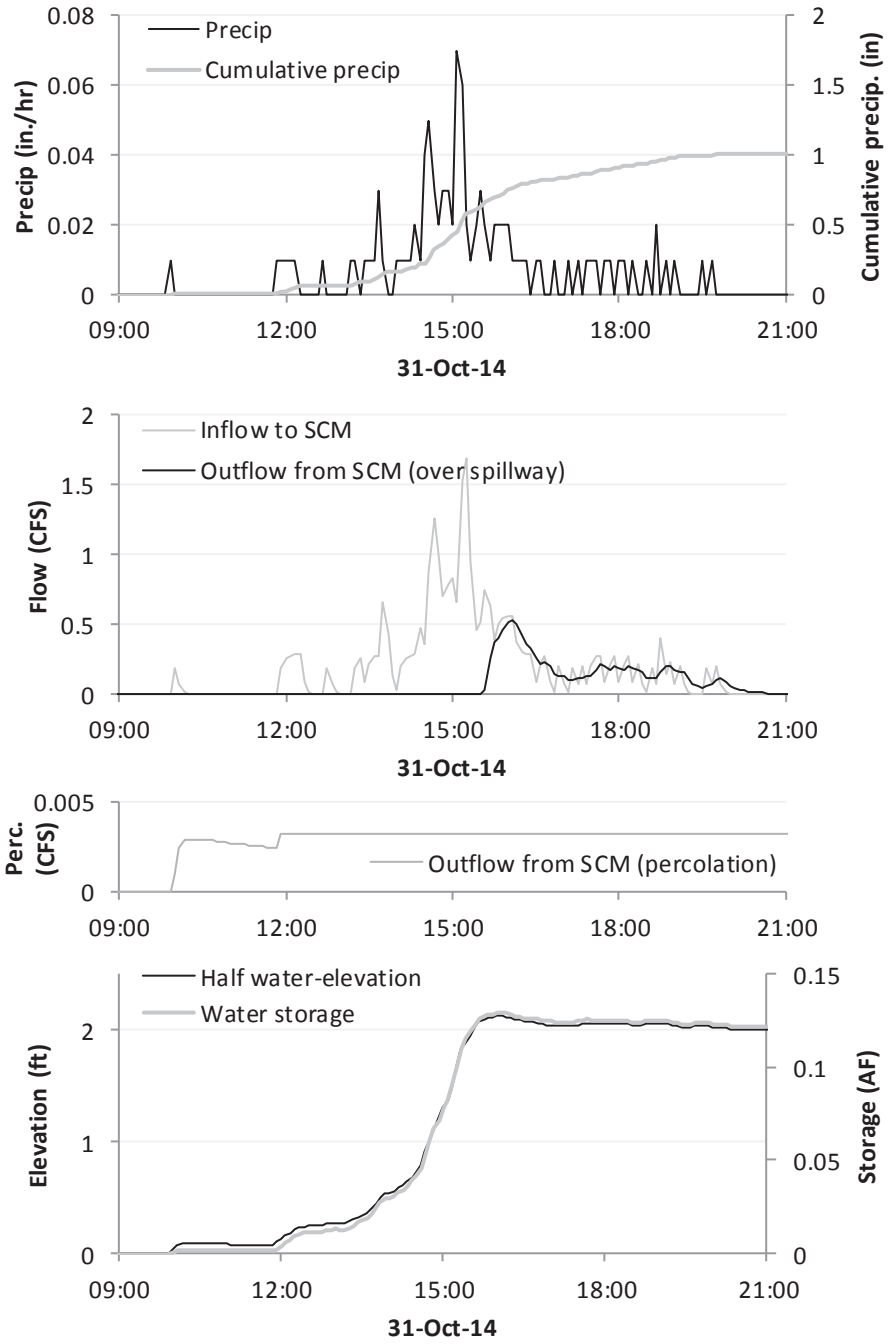

Figure 7-2. Model-predicted impact of Pine Ave SCM on stormwater flow from an 85th percentile rainfall event.

Table 7–2
SCM water balance over Period of Interest (POI)
correspoding to 1" storm (~85th percentile):
9:00 AM to 9:00 PM 31-Oct-14

Total input over POI:	0.197	AF	
Total spilled over POI:	0.073	AF	
Total percolated over POI:	0.003	AF	
Residual storage at end of POI:	0.121	AF	
Sum of outputs and residual storage:	0.196	AF	
Rounding error:	0.001	AF	0.46%
Total diverted:	0.124	AF	62.62%

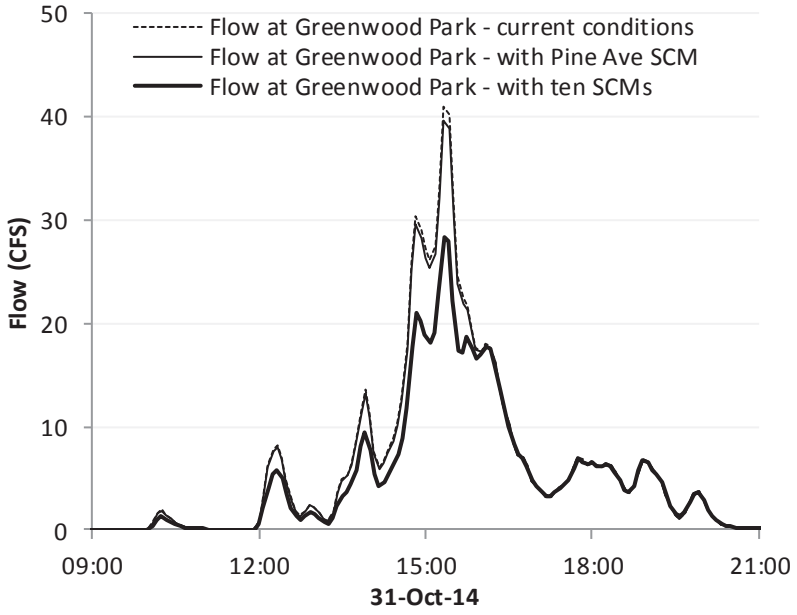

Figure 7–3. Model–predicted impact of ten SCMs (from similarly–sized sub–watersheds and SCMs as at Pine Ave) on total Greenwood Park ocean outfall stormwater flow from an 85th percentile rainfall event.

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APPENDIX A: DRAFT URBAN FOREST MANAGEMENT PLAN

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UFAC Draft Review

City of Pacific Grove

Urban Forest Management Plan

2012

James P. Allen & Associates
Consulting Arborists Dedicated to the Preservation of Trees

RBF CONSULTING

City of Pacific Grove

Urban Forest Management Plan

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On the Cover

Monterey Cypress at Pacific Grove
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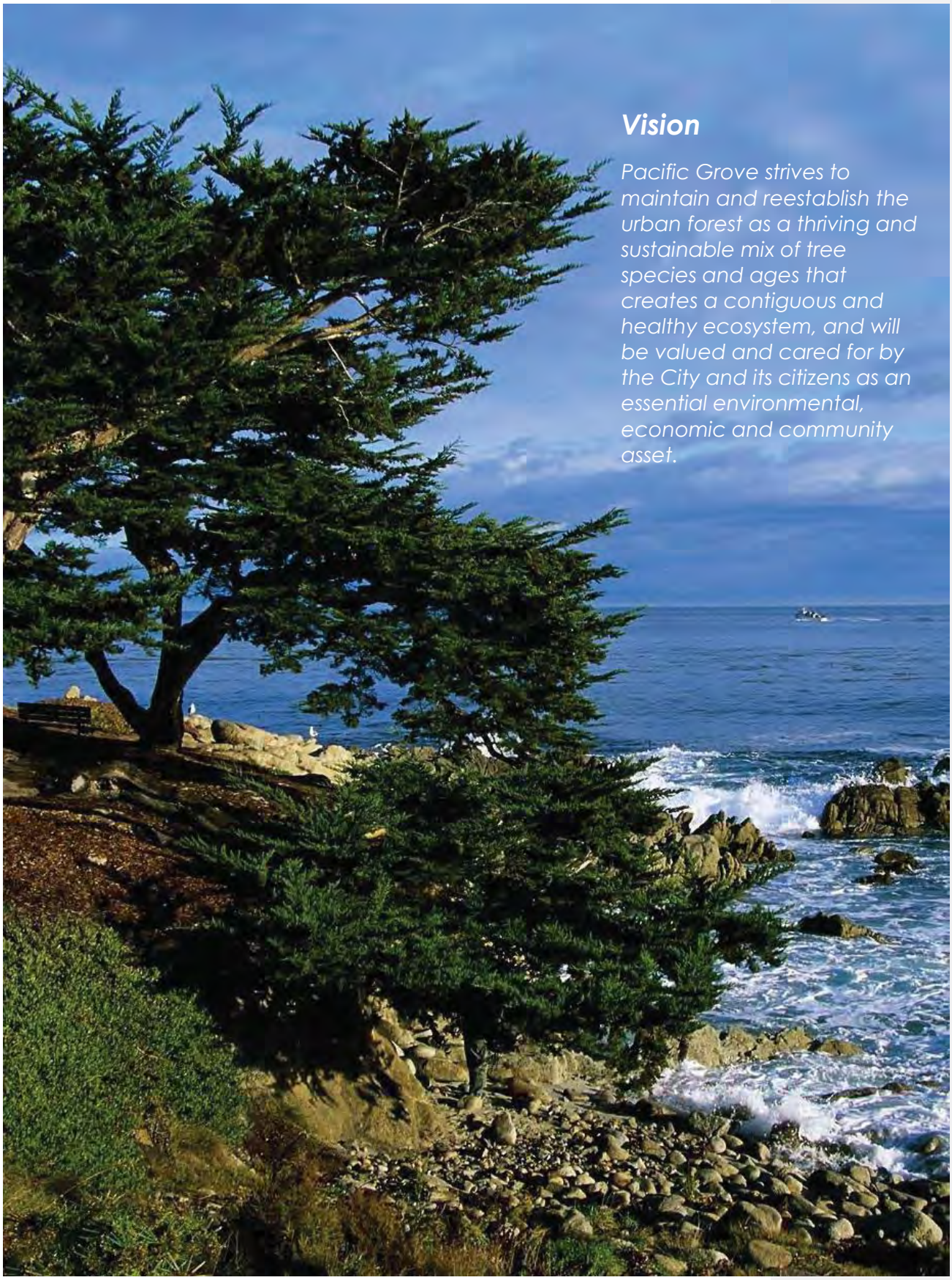
UFMP Guiding Principles

A	Preserve and enhance the visual and aesthetic uniqueness of Pacific Grove and of its neighborhoods.
B	Protect against deterioration of the urban forest over time by establishing and maintaining a diverse mix of tree age and species.
C	Manage tree resources and minimize costs by ensuring the right tree is in the right place.
D	Maximize the ecological and environmental benefits of the urban forest, including for wildlife.
E	Balance private property rights with the needs of the overall community.
F	Apply the same, or more stringent, standards to the City as to private property owners.
G	Integrate urban forestry practices with stormwater management to reduce and improve the quality of urban runoff to the Monterey Bay and Pacific Grove Area of Special Biological Significance.
H	Foster community support for, and stewardship of, the urban forest.



Vision

Pacific Grove strives to maintain and reestablish the urban forest as a thriving and sustainable mix of tree species and ages that creates a contiguous and healthy ecosystem, and will be valued and cared for by the City and its citizens as an essential environmental, economic and community asset.

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EXECUTIVE SUMMARY

Document Organization

The Urban Forest Management Plan is organized into the following chapters

- Urban Forest Sustainability
- Pacific Grove's Urban Forest Today
- Urban Forestry Long-Term and Neighborhood Strategies
- Management Plan
- Urban Forestry Standards
- References / Bibliography
- Appendices

Executive Summary

This Urban Forest Management Plan (UFMP) is a 25-year plan that recommends steps that the City of Pacific Grove should take to protect its trees and cherished Pacific coastal environment. Pacific Grove's urban forest touches the lives of its citizens every day. It consists of all trees in the city on both public and private property, including street trees, park trees, forested parklands, trees at schools, trees on the Pacific Grove Golf Links, and trees in many private ownership settings.

Unfortunately, Pacific Grove's urban forest has declined significantly over the last few decades due to an aging tree population and lack of replacement. In the past 24 years, the city's tree canopy coverage has decreased from 33% in 1986 to 19% in 2010, a decrease of 42% (Keady, 2010). Current estimates indicate that the city has just over 25,000 trees. Maintaining and restoration lost canopy will require the replanting and management of some 24,000 new trees or nearly 1,000 trees over the next 25 years.

To encourage tree preservation and planting across the city, this UFMP is based on guiding principles, long range strategies, objectives and implementing actions, and urban forestry standards that are organized according the three organizing elements of this UFMP, namely: 1) Tree Resource, 2) Management Framework, and 3) Community Framework. These will be used to interpret and implement this UFMP.

The long range strategies are intended for the City to use in establishing priorities for implementation of the UFMP over time. They will not be achieved immediately, but should be used to guide future planning and capital projects. The long range strategies envision improving key corridors and streetscapes, as well as the gateways and entries into the City with street trees. It also recommends using trees as "green" living infrastructure, rather than solely relying on "grey" infrastructure such as curbs, gutters and piped stormwater systems to capture and infiltrate wet and dry weather runoff. Trees also reduce air pollution and sequester carbon. The quality of life in Pacific Grove is important to the residents of Pacific Grove, and these measures are intended to maintain and restore the City's

urban forest and to enhance the overall environment.

Figure ES-1: Aerial Photograph of Pacific Grove

The management plan contains objectives that are also tied to the guiding principles of the UFMP. These objectives are ongoing and should be used to guide incremental decision making. The heart of the management plan is a five-year strategy for implementation, with a series of implementing actions, responsible parties, time frame and cost estimates. Each strategy contains one or more implementing actions, identifies the parties responsible for implementation, sets a target year for implementation, and lastly an estimate of costs to be used during the annual budgeting process

To achieve the city-wide tree canopy target of planting at least 24,000 trees over the next 25 years, the City will need to consider innovative strategies to plant new trees, particularly in the public right-of-way. To help meet this goal, a number of both city-wide and neighborhood urban forestry long term strategies have been identified which will help the city reach its target and creates a vision that can be championed by the community.

The long term strategies will require implementation over time. This Urban Forest Management Plan establishes a path for success in both pursuing future funding opportunities, such as grants, as well as committing to a five-year management plan that will be periodically review to implement the longer-term strategies envisioned in this document.

UFMP Chapter 5 is a set of detailed Urban Forestry Standards that are the city's primary regulatory tool to provide for orderly protection of specified trees, to promote the health, safety, welfare, and quality of life for the residents of the city, to protect property values and to avoid significant negative impacts on adjacent properties. By ensuring preservation and protection through regulations and standards of care, these resources will remain significant contributions to the landscape, streets, and parks, and will continue to help define the unique character of Pacific Grove.

These Urban Forestry Standards establish specific technical regulations, standards and specifications necessary to implement the city's tree ordinance (see Appendix A), and the management framework of this plan. These standards are intended to provide consistent care and serve as benchmark indicators to measure achievement in the following areas:

- Ensure and promote conservation of the existing tree canopy cover within the city limits.
- Provide standards for the replacement of trees that are permitted to be removed.
- Establish criteria for determining when tree risk exceeds community tolerance thresholds and management strategies need to be implemented in order to preserve public health, safety and welfare.
- Provide a standardized content for tree reports required by the city.
- Identify tree resources during the design phase of development projects.
- Increase the survivability of trees during and after construction events by providing protection standards and best management practices.
- Provide standards of maintenance required for protected and city-owned trees.

- Preserve and protect trees suitable for retention,
- Replace canopy and benefits lost when trees are removed.

1 URBAN FOREST SUSTAINABILITY

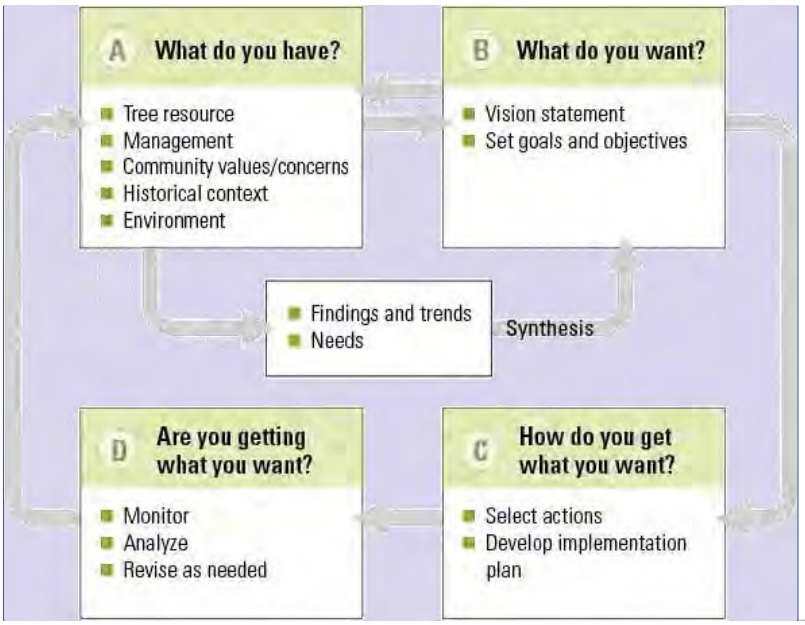
In this Chapter:

- Purpose of the Plan
- Urban Forestry Sustainability
- Pacific Grove's Urban Forestry History
- Values of Pacific Grove's Urban Forest

Purpose of the Plan

The purpose of this UFMP is to guide a broad range of actions that will achieve a sustainable urban forest in Pacific Grove. This is a 25-year plan that recommends the steps the City of Pacific Grove must take to preserve and enhance the city's trees and thereby benefit from their aesthetic, environmental and social benefits.

The UFMP has been developed in a format that can evolve and be refined over time. The UFMP is a set of guiding principles and actions that will be used to oversee implementation and as a reference to critical tree-related decisions (e.g. development projects, management practices, etc.). Supporting these guiding principles and actions is a set of urban forestry standards, which provide specific guidelines for day-to-day management and monitoring. The graphic below illustrates the process utilized in the development of the plan.



Source: CalFire (2011).

Comment [th1]: Top arrow pointing left – should that be there? Shouldn't the graphic go around clockwise instead of arrows in both directions at the top – Jay Tulley

What is the Urban Forest?

Pacific Grove's urban forest consists of all trees in the city on both public as well private properties. This forest includes street trees, park trees, forested parklands, trees on the Pacific Grove Golf Course, trees at schools, and trees on private residential and commercial uses. Whether it's walking through Rip Van Winkle Park or along the coastline, it is trees that comprise the urban forest and trees that make such an experience so memorable.

Why is it Important?

Trees located throughout Pacific Grove on public and private property affect our lives and the local economy in ways that aren't always obvious. Trees provide environmental, economic and community benefits that range from reducing the effects of density, to increasing property values, to providing ecological services such as stormwater mitigation, air toxics removal, and greenhouse gas sequestration.

Pacific Grove's Urban Forest Management Plan

While having a positive impact, the city's past regulation and management of tree resources has not been enough to protect and conserve Pacific Grove's urban forest. A resource of this magnitude requires careful management to ensure its preservation, restoration, and enhancement. For that reason, the UFMP has been developed as a roadmap for the long-term management of Pacific Grove's trees.

Managing trees in a city differs from managing forests in natural settings. Urban forest management goals such as increasing tree canopy, improving public safety, and providing native habitat and recreational and educational opportunities must be balanced with other goals such as allowing for remodels and modest development and protecting public safety from high risk trees. The UFMP is the city's plan to integrate management of the many issues and opportunities posed by Pacific Grove's tree resource.

All natural systems change over time. If we want these changes to enhance the urban forest, they must be actively managed. Nationally-based studies repeatedly support the fact that the resource deteriorates when human intervention is not a proactive part of urban forest management. Pacific Grove has an aging tree population and the tree canopy has been steadily declining over the past 25 years and likely longer. This has been further exacerbated by the fact that some trees have been planted in places that either don't allow for growth or that conflict with built structures (e.g. houses) and public infrastructure (e.g. sidewalks and power lines). Proactive management is needed to keep our trees sustainable and in balance with other urban priorities.

Lovers Point Park

Amendments to the UFMP

Over time, various sections of the UFMP may need to be revised to response to changing trends in urban forest management practices, financial constraints and opportunities, regulations, etc.

Amendments to the UFMP will fall under one of two categories, namely; 1) Administrative amendments and 2) Other amendments. A decision as to which category an amendment falls under shall be made by the City Arborist.

Administrative Amendments

Administrative amendments to the UFMP are considered minor revisions carried out at the staff level and do not require formal approval by an elected or appointed body. Administrative amendments do not deviate from the overall vision of the UFMP. Examples of administrative amendments include, but are not limited to; minor text changes, corrections and/or updates to existing conditions information, references to other publications, and minor clarifications. Such changes are considered relatively inconsequential and do not materially change the nature or intent of the UFMP such that it would constitute a change in policy, implementation, or standards, nor would it result in a potentially significant environmental impact or adversely affect the economic goals or financial commitments of the city.

Approval of administrative amendments shall be granted by the City Arborist and are subject to a 14-day appeal period after being publicly noticed. All appeals to administrative amendments shall be submitted to the Natural Resources Commission.

Comment [th2]: Comment from Dave Meyers: administrative changes to plan can be approved by the arborist? Not CDD director or PW Superintendent?

Comment [th3]: Dave Meyers: Shouldn't the NRC approve these amendments if the arborist is contracted?

Other Amendments

All other amendments to the UFMP are considered significant revisions and shall require formal approval by the City Council, based on a recommendation by the Natural Resources Commission. Other amendments are those that deviate from the overall vision and intent of the UFMP or constitute a substantive change in policy, implementation, or standards.

Monarch Grove Sanctuary

Urban Forest Sustainability

The primary purpose of the UFMP is to identify goals, recommendations, and actions that will protect, restore, enhance, and sustain Pacific Grove's urban forest over the long term. To assist in this rigorous task, a nationally recognized Model of Urban Forest Sustainability is employed. Careful consideration is given to how the resource has been managed in the past, what its value is today, how the resource can be sustained over time, and what set of actions will be required to achieve these goals. This section discusses the model used to shape this plan, the history and value of the city's trees and expected plan outcomes.

An Urban Forest Sustainability Model

Unlike timber forests that are grown primarily to produce forest products, urban forests provide benefits such as air and water quality improvement. Urban forests are directly affected by the pressures of their location in developed areas. Management intervention is necessary to keep city trees and forest lands within cities sustainable and healthy in perpetuity. To that end, this Urban Forest Management Plan uses a planning model framework built around a basic understanding of the unique characteristics of urban forests.

Pacific Grove's UFMP is informed by "A Model of Urban Forest Sustainability" (Clark et. al, 1997). This model recognizes the challenges, benefits, and opportunities unique to city trees. Pacific Grove's sustainable urban forest model is built around four principles from this model:

- Sustainability is a broad, general goal that results in the maintenance of environmental, economic, and social functions and benefits over time.
- Urban forests primarily provide benefits and services rather than goods.
- Sustainable urban forests require regular maintenance and monitoring.
- Trees growing on private lands compose the majority of urban forests.

Pacific Grove's UFMP has adapted the sustainability model to provide a structure that organizes the goals and the actions needed to achieve them. The three primary management elements of the model are:

- **Tree Resource:** an understanding of the trees themselves, as individuals or in forest stands
- **Management Framework:** assignment of responsibility, resources, and best practices for the care of trees
- **Community Framework:** the way residents engage in planning and caring for trees. Because most trees in the urban forest are on private property, a successful program requires that the community plant and maintain trees on their property.

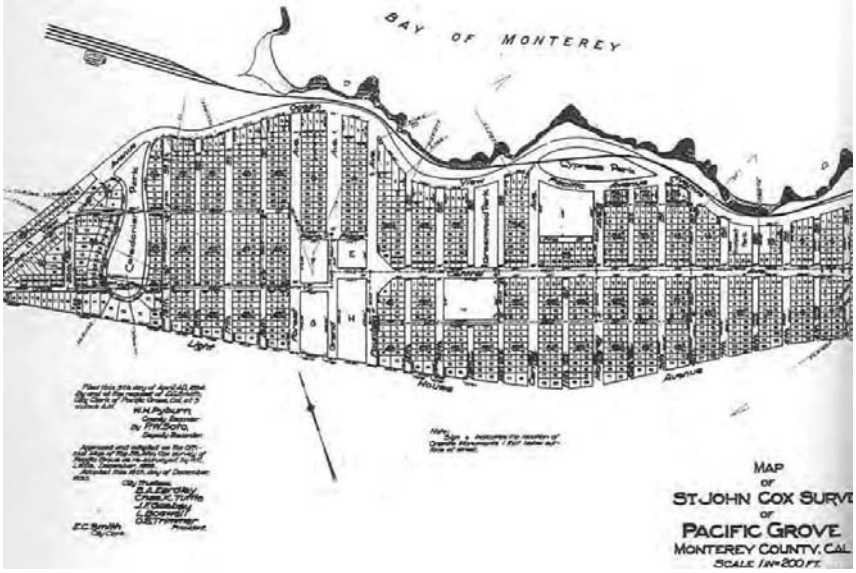
Pacific Grove's Urban Forestry History

Land Development

Pacific Grove was founded in 1875 by a group of Methodists who modeled the town after Ocean Grove, New Jersey. In time, the butterflies, fragrant pines and fresh sea air brought others to the Pacific Grove Retreat to rest and meditate. The initial meeting of the Pacific Coast branch of the Chautauqua Literary and Scientific Circle was held in Pacific Grove in June 1879. Modeled after the Methodist Sunday school teachers' training camp established in 1874 at Lake Chautauqua, N.Y., this location became part of a nationwide educational network.

With its origins as a summer religious retreat, early development was largely the subdivision of land into small lots designed for seasonal use. The use of a grid system with uniform lot sizes was not only the most expedient method for surveying the land, but also maximized the number of lots that could be sold. Typically, the lots in Pacific Grove measured 30 feet wide by 60 feet deep. By conventional standards these were relatively small. But at the time of the retreat's founding it was envisioned that most would be used for camping purposes rather than the erection of permanent homes.

As Pacific Grove developed, the town's largest landowner, the Pacific Improvement Company, continued this small-lot subdivision pattern with five additions to the city grid. The firm also exerted considerable control in restricting commercial and industrial development, such that the "historic core" of the city—the original Retreat boundaries plus the first five additions—evolved as an overwhelmingly residential area, with commercial uses found only along Lighthouse Avenue. The city's early development was also strongly influenced by the annual visits of the Chautauqua and other social improvement and/or religious organizations, which encouraged a number of significant civic improvements.



First survey of Pacific Grove, 1894 (Images of America, Pacific Grove)

During the early twentieth century, Pacific Grove transitioned from religious retreat to a secular resort. This included the construction of some of the city's most iconic commercial buildings, as well as redevelopment of the beach area at Lovers Point Park. The introduction of the automobile also had a dramatic impact on the city. In the first half of the twentieth century, Pacific Grove saw the construction of garage and service facilities, as well as the development of tourist auto camps. During this time, the city also began to assert greater control over its natural resources, including acquisition of the city's coastline and the establishment of parks and nature reserves.

Early view of Grand Avenue, circa 1880 (CA State Library)

Following World War II, the city experienced the greatest period of growth in its history. This is most evident in the build-out of large subdivisions at the western and southern ends of the city. The layout of these new suburban-style developments broke from the original city grid and featured larger lot sizes. A considerable amount of post-war development also occurred as infill within older areas of the city, resulting in a scattered pattern of older homes existing side-by-side with more recent construction.

Panorama of Pacific Grove, 1908 (Heritage Society of Pacific Grove)

Urban forest Context

While there is no known statistical data regarding tends in the amount of tree canopy over time, it is clear from historic documents that concurrent with land development, a significant number of trees were removed from Pacific Grove.

One of the earliest references to trees was in 1602 when Sebastian Vizcaino received a commission from the Spanish Viceroy in Mexico, the Comde de Monterrey, to investigate the California coast. Vizcaino's party visited the Carmel

River, and described it in relation to the Monterey Peninsula and Monterey Bay: "Two leagues beyond is a fine port, between which and the river there is a forest of pine trees more than two leagues across. This land makes a point almost at the entrance of the port, which was named 'Puntade Piños' (Page & Turnbull, p. 22)

Vizcaino's fleet entered the bay on December 16, naming it Monterey in honor of their benefactor. Members of his party marveled at the abundance of wildlife, as well as the "immense number of great pine trees, smooth and straight, suitable for the masts and yards of ships" (Ibid).

Following the first retreat in 1875, land development was initiated in earnest when all of the land in the Pacific Grove Retreat was acquired by David Jacks. Eager to see the value of his lots increase, Jacks continued a program of improvements, including "building bridges over gulches, felling trees and clearing avenues, building fences and stiles, and planting cypress and eucalyptus trees." At this time, nearly all of the streets at the Retreat were largely unimproved, as were the lots. Early photos show that even Grand Avenue, the focus of the Retreat, was thick with large pine trees (Ibid, p. 45).

Early image of Chautauqua Hall, 1885 (Images of America: Pacific Grove, 30)

Development of the Pacific Grove Retreat and Beach Tract, which had been subdivided in 1919, was ongoing through the first half of the twentieth century, and typically featured much smaller lot sizes. With the advent of the automobile, and primarily after WWII, residential development extended to the west end of the city with larger lots sizes, which more easily accommodated the sprawling Ranch style designs that became popular in California. Houses were sited much deeper on their lots, and there was less need to clear trees.

Today, the west end of Pacific Grove still retains large portions of the original pine forest, while the small lots of the original Retreat meant that the majority of trees in the "Piney Paradise" had to be removed in order to make way for development.

1961 Aerial Photograph, showing post-war build-out of the Beach Tract, which had been subdivided in 1919 (Monterey Peninsula Herald, 8 May 1961)

Values of Pacific Grove's Urban Forest

Sustainable urban forests result when ". . . naturally occurring and planted trees in cities are managed to provide the inhabitants with a continuing level of economic, social, environmental, and ecological benefits today and into the future" (Clark et al. 1997). As can be expected, healthy, well-managed forests provide greater amounts of these benefits than forests that are poorly maintained and less healthy.

Environmental Values

Pacific Grove's urban forest is home to common wildlife includinge deer, raccoon, skunk, squirrel, and numerous bird species. Within park-owned property alone, such as Rip Van Winkle and George Washington Parks, are a variety of terrestrial and aquatic habitats that support a broad variety of wildlife. Trees in these forestlands provide valuable terrestrial habitat. It is also important to note that Pacific Grove is located adjacent to Pebble Beach which has significantly larger lot sizes and contains vast areas of Monterey pine forests providing critical wildlife habitat.

At the same time, trees provide shade, intercept rainwater in the canopy and root systems, and lessen the impacts of storm events. As a result, fluctuations in stream flows are reduced and stream water quality is improved. Furthermore, trees on residential and commercial lots tend to grow together often forming substantial linear forested stretches that provide added habitat and forest connectivity.

In addition to making Pacific Grove more livable for the population, its urban forest provides habitat to a variety of wildlife and native and migratory songbirds and insects, including the Monarch butterfly.

Economic Values

Conventional "grey" public infrastructure such as stormwater drainage systems, are often highly engineered systems of pipes and pumping stations, built of steel and concrete and requiring major capital investments to develop and maintain. However, sustainability-designed infrastructure, notably trees, provide ecological services that include the ability to capture rainwater to reduce stormwater runoff and flooding. The real dollar value of these ecological services can be many thousands of dollars annually.

Trees also improve air and water quality, and sequester global warming pollution (i.e. carbon dioxide). Recent studies estimate a dollar value for these benefits as well. The extent of economic value attributable to the urban forest is directly related to the amount and condition of existing tree canopy. If Pacific Grove's

urban forest is managed well, it can maximize the ecological benefits that these trees provide at a substantially less cost than the concrete and steel alternatives. It's a value that brings with it many companion benefits. Just as we do for engineered infrastructure, it is important to consider the value of these ecological services when budgeting for the management of the city's green infrastructure.

Social Values

Street trees provide scale and interest and contribute significantly to the aesthetic quality and character of Pacific Grove's neighborhoods. They also help calm traffic and separate pedestrians and vehicles. Pacific Grove's system of bike and pedestrian trails are well used and valued as a resource to promote exercise and a healthier lifestyle.

Trees have been shown to have a range of social benefits, such as improving hospital recovery times, reduce air pollution and stress on children with asthma, and improve children's performance in school.

Trees are often the primary 'architectural' element in our developed parklands and, as such, define functional use areas, and add significant aesthetic character. Natural areas in city parks give residents access to trails and environmental learning opportunities that help keep us connected to the needs of wildlife and the experience of being in nature while in the city. The presence of many trees can often define a neighborhood, and conversely, the absence of trees can do the same.

2 PACIFIC GROVE'S URBAN FOREST TODAY

In this Chapter:

- Introduction
- Current Challenges
- Tree Resource Assessment
- Current Management Framework
- Community Framework Assessment

Introduction

A comprehensive resource management plan must begin with a thorough understanding of the resource itself. This is accomplished through an inventory and assessment process. This process identifies the current state or condition of the resource and highlights both challenges and opportunities for future resource management.

For the purposes of the UFMP, the three key elements of the sustainability model, namely Tree Resource, Management Framework, and Community Framework, provide the structure for this inventory and assessment.

Current Challenges

Comment [th4]: View shed should be mentioned in the challenges section

As part of the development of this UFMP, an extensive public outreach process was undertaken to understand the community's issues and concerns. This outreach included two City Council and two community workshops and several meetings with the Urban Forest Advisory Committee (UFAC). A summary of these issues are described below.

Tree Resource

- The loss of tree canopy
- Restoration of Monterey pines
- Diversity of tree species
- Encouraging the planting of native, non-invasive tree species
- The limited number and maintenance costs of street trees
- Trees as a means to support environmental benefits (e.g. stormwater management)
- Planting the right tree for the right place
- Lot size, particularly on residential properties
- Impact of trees on foundations, sidewalks, infrastructure, etc.
- Reducing stormwater runoff and discharges into the Monterey Bay

Management Framework

- Properly manage city-owned trees
- Establish rules that guide, encourage, and enable, rather than oppress (e.g. tree replacement requirements)
- Increase the maintenance of trees on public property
- Management of high risk trees and protection of public safety
- Tree health assessment process
- Tree replacement enforcement
- Better management of the in-lieu tree replacement fee
- Experienced arborist and/or City Arborist (final) determination regarding tree removal

Community Framework

- Working cooperatively with neighbors and the city
- Greater partnerships with businesses and organizations to foster community support for the urban forest
- Engaging the community in active stewardship of the urban forest
- Educating the community about how to care for trees
- Respecting and protecting the rights of Pacific Grove citizens

Tree Resource Assessment

Soils

With the notable exception of rock outcrops, soils in Pacific Grove are all sand or sandy loam (see Figure 2-1: Soil Types). Large areas are covered with decomposed granite, marine terrace deposits, dune sands, and alluvium. The permeability of the soil varies, as does the runoff rate.

Along the coast line and dunes areas, erosion hazard is highest and are particularly susceptible to disturbance. In the Asilomar area, these dunes extend nearly a half mile inland. The trampling of dune vegetation causes blowouts, in which the destabilized sand is carried away by the wind.

Farther inland, trees and other vegetation growth are more successful. However, given the soils high permeability and relatively low nutrient value, only certain species are able to survive successfully under natural conditions.

Topography

As shown in Figures 2-2: Topography, the elevation in Pacific Grove generally slopes downward from the south east edge of the city limits (adjacent to the City of Monterey) west and north. The highest point is at the south end of Forest Avenue (Highway 68) where the elevation is about 420 ft. above sea level. The slope then decreases, fairly gradually towards the Monterey Bay at elevation zero.

Land Use

Land use and, in particular, lot size, have a profound impact on Pacific Grove's urban forest (see Figures 2-3: Land Use and 2-4: Lot Size). As described in Chapter 1, early development of Pacific Grove largely consisted of very small residential lots. Given their limited space and need to accommodate tents and houses, many of the trees were removed.

As the city became built-out, a significant number of trees were removed to make way for roads, houses, and commercial areas. Today, given this type and density of development, it is a challenge to plant trees species that can grow to produce a large canopy coverage effect. This is particularly true on the smaller lots located in the Pacific Grove Retreat, Downtown, and Additions neighborhoods.

Furthermore, many of the remaining larger canopy trees are aging and present significant risks due to falling limbs and diseased and dying trees.

Figure 2-1: Soils Types

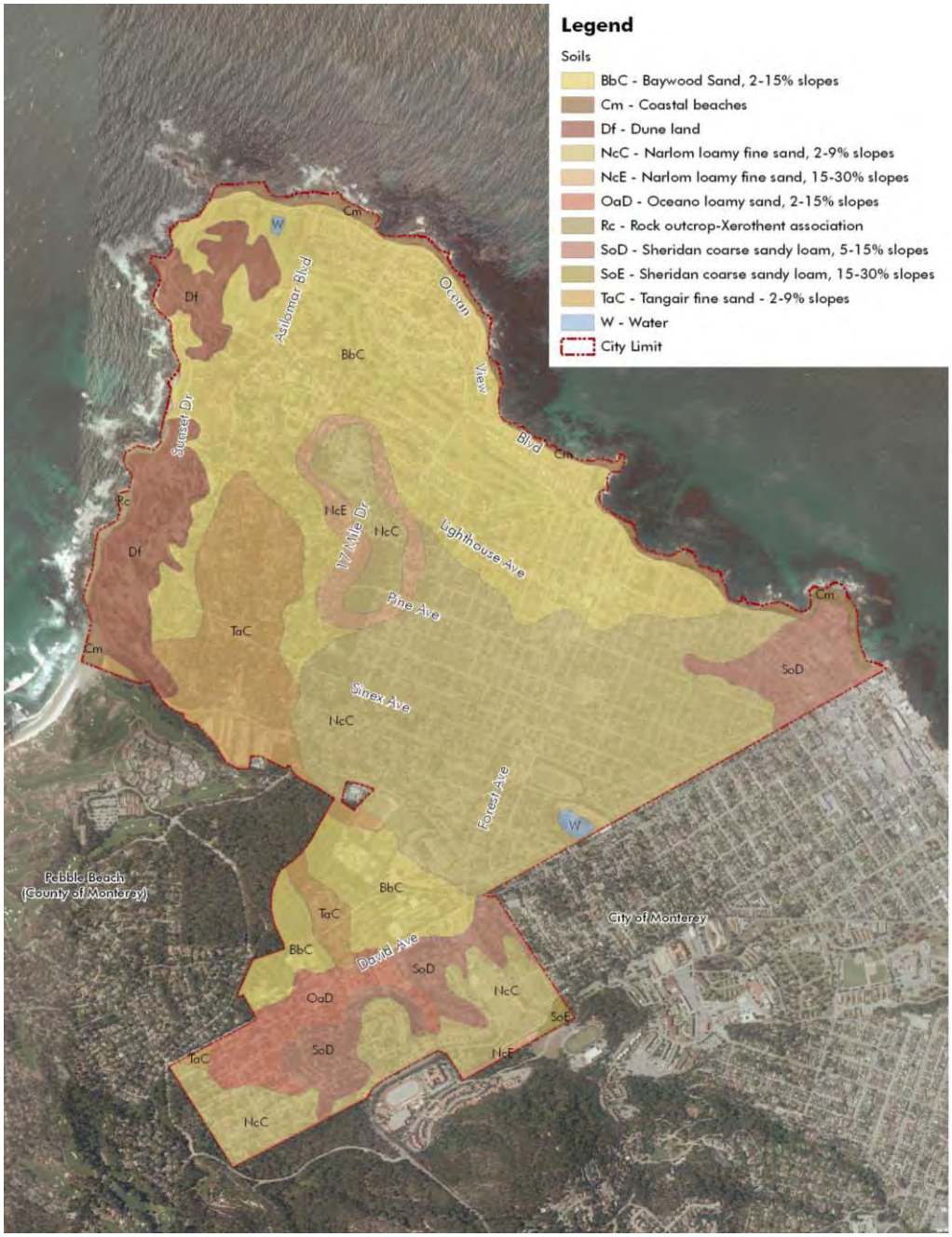


Figure 2-2: Topography

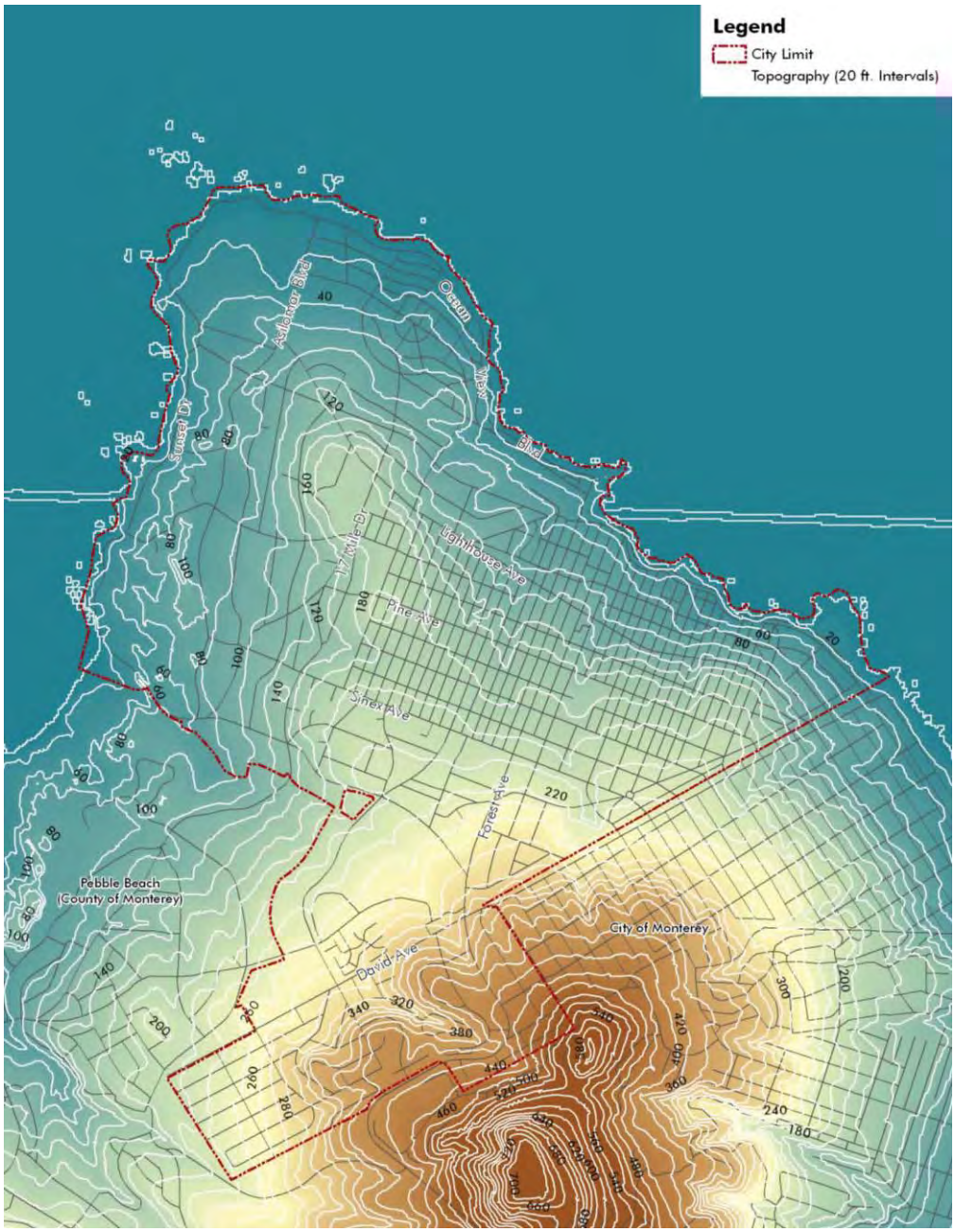


Figure 2-3: Land Use

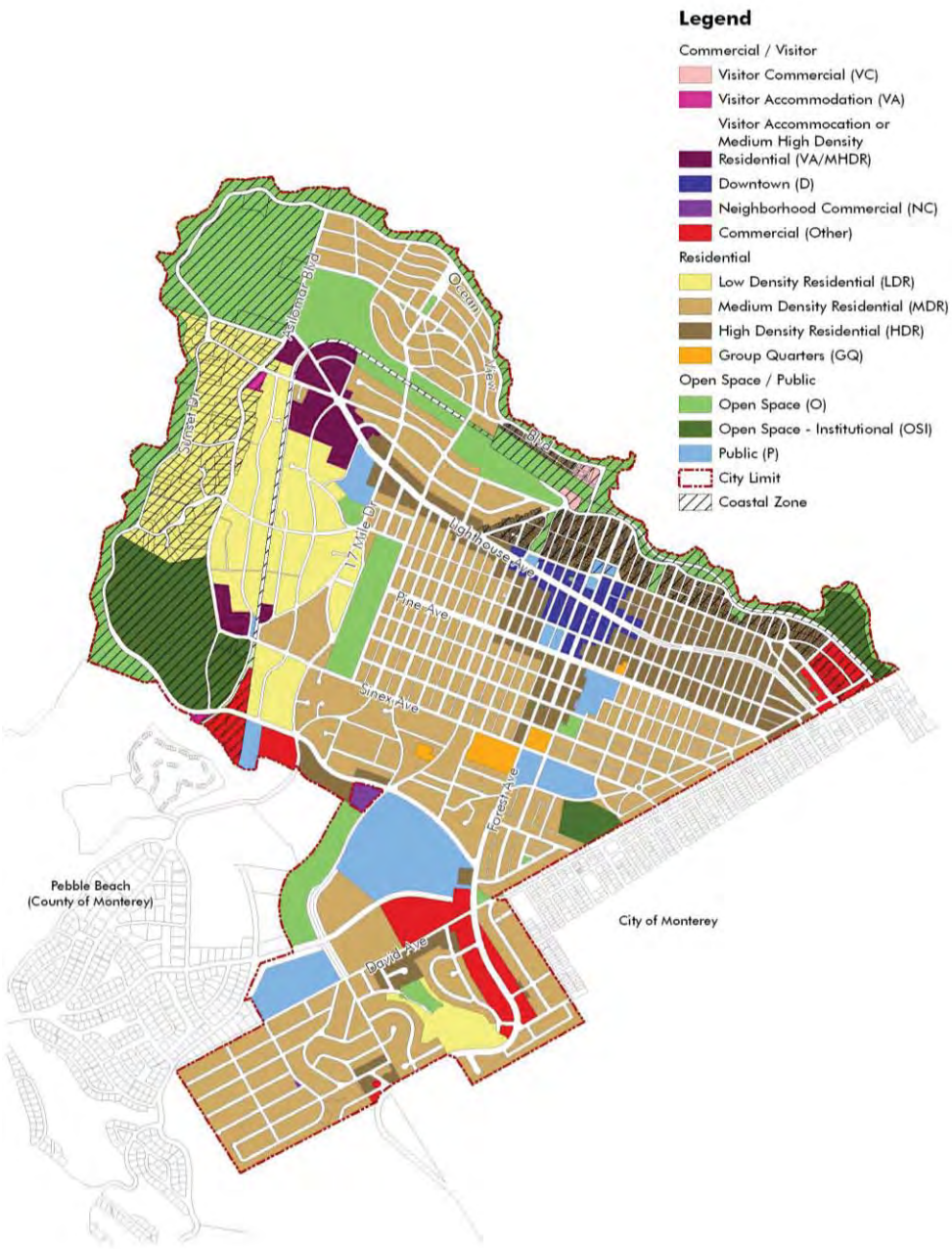
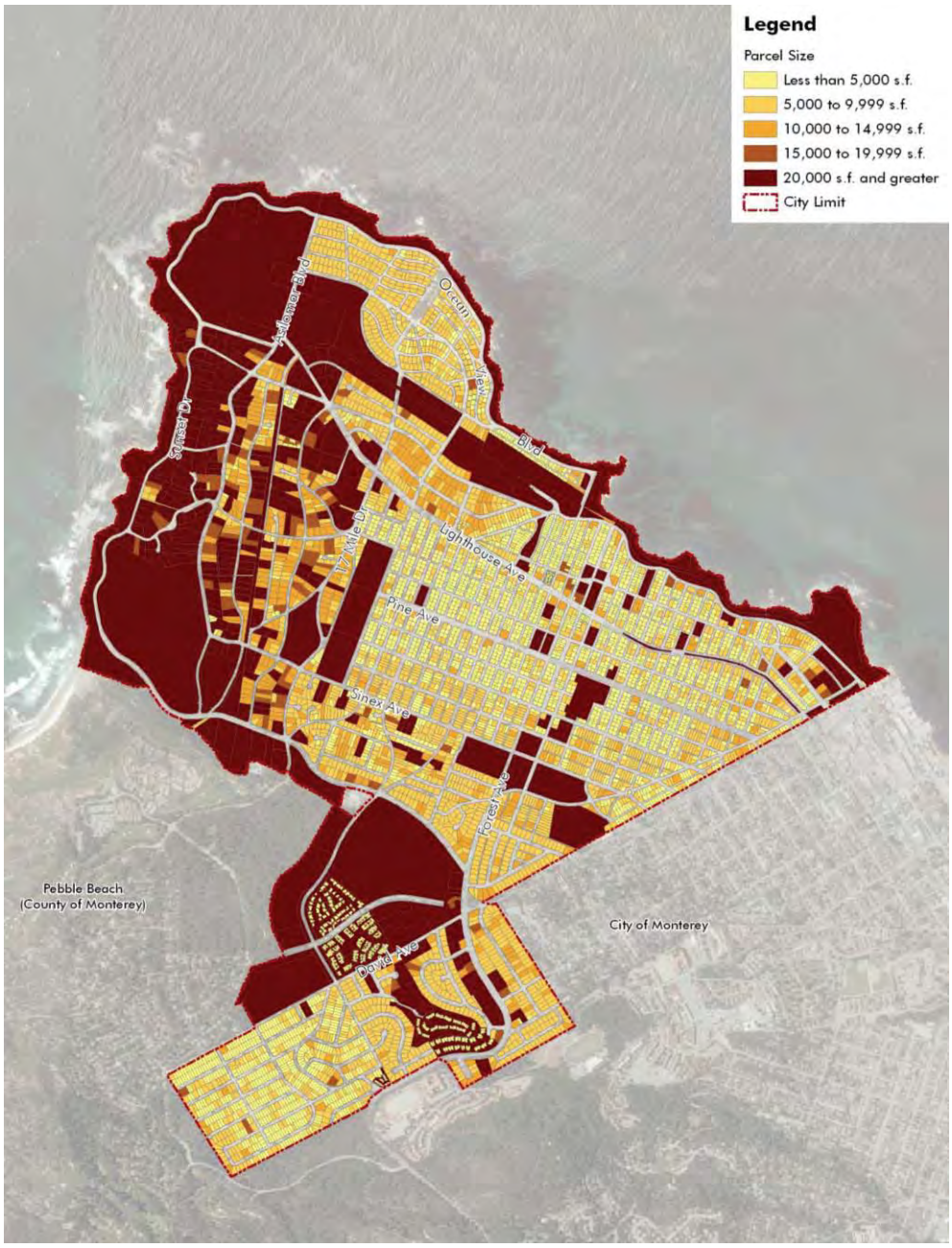


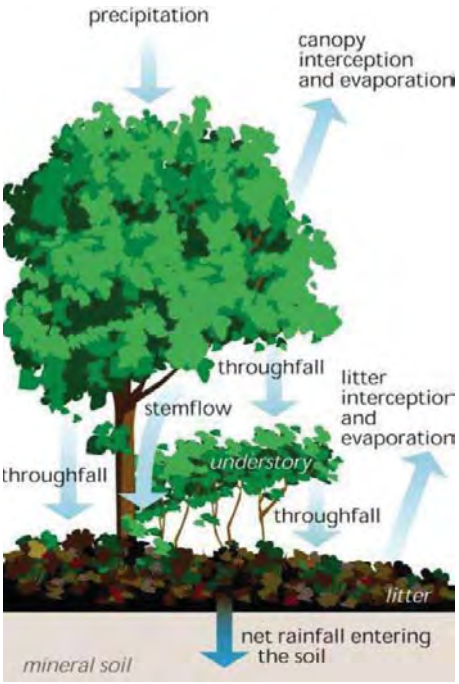
Figure 2-4: Lot Size



Hydrology and Stormwater Management

Comment [th5]: Format picture so text isn't misplaced

Stormwater management in urbanized settings faces special challenges: Paved surfaces and buildings generate high amounts of runoff while at the same time leaving little space for constructed stormwater management facilities or for soil and vegetation combination that could reduce the need for these facilities.



Like their forestland counterparts, urban trees intercept rainfall, direct precipitation the ground through trunk flow, and take stormwater through their roots. In addition, urban tree roots penetrating through typically impermeable urban soil layers into more permeable zones have the potential increase stormwater infiltration rates.

However, urban canopy cover (and thus interception) is greatly limited by urban soil conditions such as compaction, reduced rooting volume, and elevated pH. The use structural soils which are engineered soil mixtures with a high porosity, allow tree roots to penetrate freely and stormwater infiltrate rapidly and then be stored until it percolates into the soil beneath. As runoff infiltrates into the subsoil, pollutants and contaminants can be removed from the stormwater via filtration and/or adsorption.

Similar to most coastal areas, the City of Pacific Grove must contend with the effects of urbanization and polluted runoff. Because a majority of the city's stormwater infrastructure was constructed prior to 1939 and was not designed to optimize near-source retention, the city faces many challenging stormwater management issues. This is made more acute by the fact that Federal and state regulations are becoming more stringent.

Stormwater and Regulation

The cities of the Monterey Peninsula, including Pacific Grove, created the Monterey Regional Stormwater Management Program (MRSWMP) to apply for a joint National Pollutant Discharge Elimination System (MPDES) permit to regulate the discharge of runoff from each city's municipal storm sewer systems. Pacific Grove has additional obligations to reduce pollutant loads within storm runoff flowing to near shore areas within the Monterey Bay National Marine Sanctuary designated as Areas of Special Biological Significance (ASBS).

In the first quarter of 2011, the Central Coast Regional Water Quality Control Board (CC RWQCB) mandated that all local jurisdictions with storm water permits review their municipal codes and zoning to identify mechanisms for encouraging "low impact development" (LID). LID attempts to match predevelopment conditions with design features that compensate for losses of rainfall abstraction and changes in runoff concentration due to site development. LID design features include vegetation and landscape features, including trees, that maintain a sites infiltration

potential, evapotranspiration, and surface storage, as well as increased travel time to reduce rapid concentration of excess runoff.

As an existing urbanized area, Pacific Grove has limited ability to implement LID design requirements into new development, and most redevelopment is too small in scale to meet the already established Mandatory Design Standards required by the Monterey Regional Storm Water Management Program (MRSWMP). Given their environmental benefits, trees are an important component of the City's LID strategy that is being required by the CC RWQCB.

Pacific Grove's Stormwater System

Through the Watershed Institute, students at California State University Monterey Bay conducted a study of the stormwater outfall system for the city (The Watershed Institute, 2011). As shown in Figure 2-5: Watershed Boundaries, the students delineated watershed for all stormwater outfalls over ten inches. Of the 34 outfalls, 24 drain into the ASBS.

The amount of impervious surfaces within Pacific Grove is quite high. As shown in Figure 2-6: Impervious Cover, many of the watersheds contain more than 50% impervious surfaces and 44% of areas draining into the ASBS are impervious surfaces. This requires a large amount of runoff to be conveyed by the city's stormwater infrastructure. The eastern half of the city is heavily paved, with a network of streets extending from upper elevations, down slope to the ocean. A majority of the western half of the city lacks curbside drains and sidewalks, with considerably fewer paved surfaces extending to the ocean.

During the dry weather season, Pacific Grove diverts its stormwater to capture runoff containing high pollutant concentrations before it reaches the ADBS. This diversion system captures flow from most outfalls located between Lovers Point and First Street, and is operated via two sewer pumps. This water is then diverted north to the city of Marina, where it is processed at the regional wastewater treatment plant operated by the Monterey Regional Wastewater Pollution Control Agency.

Comment [th6]: Does PG pay to pump water to Marina? What if outside development adds to the volume? – comment from Jay

Reducing stormwater runoff and improving water quality is an important long-term goal.

Figure 2-5: Watershed Boundaries

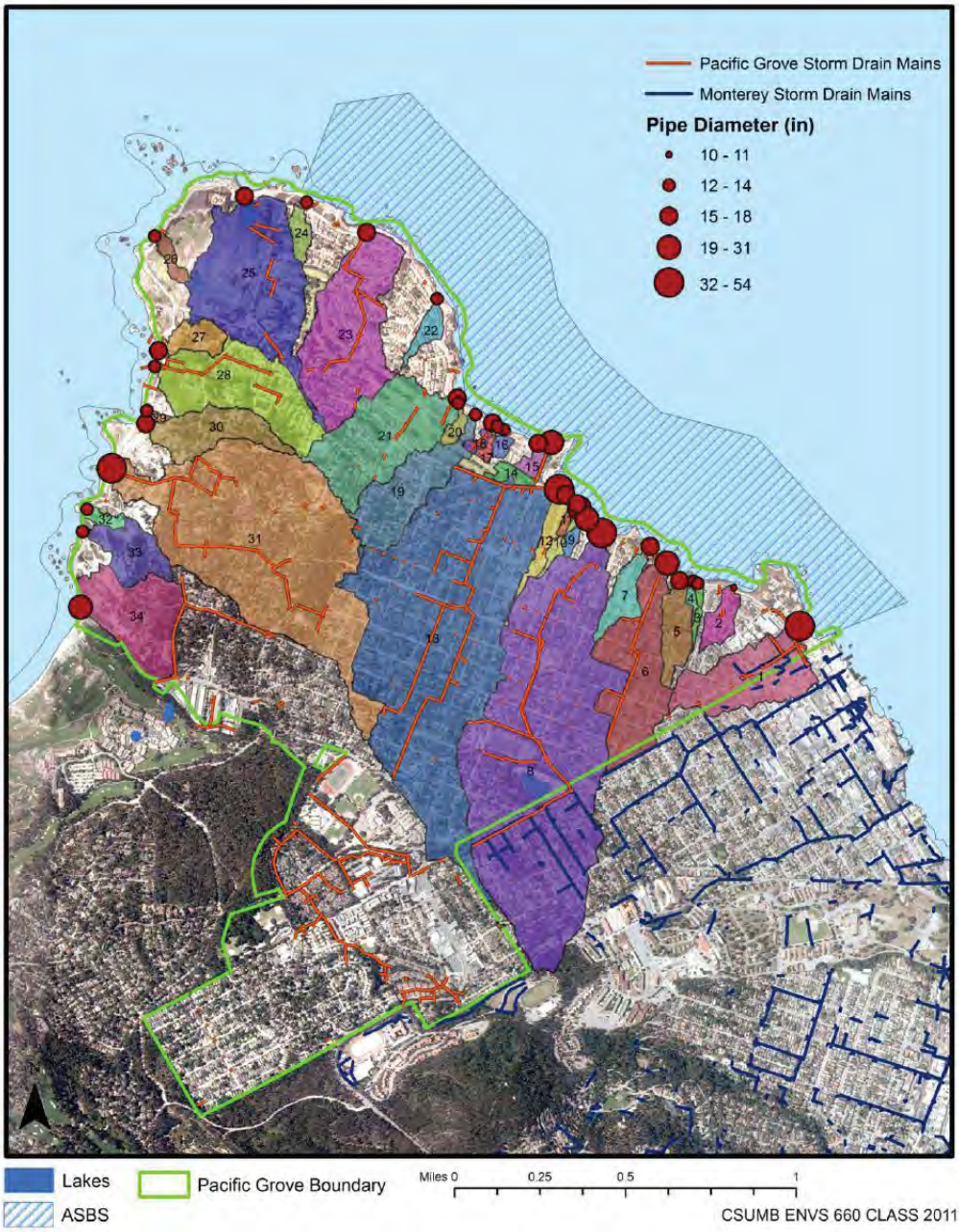
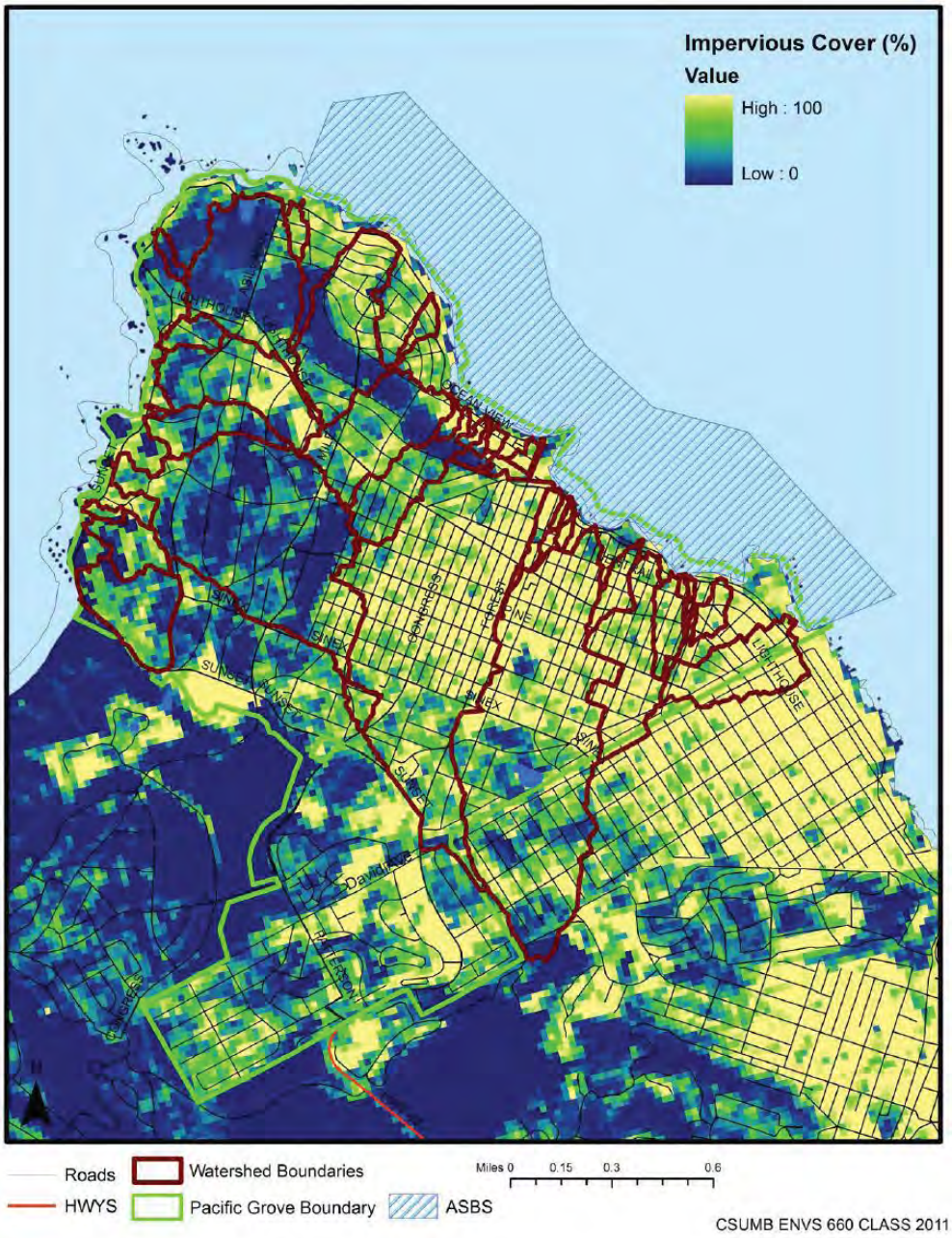


Figure 2-6: Impervious Cover



Parks and Open Space

Parks and Open Space represent a significant source of tree coverage, as well as other environmental and social benefits. As shown in Figure 2-7: Parks and Open Space, the City of Pacific Grove contains 28 formally-designated park, open space, and recreation facilities totaling nearly 450 acres. This is in addition to public school facilities which are also used for recreation. Several other areas constitute important open space resources, but are not available for traditional park and recreation use.

George Washington Park (20 acres) is the largest of Pacific Grove's city parks. It is six blocks long (from Short Street to Sinex Avenue) between Melrose and Alder Streets. Most of the park is natural forest land that offers important wildlife habitat. Monarch butterflies reside here annually from October to March.

George Washington Park

Another significant open space feature is the Monarch Grove Sanctuary located northwest of George Washington Park. The Sanctuary contains a number of Eucalyptus Trees that are used as over-wintering nesting sites for Monarch butterflies. The Monarch Grove Sanctuary Restoration Project is working to conserve and restore the Sanctuary through re-vegetative tree planting. Carried out largely through volunteer efforts, the Project will plant and maintain 24 new trees consisting of Monterey cypress, Coastal live oak, Douglas fir, and Eucalyptus, as well as flowering trees to provide on-site nectar sources.

Lynn "Rip" Van Winkle Open Space (20 acres) is a narrow ribbon of open space approximately 2,200 feet long and 400 feet wide. Located between Sunset Drive and Forest Lodge Road along Congress Avenue, it is rugged, wild, and heavily forested with Monterey cypress, Monterey pine, and coast live oak.

The Pacific Grove Golf Links (90 acres) is the Peninsula's only municipal golf course. It has an 18-hole course, a clubhouse, golf equipment, electric carts, and a driving range.

Pacific Grove Golf Links

The Union Pacific Railroad right-of-way (12.9 acres), owned by the Union Pacific Land Company, extends from the Monarch Pines Mobile Home Park on the east to Sinex Avenue on the south. The grassy, tree-lined right-of-way passes through the Pacific Grove Golf Links. Local residents walk and jog along the portion between Lighthouse Avenue and Hayward Park.

Union Pacific Railroad Right-of-Way

Figure 2-7: Public Lands and Open Space

Tree Resource Assessment

The urban forest can be evaluated using many factors, including extent of tree canopy coverage, species diversity, age, and health of trees. Forests are not static -- native forests undergo change through succession and change in reaction to impacts by humans with species selection requiring ongoing adaptation to optimize the potential of the site. Factors to consider beyond the visually obvious (size, shape, and aesthetic appeal) include:

- Horticultural requirements for drainage, soil conditions and solar exposure
- Community interests and priorities
- Habitat value for urban wildlife
- Size of available space and location of buildings, paved surfaces and utilities

Other pressures on trees in the urban environment are from development. These threats include land clearing to accommodate growth and views and tree removal to reduce conflicts between trees, power lines, and street signs and to provide sight lines along roadways.

An assessment of the vegetation structure, function, and value of Pacific Grove's urban forest was conducted in 2010. Data was collected from 126 field plots located throughout the city. This data was then analyzed using the Urban Forest Effects (UFORE) model developed by the U. S. Forest Service, Northern Research Station.

Tree Characteristics and Density

The urban forest of the City of Pacific Grove has an estimated 25,900 trees with a tree canopy cover of about 19%. As shown in Table 2-1: Predominant Tree Species in Pacific Grove, a significant portion of these trees is comprised of three dominant species, namely Monterey pine (34%), Coastal live oak (29%), and Monterey cypress (21%).

Table 2-1: Predominant Tree Species in Pacific Grove

Common Name	Percent Population	Percent Leaf Area	Importance Value [1]
Monterey pine	34.3	42.7	77.0
Monterey cypress	21.2	31.6	52.8
Coastal live oak	28.8	12.4	41.2
Coast redwood	0.6	3.2	3.7
Black acacia	1.8	1.7	3.6
Red gum eucalyptus	1.1	2.0	3.2
Cladrastis ssp	0.5	1.3	1.8
Willow ssp	0.7	1.1	1.8
Victorian box	1.1	0.2	1.2
Flowering plum	1.1	0.1	1.2

Notes:
(1) Importance values are calculated as the sum of relative leaf area and relative composition.
Source: i-Tree Ecosystem Analysis for the City of Pacific Grove, June 2011.

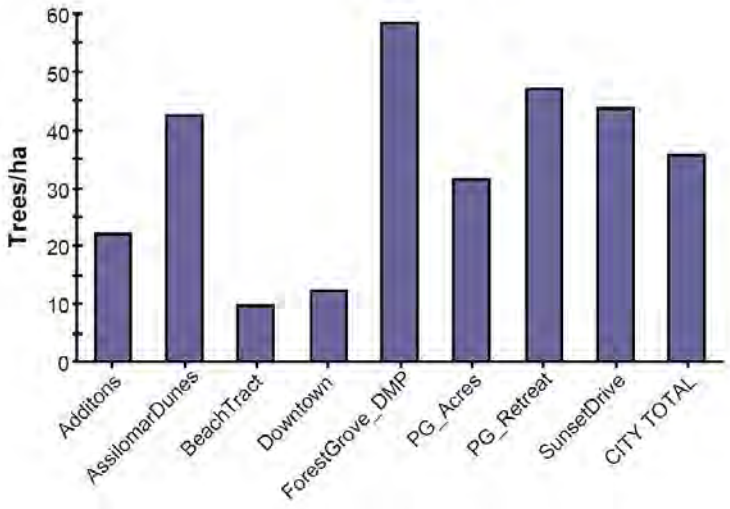
Comment [th7]: Importance of what?

Comment [th8]: Should this be included? – It is an invasive species.

Trees that have diameters less than six-inches constitute 11.3% of the population which indicates that a significant number of the trees are older, more mature trees. This would tend to indicate that there is a deficiency in the number of replacement trees that are needed to replace these older trees that will die in the not-too-distant future.

Among the neighborhoods, the highest tree densities occur in the Forest Grove/Del Monte Park neighborhood, followed by the Pacific Grove Retreat and Sunset Drive neighborhoods. The average tree density in Pacific Grove is nearly 36 trees/hectare (88 acres) (see Figure 2-8: Number of Trees per Hectare in Pacific Grove (by Neighborhood).

Figure 2-8: Number of Trees per Hectare in Pacific Grove (by Neighborhood)



Source: i-Tree Ecosystem Analysis, 2011.

Tree Canopy Coverage

Over the past 25 years, a significant number of trees have been lost in Pacific Grove. As part of an analysis of Pacific Grove's urban forest by Jake Williams and Katherine Keady (Keady/Williams, 2010), satellite imagery was used to compare tree coverage between 1986 and 2010.

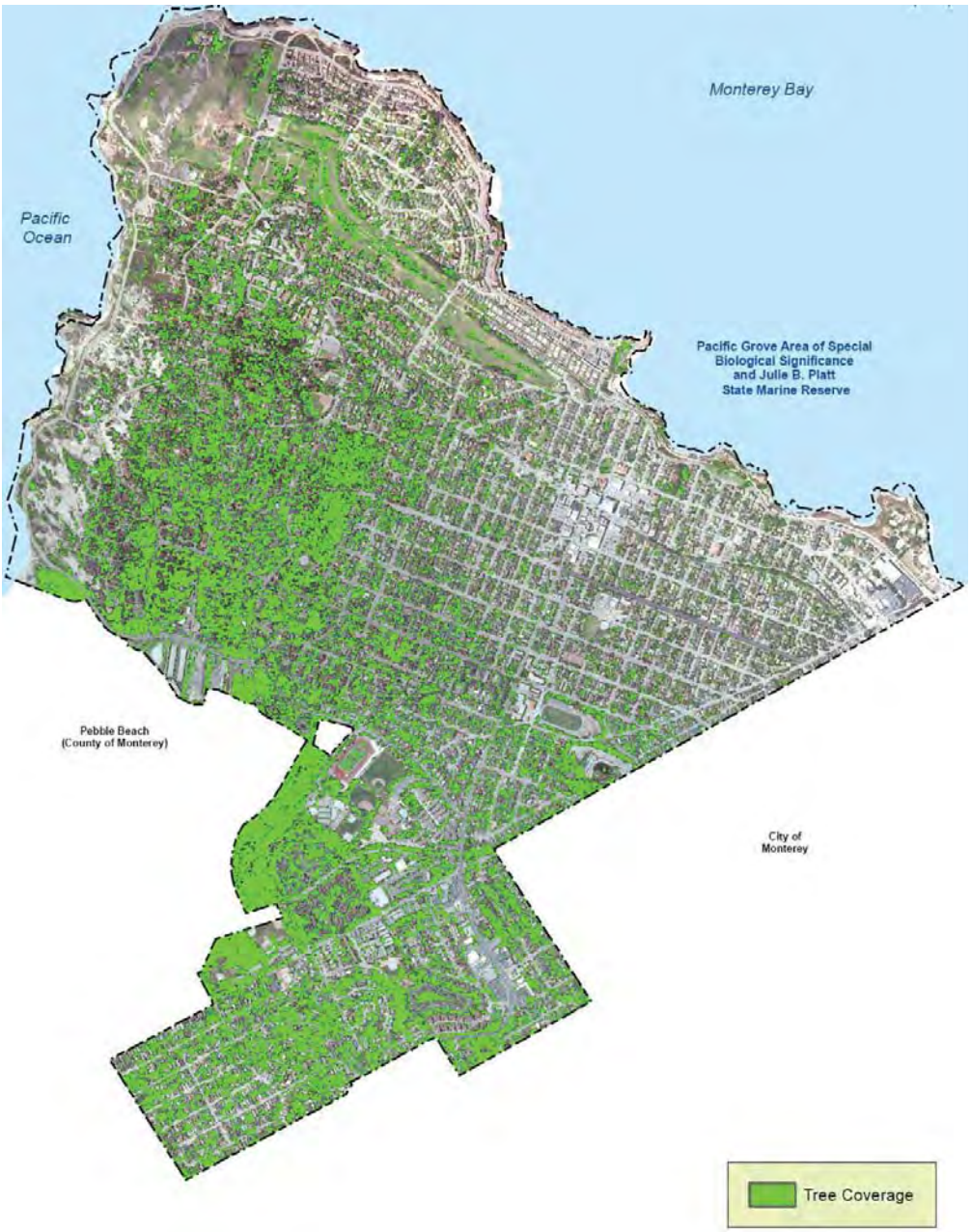
As shown in Figure 2-9: Tree Canopy Loss – 1986 to 2010, tree cover made up approximately 33% of the city in 1986 (Note - image excludes a western portion of the city as the 1986 data was not available). By 2010, the amount of tree cover was reduced to 19%, a net decrease of 42% of the total tree coverage. While tree loss occurred throughout the city, a significant amount of vegetation was lost in the western half in the Pacific Grove Acres neighborhood, consistent with the residential development and infill that has occurred in this area.

Figure 2-9: Tree Canopy Loss – 1986 to 2010

Figure 2-10: Citywide Tree Coverage, shows the predominant locations where trees currently exist in city. This image was derived from an aerial photograph and interpolated in GIS. Due primarily to larger lot sizes and topography, the predominant tree coverage is located in the southern and western portions of the city. Figure 2-11: Tree Coverage on Public Land, shows the same data, but limited only to public lands, which includes parks, open space and roadways. This comparison illustrates the significance of private property trees and highlights opportunity areas for the city where tree coverage could be expanded.

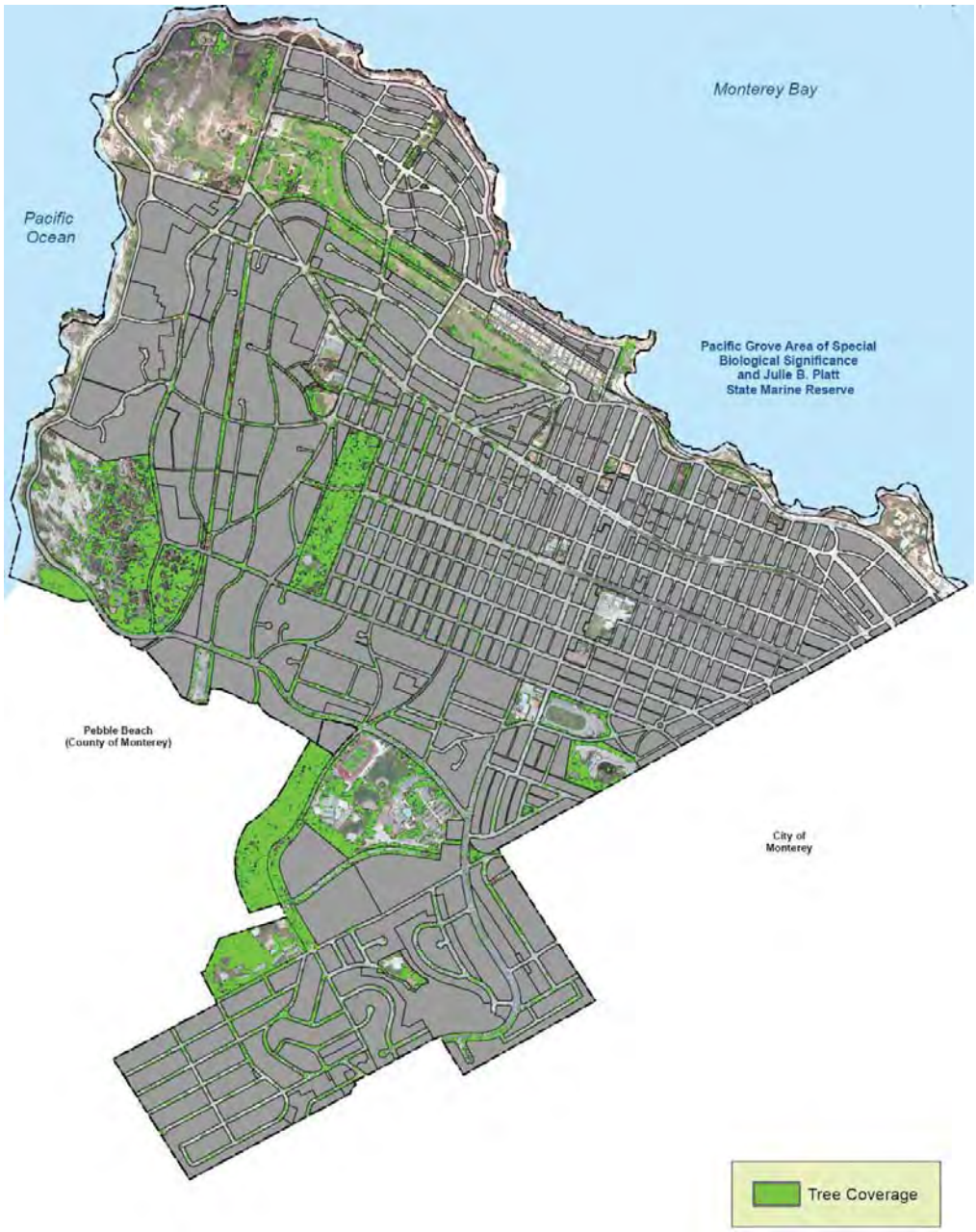
Comment [th9]: Comment from Jay – Can you provide before and after maps from the Keady /Williams study? Also, this map should be superimposed on a city map since the area is not full City limits.

Figure2-10: Citywide Tree Coverage



Source: Tess Harris, Monterey Institute of International Studies, Student Project, 2011.

Figure 2-11: Tree Coverage on Public Land



Source: Tess Harris, Monterey Institute of International Studies, Student Project, 2011.

Tree Removal

As part of the development of this UFMP, city staff analyzed the number of tree permits issued and replanting over the past three and a half years. City staff found that from January, 2008, through July, 2011, 708 permits were issued for the removal of 1,241 trees, for an average of 29 trees per month. Of the total trees removed, 222 (or 18%) were on public property and 1,019 (or 82%) on private property (see Figure 2-12: Tree Loss – 2008 to July 2011).

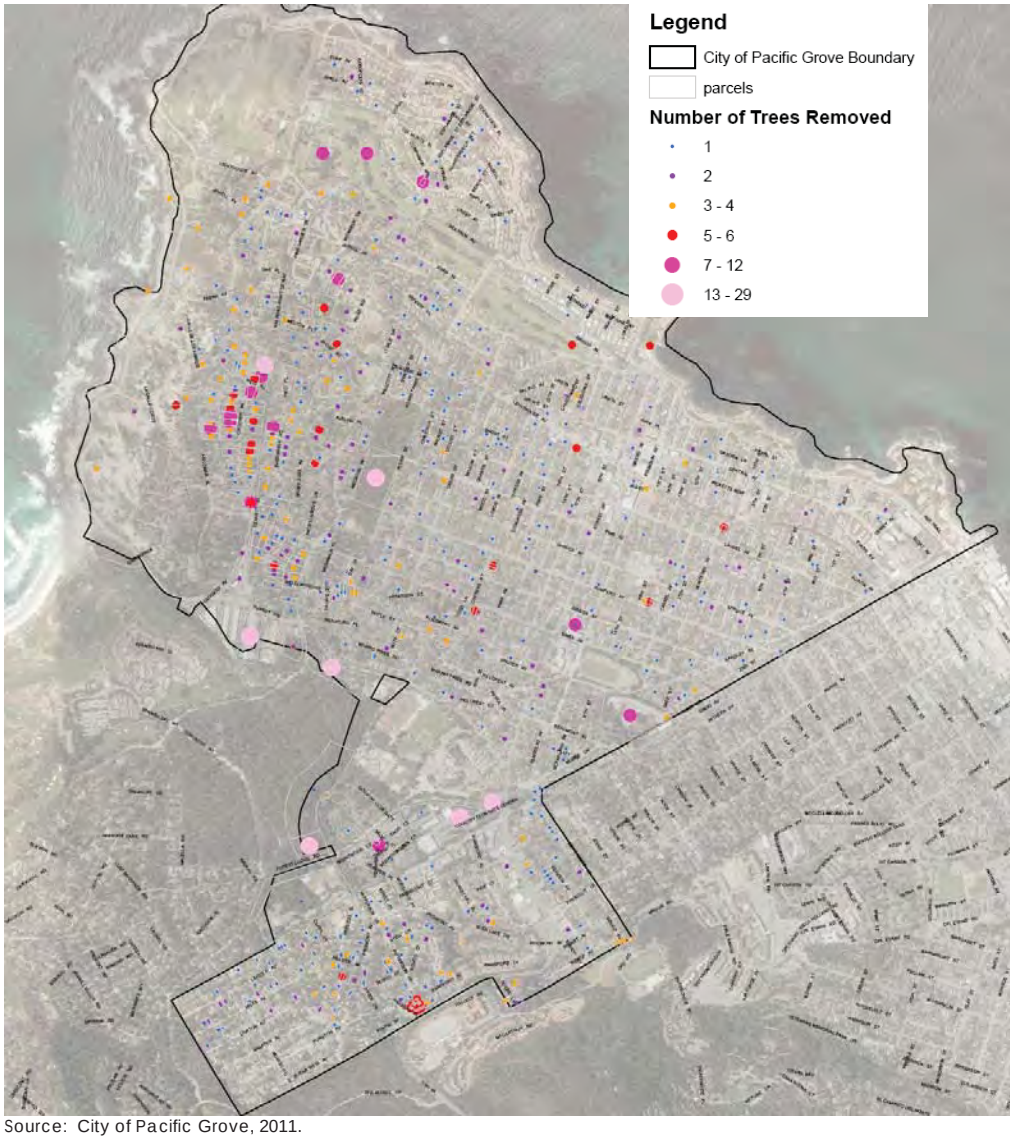
On private property, 586 permits were issued for the removal of 1,019 trees. Of these, 275 were removed without the requirement to replant for the following reasons:

- 5 were removed by paying in lieu fees
- 107 were removed as part of an ongoing replanting program
- 78 were removed with a planting plan in conjunction with a development approval
- 18 were emergency removals that did not require replanting
- 18 permits were issued by the City Arborist not requiring replanting due to limited available space on the parcel
- 49 permits were issued without a requirement to replant by the City Arborist, with no specified reason

Of the remaining 744 tree removal permits that were issued, the total number of trees required for replanting by private property owners under the current ordinance would have been 1,221 (an average of 1.6 trees to be replanted for each tree removed). To date, only 320 of these trees have been planted.

On city property, 122 permits were issued for removal of 222 trees. Of the 222 trees removed on city-owned properties during this time period, the City Arborist did not require replanting for 74 (or 33%) of the trees. Nineteen were emergency removals, and one was removed as part of an ongoing replanting at Lovers Point Park. One hundred replacement trees were required by the City Arborist, however, none had been planted by July 2011.

Figure 2-12: Tree Loss – 2008 to July 2011



Source: City of Pacific Grove, 2011.

Environmental Conditions

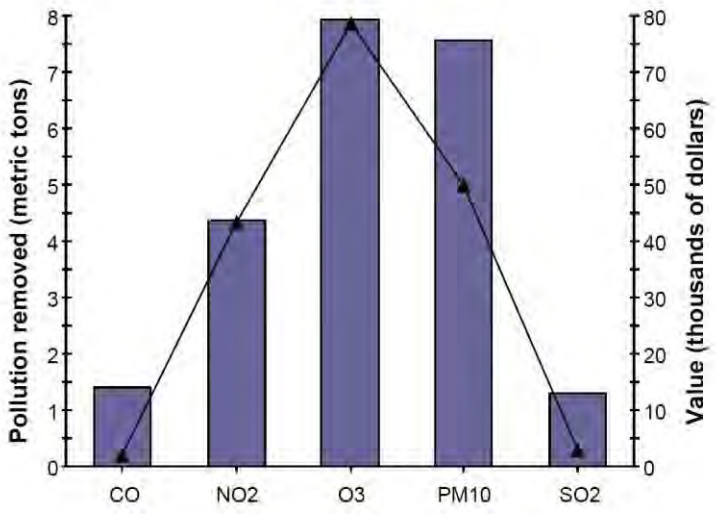
Urban forests provide many environmental benefits including air pollution removal, carbon storage and sequestration, and stormwater retention. If not managed properly, they can also become high risk as a result of falling limbs or excessive fuel loading with the potential to cause a significant fire hazard.

Air pollution

Poor air quality is a common problem in many urban areas. It can lead to decreased human health, damage to landscape materials and ecosystem processes, and reduced visibility. The urban forest can help improve air quality by reducing air temperature, directly removing pollutants from the air, and reducing energy consumption in buildings, which consequently reduces air pollutant emissions from the power plants. Trees also emit volatile organic compounds that can contribute to ozone formation. However, integrative studies have revealed that an increase in tree cover leads to reduced ozone formation (i-Tree, 2011)

As part of the i-Tree analysis, pollution removal by trees and shrubs in City of Pacific Grove was estimated using field data and recent pollution and weather data available. Pollution removal was greatest for ozone. As shown in Figure 2-13: Pollution Removal and Associated Value for Trees in Pacific Grove, it was estimated that trees and shrubs remove 23 metric tons of air pollution per year with an associated value of $177,000.

Figure 2-13: Pollution Removal and Associated Value for Trees in Pacific Grove



Notes:
(1) Line graph is "Value."
(1) Based on estimated national median externality costs associated with pollutants
Source: i-Tree Ecosystem Analysis for Pacific Grove, 2011.

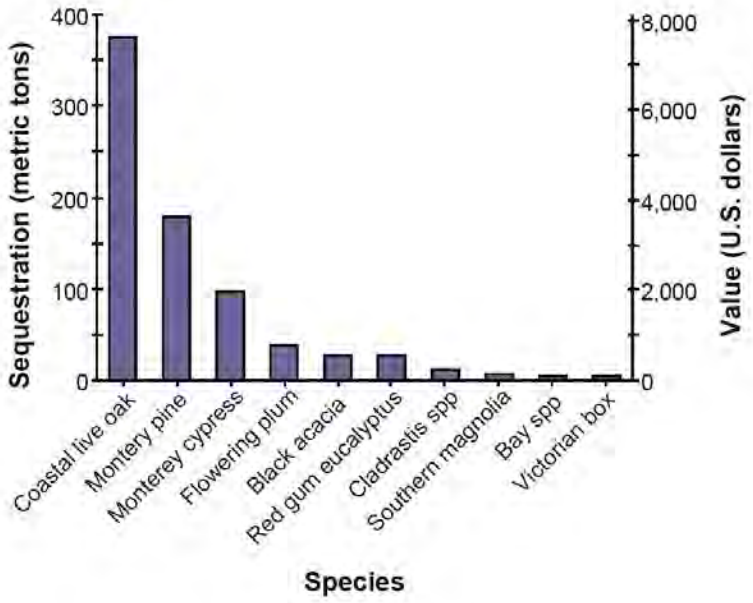
Carbon Storage and Sequestration

Climate change is an issue of global concern. Urban trees can help mitigate climate change by sequestering atmospheric carbon (from carbon dioxide) in tissue and by altering energy use in buildings, and consequently altering carbon dioxide emissions from fossil-fuel based power plants (i-Tree, 2011).

Trees reduce the amount of carbon in the atmosphere by sequestering carbon in new growth every year. The amount of carbon annually sequestered is increased with the size and health of the trees. The gross sequestration of City of Pacific Grove trees is about 890 metric tons of carbon per year with an associated value of $18,100. Net carbon sequestration in the urban forest is about 819 metric tons.

As trees grow they store more carbon as wood. As trees die and decay, they release much of the stored carbon back to the atmosphere. Thus, carbon storage is an indication of the amount of carbon that can be lost if trees are allowed to die and decompose. Trees in City of Pacific Grove are estimated to store 10,900 metric tons of carbon (with a value of $222,000). Of the species sampled, Coastal live oak stores and sequesters the most carbon (approximately 36.6% of the total carbon stored and 45.9% of all sequestered carbon) (i-Tree, 2011) (see Figure 2-14: Carbon Sequestration in Pacific Grove).

Figure 2-14: Carbon Sequestration in Pacific Grove



Source: i-Tree Ecosystems Analysis for Pacific Grove, 2011.

Current Management Framework

Public Works Department

The City of Pacific Grove Public Works Department is responsible for overall management of the urban forest. This includes street tree and parklands maintenance, the assessment of high risk trees, and issuing and monitoring tree permits.

Community Development Department

The Building, Housing, and Planning Divisions of the Community Development Department provide services to the residents and businesses of Pacific Grove to ensure and support zoning regulations, building code compliance, housing availability, and safety.

Any proposed development project, including remodels, requires a permit and is subject to review. This includes the altering or removal of any trees on private property.

Pacific Grove Golf Links

The City of Pacific Grove owns and operates the 18-hole Pacific Grove Golf Links, which includes a driving range, new clubhouse, and separate golf shop built in 2005.

The city is responsible for maintenance of the course which includes the maintenance of existing trees and replanting of new trees.

Natural Resources Commission

The Natural Resources Commission (NRC) consists of seven members, charged with developing and recommending projects and programs to advise on the city's natural resources and beautification matters.

The NRC exists to support, encourage and facilitate conservation, restoration, beautification and improvement of natural resources in the city through projects, programs and activities. Their responsibilities are;

- To develop with staff and others knowledgeable in management programs for the urban forest and wildlife habitat;
- Promote reforestation and tree preservation;
- Advise staff and City Council on the tree planting list;
- Develop with staff and other commissions landscaping and beautification projects for city owned parks and open spaces;
- Advise the Planning Commission (PC), Architectural Review Board (ARB) and City Council on beautification and natural resource ordinances and amendments here to as they relate to building construction and development in the city;
- Advise on beach, waterfront areas and recreation trail as to preservation, improvement and maintenance;
- Advise the Architectural Review Board (ARB) on directional and sandwich signs; oversee with staff and advise the City Council on all matters regarding the Monarch Grove Sanctuary;
- Invite assistance from staff and the public regarding NRC matters;

- Inform the public and advise City Council on recycling and reuse matters;
- Develop partnering projects with schools about natural resource awareness;
- Advise Public Works and Public Safety personnel regarding nonemergency matters impacting natural resources and beautification in public spaces;
- Consult the Cultural Arts Commission and City Council on issues of public art for public places;
- Assist staff regarding site furniture and memorial benches for public spaces; and,
- Advise and participate with staff on issues of water resources.

Part of the NRC's charter is to develop a street tree program which will promote reforestation and tree preservation in the city and advice on landscaping and design plans in the city parks and other city-owned open space property. The NRC serves to inform the public in regards to problems of the urban forest, including a public information program and cooperation with school programs and the like; and addresses specific areas of interest, including restoration of the monarch butterfly habitats and shoreline improvements. The NRC formally hears appeals of actions as they pertain to tree permits and may affirm, reverse, or modify such action. Actions of the NRC may be appealed to the City Council.

Maintenance

The city has not had the staff or resources necessary to maintain a proactive or reactive tree management program throughout the city's forest. Issues related to tree risk management and flammable fuel management are discussed below.

Comment [th10]: How will this change after the plan is approved?

Tree Risk Management

High risk trees are a particularly acute issue in Pacific Grove. This is due in part to the predominant types of tree species, especially the Monterey pine, and the aging forested areas throughout the city (e.g. George Washington Park and Rip Van Winkle Park).

Warning sign in George Washington Park

The city strives to eliminate any city tree deemed high risk. When available fiscal and human resources limit the ability of the city to remove high risk trees, the priority should be trees deemed to carry the highest risk. The management of high risk trees on private property is the responsibility of the respective land owner.

The city uses the International Society of Arboriculture (ISA) risk rating system. The City Arborist is responsible for administering the program and is responsible for making the final determination in all matters concerning the mitigation measures taken for any tree deemed high risk.

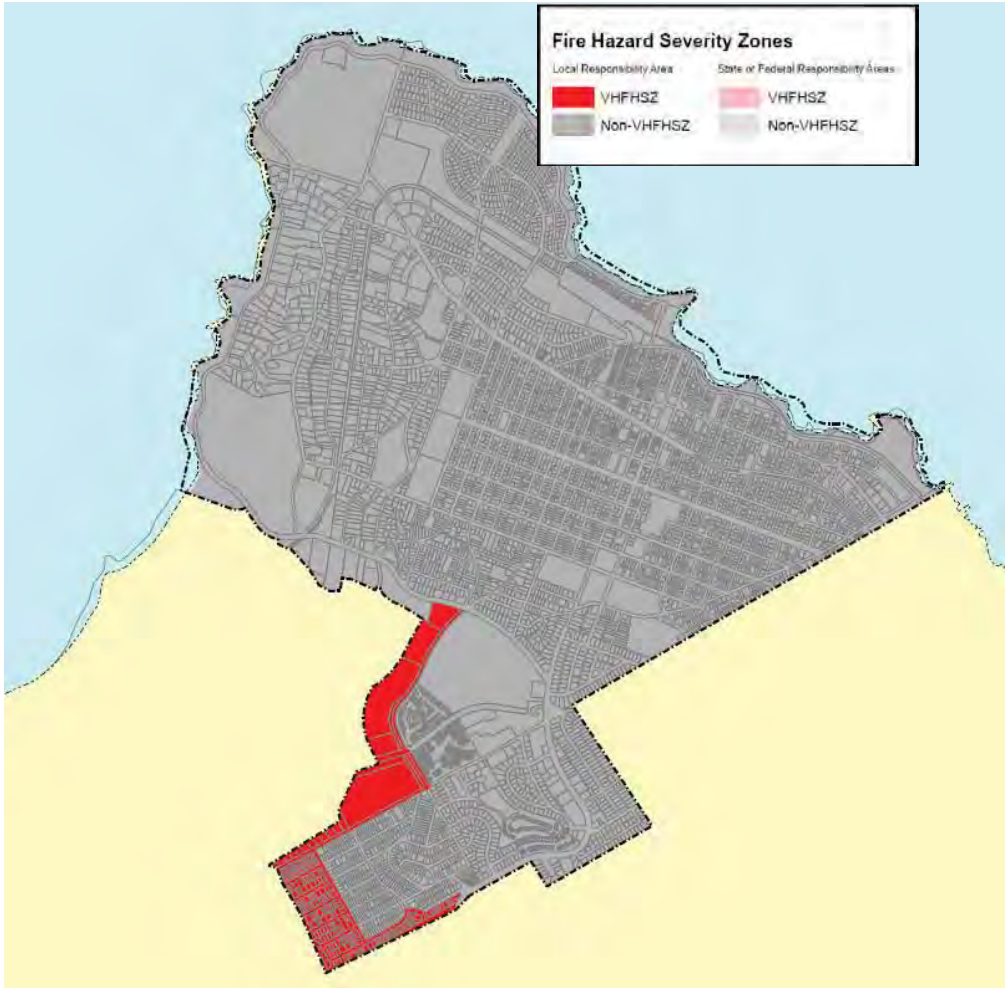
Flammable Fuel Management

In parts of California, wildfire has become an increasing concern as communities spread into fire-prone vegetation types. Management of vegetation at the wildland/urban interface to reduce fire risk has become an important planning issue.

CalFire has developed a rating of wildland fire threat for the entire state. The rating is based on potential fire behavior (derived from weather, terrain and vegetative-fuel data) and expected fire frequency (derived from 50 years of fire-history data). Areas are assigned one of four fire threat ratings: moderate, high, very high and extreme. As shown in Figure 2-15: Fire Hazard Areas for Pacific Grove, the area shown in red along the southern portion of the city limits and adjacent to the Pebble Beach Del Monte Forest is designated as a Very High Fire Hazard Severity Zone (VHFHSZ) of local responsibility.

The California State Public Resources Code section 4291-4299 has requirements for creating defensible space for structures in lands covered by flammable vegetation. The guidelines created by CalFire to help landowners interpret these rules state: In general, fuel reduction means arranging the trees, shrubs and other fuels sources in a way that makes it difficult for fire to transfer from one fuel source to another. It does not require cutting down all trees and shrubs or creating a bare ring of earth across the property.

Figure 2-15: Fire Hazard Areas



Community Framework Assessment

A sustainable urban forest is a community asset. Community appreciation for the benefits and needs of trees and engagement in planning, planting and caring for trees is essential to the long-term health of the asset. Citizen input and volunteer participation are critical to the success of city programs. Without the active support and engagement of the community, urban forestry programs cannot succeed. This section describes the ways the community is currently informed about and participates in stewardship of the urban forest.

Outreach

The city has an important role in fostering residents understanding of the environmental, economic, and community benefits of trees as well as proper selection, planting and care. The city provides information through its website as well as brochures and other publications including the following:

- Landscape Trees for Pacific Grove -- A Guide to Selection, Planting and Care (January 2011)
- Pacific Grove Monarch Grove Sanctuary Management Plan (June 2011)
- i-Tree Ecosystem Analysis for Pacific Grove (June 2011)

Volunteer Opportunities & Partnerships

The NRC is responsible for identifying volunteer opportunities and partnerships for projects as they relate to the city's urban forest. The NRC works in concert with staff to develop the scope for projects that enhance and maintain our urban forest and recommends these volunteer projects to the City Council for consideration and approval.

Since its creation in 2006, Trees for P.G. has worked creatively to replant the aging and declining forests in Pacific Grove. In its first year, Trees for P.G. raised over $10,000 and planted more than 1,000 native trees. Previous Arbor Day tree planting events have successfully engage community volunteers and city staff in the reforestation of two key segments of George Washington Park.

Comment [th11]: Good thing, but how many of the 1000 trees lived?

3 | URBAN FORESTRY LONG TERM AND NEIGHBORHOOD STRATEGIES

In this Chapter:

- Introduction
- City-wide Urban Forestry Long Term Strategies
- Neighborhood Urban Forestry Strategies

Comment [th12]: Terry O'Connell made comments throughout this section

Introduction

To encourage tree preservation and planting across the city, this UFMP is based on guiding principles, long range strategies, objectives and urban forestry standards that are organized according the three organizing elements of this UFMP, namely: 1) Tree Resource, 2) Management Framework, and 3) Community Framework. These will be used to interpret and implement this UFMP.

To achieve the city-wide tree canopy target of planting at least 24,000 trees over the next 25 years, the City will need to consider innovative strategies to plant new trees, particularly in the public right-of-way. To help meet this goal, a number of both city-wide and neighborhood urban forestry long term strategies have been identified which will help the city reach its target and creates a vision that can be championed by the community.

The long term strategies will require implementation over time. This Urban Forest Management Plan establishes a path for success in both pursuing future funding opportunities, such as grants, as well as committing to a five-year management plan that will be periodically review to implement the longer-term strategies envisioned in this document.

Furthermore, it is important to note that any of these proposed city-wide strategies and neighborhood actions will need to be consistent with the existing goals and policies as identified in the city's General Plan and Coastal Land Use Plan (CLUP). Where conflicts arise, the General Plan and the CLUP shall supersede.

These strategies build on the goals and policies of existing city documents, and the charter and interests of various appointed committees. These include:

Relevant City Plans and Policies	Relevant Appointed and Elected Representatives
▪ General Plan ▪ Coastal Land Use Plan ▪ Forest Hill Specific Plan ▪ Monterey Regional Storm Water Management Program ▪ Capital Improvement Program ▪ Pacific Grove Pedestrian Safety Assessment	▪ City Council ▪ Urban Forest Advisory Committee ▪ Planning Commission ▪ Natural Resources Commission ▪ ADA Compliance Advisory Committee ▪ Traffic Safety Commission ▪ Recreation Board

In particular, the Natural Resources element of the Pacific Grove General Plan specifically identify goals and policies related to the protection of tree resources and the preparation of an urban forest management plan, as described below:

Goal 1 – Comprehensively manage Pacific Grove's vegetation and wildlife habitat.

Policy 3 – Actively promote tree planting to maintain and renew the urban forest. The Local Coastal Program Land Use Plan calls for the City to undertake and implement a tree management program to maintain and enhance the Monterey pine and cypress stands within the city. LUP 2.3.6.1 calls for a complete inventory of the trees within the city's coastal zone to determine age, disease, and need for reforestation. The City intends to develop a city-wide tree management program to include replacement plantings of Monterey pines, Monterey cypresses, and coast live oaks.

Program B – Prepare and adopt a comprehensive and city-wide urban forest management plan. Among other issues, the urban forest management plan will address aesthetics, forest renewal, and safety.

Program C – Work with citizens to encourage tree planting on private property.

The City will refine and publish a planting list of desirable and adaptable trees, and native drought resistant vegetation.

Program D – Encourage the restoration and maintenance of native plants.

These strategies are also the mechanism by which the UFMP guiding principles, strategies, and implementing actions identified in Chapter 4, as well broader environmental, economic, and social values identified in this plan, can become realized.

Specifically, there are a number of key issues that the City of Pacific Grove is addressing that are reflected and indeed compliment the following city-wide and neighborhood strategies. These include improving ADA accessibility on sidewalks throughout the city, improving pedestrian safety, particularly in the downtown, minimizing stormwater outfall into the Monterey Bay National Marine Sanctuary (as required under state law), and improving the economic and fiscal conditions for both the City of Pacific Grove and local businesses.

City-wide Urban Forestry Long Term Strategies

Strategy #1: Greening Pacific Grove – Establishing a Urban Forest Restoration Program

To meet Pacific Grove's tree canopy coverage objectives, a vigorous tree-planting program will be initiated by the City of Pacific Grove to meet the planting goal of 24,000 new trees over the next 25 years, or nearly 1,000 new trees per year. This strategy will consist of three major efforts: 1). Plan for and construct a nursery to grow and maintain a healthy tree stock, 2). Establish a tree planting outreach program to support the planting and maintenance of new trees, and 3). Develop a comprehensive tree maintenance program.

Pacific Grove Plant Nursery

Comment [th13]: How will the nursery be financed?

Comment [th14]: Great idea, but there is a financial risk for the City. Perhaps contract to have private firm run the nursery on public land with oversight and option for years on the contract, with re-bid every 5 years.

To provide suitable planting stock for plantings on public land as well as private property, the City of Pacific Grove will develop and operate a community nursery, or conversely, partner with an existing nursery business.

To ensure a healthy stock, seeds will be collected from genetically sound native tree species indigenous to Pacific Grove. Additional tree species, both native and non-native, will be chosen from *Landscape Trees for Pacific Grove – A Guide to Selection Care and Planting*. This will provide a wide selection of species that can be planted, and will increase diversity in the city's tree population.

Trees will be germinated, grown to sapling size, containerized and moved into larger containers as roots develop and expand until trees are of sufficient size to be planted. Species without collectable seed sources will be propagated from cuttings or grown from liner stock obtained from regional nurseries. Trees with poor structure or other defects will be culled.

It is anticipated that approximately 1-2 acres will be required for the nursery. The city's public works corporation yard as already has an outdoor nursery (52' x26' [1,352 sf]) and small greenhouse (12" x 6' [72 sf]). The goal is to expand the indoor and outdoor portions of this nursery to accommodate additional tree potting for 15 gallon potted trees to 1,800 square feet for the outdoor and 200 square feet for the greenhouse.

Finding a suitable site will be an important first step. It is envisioned that the city will either locate the nursery on existing city-owned property, or enter into a joint agreement with a third party to establish the nursery on privately-owned land. If a city nursery is chosen, possible candidate sites include:

- Pacific Grove Public Works Corporation Yard
- CalAm Corporate Yard
- Pacific Grove Golf Links
- Asilomar Dunes State Park
- School site(s):
- Pacific Grove Adult Education
- Forest Grove Elementary
- PG High School
- PG Middle School
- Robert Down Elementary School

Discussions will be necessary with the owners of relevant private properties to determine their interest in participating.

Trees grown will be distributed to community groups, businesses, schools, and private property owners. Additionally, a focused program will be initiated by city staff to reforest high-priority public lands throughout the city. These high-priority locations (see Figure 2-7: Public Lands and Open Space) include:

- George Washington Park
- Rip Van Winkle Park
- Lovers Point Park
- Downtown Pacific Grove
- Streets along designated "Green Streets" (described below)
- Pacific Grove Golf Links
- Union Pacific Railroad right-of-way

Urban Forest Restoration Program

Comment [th15]: Jay – great idea

Any successful tree replanting program requires cooperative involvement by the community. This will help foster greater awareness, community stewardship, and prioritization of urban forest management practices. To this end, the city will play an active role in the formation of a nonprofit organization that will provide volunteer recruitment, training, and supervision support for city forestry programs, of which the tree replanting program will be a primary effort.

PGreen PARTNERSHIPS
"ReGreening" Pacific Grove

Working with city staff, the Natural Resources Commission, and the City Council, the city will establish annual planting goals and programs and identify priority planting areas on public and private property in all neighborhoods throughout the city. It is envisioned that residents will be provided trees without charge to encourage voluntary planting of trees on private property.

The city will also facilitate outreach programs with schools, local businesses, neighborhood organizations, and other groups to educate people about the importance of the Pacific Grove urban forest and to enlist their support in annual planting programs. Finally, this organization will help in organizing annual events (e.g. Arbor Day) to promote the planting of new trees in Pacific Grove.

It is envisioned that this ongoing organization will be funded partly via city funds, as well as sponsorships from the local and regional area.

Tree Maintenance Program

Comment [th16]: Watering truck with a long hose is also needed to water trees in GW and RVW parks - Jay

Comment [th17]: Dependent on funds – Terry O'Connell

Planting trees is but one, minor element of a successful reforestation effort. To ensure trees grow to their full potential and provide maximum benefits for their lifespan, the program must be multi-faceted. Trees do not just die from old age. They also die as a result of disease, insect attacks, and damage by humans or natural disasters. Newly planted trees frequently die from poor site selection/preparation and lack of aftercare.

To help ensure the greatest survival rate of new and existing (healthy) trees, the city, working with the nonprofit organization, will provide educational assistance to the community regarding the proper care and maintenance of trees and the urban forest. Topics to be addressed include:

- Appropriate soil type
- Drainage capability
- Available sunlight
- Adequate space, both above and below-ground to assure future growth does not damage infrastructure or constrain usable space
- Suitable species
- Well-structured, healthy planting stock
- Aftercare to insure newly planted trees are irrigated and cared for during the initial acclimation period until they adapt to the new growing environment.
- Early training pruning
- Periodic monitoring

This assistance will be in the form of educational publications, school outreach programs, workshops, neighborhood meetings, etc. A primary element of this program will be to update the city's *Landscape Trees for Pacific Grove - A Guide to Selection Care and Planting* to address these topics identified above.

In addition, the city will conduct an annual inspection of trees on public property (e.g. parks and open space, street trees, etc.) to ensure that the trees are healthy and do not pose a potential risk to the community.

Tree Inventory

To better understand the quantity and condition of public trees, the city will compile and maintain an inventory of individual trees on all public lands. The inventory will be cataloged to record street trees, park trees, and facility trees by land use. The inventory will objectively evaluate tree resources to aid in decision making for maintenance, planting, and budgeting.

The inventory will include a land use specific canopy analysis identifying current coverage levels. This baseline data will be used to more accurately determine existing canopy coverage, available planting sites and measure success of tree-growing objectives.

The inventory will include all vacant available planting sites, and provide the data needed to calculate the costs and benefits of the community's tree resources.

The inventory will be updated and managed with the most recent information each time a tree is inspected or maintained.

The inventory could be developed as an online resource with mapping features depicting locations and specific information; attributes, weaknesses, age class, risk rating and photos. This way it can be more readily used as a community engagement and educational tool.

Comment [th18]: This will use GIS right? Can this be an ongoing project for schools, or adult education or CSUMB students? GIS takes a lot of field work, but would be great job training -Jay

Comment [th19]: Who will maintain tree inventory and records of plantings and removals? – Dave Meyers

Comment [th20R19]: Terry O'Connell suggests using "may" instead of "will" throughout

Strategy #2: Green Streets – Promoting Sustainable Stormwater Management and Mobility

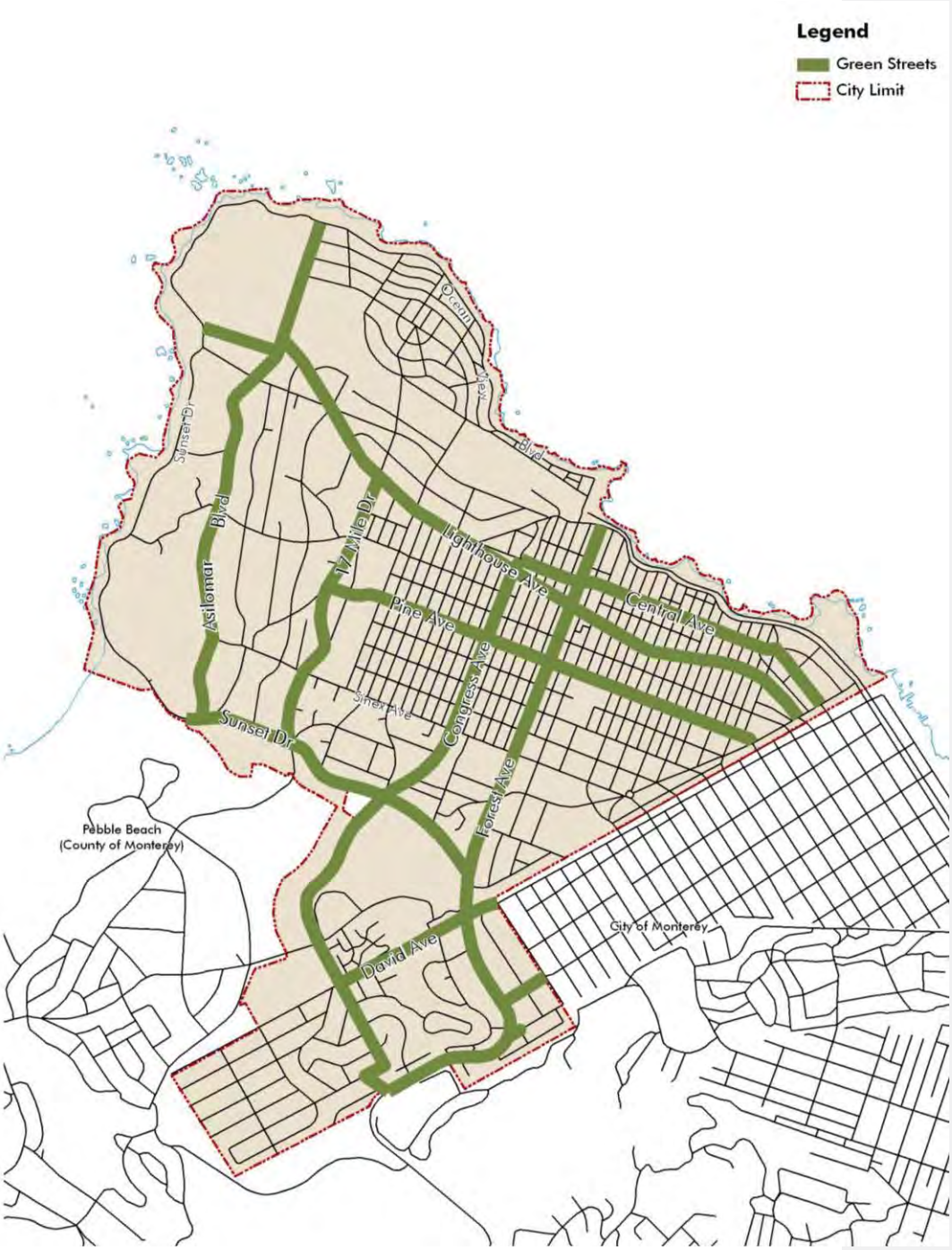
This strategy is consistent with a growing national trend [1]to think of public streets not just as pavement for automobiles, but rather a multi-functional urban asset that promotes alternative pedestrian-friendly modes of travel while also improving the aesthetic character and environmental quality and function of streets and neighborhoods. As shown in Figure 3-1: Proposed Green Street, the roadways would include:

- Forest Avenue
- David Avenue
- Congress Avenue
- Sunset Drive
- Pine Avenue
- Lighthouse Avenue
- Central Avenue
- 17 Mile Drive
- Asilomar Boulevard

This strategy consists of two components, namely; sustainable stormwater management, and improved pedestrian and bicycle safety and accessibility. Street trees are considered an essential element to both of these components.

[1] See the National Complete Streets Coalition (http://www.completestreets.org/) and the Low Impact Development Center (http://www.lowimpactdevelopment.org/greenstreets/index.htm) as examples.

Figure 3-1: Proposed Green Streets



Sustainable Stormwater Management

Sustainable stormwater design treats rainfall runoff as a valuable resource. It is based on balancing urban development while preserving natural hydrological functions. Furthermore, sustainable stormwater design achieves the multiple goals of being cost effective, improving water quality, and addressing community concerns. Mimicking the natural hydrologic function of healthy ecosystems in street and parking lot landscapes can dramatically reduce pollution, decrease runoff volume, reduce runoff temperature, protect aquatic habitat, and create more interesting places to live.

Urban stormwater runoff that isn't properly managed can pollute Pacific Grove and the Monterey Bay.

Green Streets reduce the negative impacts of stormwater runoff. They mimic natural conditions by using soil and vegetation to manage runoff on the surface, at the source.

The city's current stormwater management infrastructure (including sales, drain inlets, and pipes) serves less than 15% of the city's total curb miles. In addition, parts of the existing system are not connected or are otherwise not serviceable. The city engineer has estimated that to repair and expand the current infrastructure to serve the entire city using methods would cost over $75 million.

As an alternative to costly infrastructure upgrades to existing stormwater pipes and pollution prevention devices, the City of Pacific Grove has been actively studying alternative strategies to manage stormwater runoff, enhance community and neighborhood livability, and strengthen the local economy.

Green Streets Program

A street that uses vegetated facilities to manage stormwater runoff at its source is referred to as a "Green Street." Green Street's are a sustainable stormwater strategy that meets regulatory compliance and resource protection goals by using a natural systems approach to manage stormwater, reduce flows, improve water quality and enhance watershed health.

A number of streets within the city already incorporate one or more of the features of Green Streets. Congress Avenue north of David, the east end of Lighthouse Avenue, Alder Street, Pico Boulevard behind the Municipal Ball Field, and Asilomar Boulevard are particularly instructive examples. The Green Streets concept is consist with – and can enhance the look and feel, as well as the environmentally friendly character – of many Pacific Grove neighborhoods.

The city recognizes that a comprehensive Green Streets approach is an important development strategy to:

- Reduce polluted stormwater from entering the Monterey Bay National Marine Sanctuary;
- Improve pedestrian and bicycle safety;
- Divert stormwater from the sewer system and reduce localized flooding, sewer backups and combined sewer overflows (CSOs);

- Reduce impervious surface so stormwater can infiltrate to recharge groundwater and surface water;
- Increase urban green space;
- Improve air quality;
- Reduce demand on the city's sewer collection system and the cost of constructing expensive pipe systems; and,
- Address requirements of federal and state regulations to protect public health and restore and protect watershed health.

To this end, the city will actively develop a Green Streets program on public roadways that will incorporate trees and other vegetation as a means to reduce urban runoff by reducing the amount of impervious surface and increasing infiltration. The city will also actively pursue grant funding opportunities as part of this Green Streets program.

Given the city's topography, stormwater flows generally south to north into the Monterey Bay, and in particular the Area of Special Biological Significance. The city envisions intercepting this stormwater at the Pacific Grove Golf Links and with Green Streets along the east-west streets of Pine, Lighthouse, and Central Avenues, as well as Ocean View Boulevard.

The "Multiple Shades of Green Streets"		
Level 1	Maximize landscaped areas along the street and minimize overall impervious area. Some runoff from adjacent sidewalks may be managed in landscaped areas.	
Level 2	Significant tree canopy is added to the urban streetscape.	
Level 3	Stormwater runoff is fully managed from the street, sidewalk, and driveway areas within a landscape system. Design solutions are cost effective, provide direct environmental benefits, and are aesthetically pleasing.	
Level 4	Green street provides a direct focus on alternative modes of transportation including mass transit, biking, and walking.	
Level 5	The building, site, and street frontage become one integrated space for stormwater management. The entire green street "envelope" manages both public and private runoff.	

Source: San Mateo County, Sustainable Green Streets & Parking Lots Design Guidelines, 2009.

Types of Green Streets

Green Streets have different shapes and sizes, but they all have stormwater management benefits and help protect watershed health. Examples are shown below.

Stormwater Curb Extension

Extending into the street, stormwater curb extensions transform the curb lane into a landscape area. Curb extensions can conveniently integrate a ramp for safe pedestrian crossing.

Stormwater Street Planter

Stormwater street planters between the sidewalk and the curb work well in areas with limited space, and they allow for adjacent street parking or travel.

Rain Gardens

Where there is enough space, rain gardens are ideal. They can also transform awkward street intersections into safe pedestrian and bicycle crossings.

Simple Green Street

Excavating an existing planting area behind a reinforced curb, making curb cuts for inflow and outflow, and landscaping with appropriate vegetation is a simple approach to capture and treat street runoff.

Source: City of Portland, Green Streets Program, 2011.

Creating Walkable Pathways

Another advantage of this Green Streets strategy is to create more pedestrian-friendly streets and also address the city's need to improve ADA accessibility, support the development of a "Safe Routes to School" program, improve pedestrian safety, and enhance the overall aesthetic quality and character of Pacific Grove's neighborhoods.

Below are two representative site studies for two possible Green Streets in Pacific Grove. The first is in downtown on Lighthouse at Forest Avenue. The second is on Pine Avenue near Forest Avenue. These illustrations are meant to convey a vision of what could be built. Obviously, financial constraints, stakeholder, business and neighborhood interests, traffic and circulation requirements, parking, and other issues will have to be carefully considered before any final plan can be constructed.

Lighthouse Avenue at Forest Avenue

Downtown Pacific Grove on Lighthouse Avenue has a unique streetscape with two separated one-way lanes divided by a wide median area that in many areas accommodate angled parking. As a result, the right-of-way of Lighthouse Avenue is very wide, making it difficult for pedestrian crossing.

The intersection of Lighthouse Avenue at Forest Avenue was analyzed in 2008 as part of the Pacific Grove Pedestrian Safety Assessment (City of Pacific Grove, 2008). This intersection has corners typical of downtown, namely: one curb ramp per corner, no curb extensions, and no "thumbnail" islands protecting the midpoint of the crosswalks across Lighthouse Avenue.

The Downtown Public Improvement Committee (DPIC) developed initial plans and recommendations for public improvements to Lighthouse Avenue. The DPIC sought to balance the need to preserve parking spaces with the need to create a vibrant, attractive and pedestrian-friendly downtown. They also seek to develop plans that are flexible enough to accommodate a wide variety of public events on Lighthouse Avenue. These plans are consistent with this Green Streets strategy.

As shown in Figure 3-2: Lighthouse Avenue Green Street Illustration, green corridor improvements on Lighthouse Avenue could include:

- Additional tree plantings along the sidewalks and in the parking lanes
- Additional tree plantings in the median with minimal loss of existing parking spaces.

- "Bulb-outs" at all corners to the depth of the diagonal and parallel parking areas
- Incorporation of stormwater infiltration systems
- Colored pavement treatment to crosswalks
- Mid-street "thumbnail" islands to improve pedestrian safety

Figure 3-2: Lighthouse Avenue Green Street Illustration

Pine Avenue Near Forest Avenue

Pine Avenue spans the Additions residential neighborhood of Pacific Grove east of George Washington Park, a distance of approximately one mile (35 blocks). The street is 60' wide with four travel lanes but carries only about 5,000 cars daily (City of Pacific Grove, 2008). Given these relatively low volumes, reducing the travel lanes from four to two would lower vehicle speeds. Bike lanes could be added to both side of the street and turn lanes and landscaped medians constructed in the center of the roadway.

As discussed below, Pine Avenue is a prime roadway that could also act as an intercept corridor for stormwater flows with the installation of infiltration systems.

As shown in Figure 3-3: Pine Avenue Green Street Illustration, green corridor improvements on Pine Avenue could include:

- Reconfiguration from four to two travel lanes
- Class II bike lanes in both directions
- Additional tree plantings along the sidewalks and in the parking lanes
- Significant tree plantings in the median to create a large tree canopy
- "Bulb-outs" at all corners to the depth of the diagonal and parallel parking areas
- Incorporation of Best Management Practices (BMP) infiltration systems
- Colored pavement treatment to crosswalks
- Mid-street "thumbnail" islands to improve pedestrian safety

Example of a "bulb-out" with street trees.

Figure 3-3: Pine Avenue Green Street Illustration

Strategy #3: Memorable Gateways – Using trees to Create Distinctive Entries into Pacific Grove

Boundaries are an important urban design element that signals one's arrival at a city boundary, a new land use, area, or feature. Entries features that announce the arrival into a new city are an effective way of strengthening a city's identity and re-enforcing a sense of community identity.

As shown in Figure 3-4: Significant Entryways into Pacific Grove, there are six predominant entries into the City of Pacific.

From Monterey County:

- Highway 68 (Forest Avenue) at Stuart Street (from Monterey County)

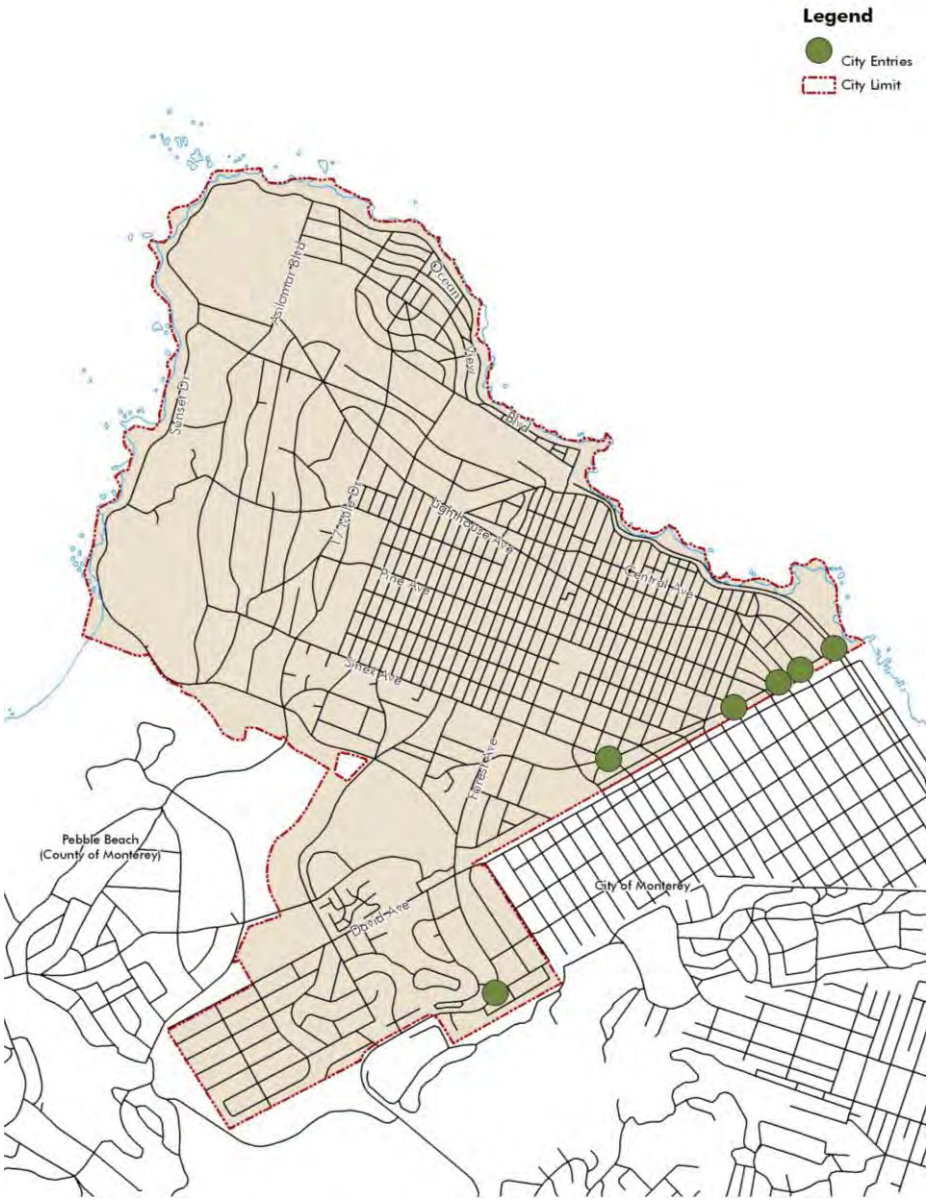
From the City of Monterey at Eardley Street:

- Sinex Avenue
- Pine Avenue
- Lighthouse
- Central Avenue
- Ocean View Blvd.

Some of these entry sites already have monument signs that announce one's entry into the City of Pacific Grove. These signs contain a stone base topped with a wood sign.

Entry Sign at Lighthouse and Eardley Avenues

Figure 3-4: Significant Entryways into Pacific Grove



Under this strategy, these entries would be enhanced with additional landscaping, including street trees along both sides of the streets, and, where right-of-way space is available, within newly constructed medians. The goal will be to create a landscaped row of trees and associated shrubs and low profile plants that envelope the streetscape and create a dramatic visual effect. Close coordination with adjacent residents and commercial business will be an important part of the site design to ensure there is adequate safety and minimal disruption.

Tree species will be identified based on site conditions. Appropriate tree species that produce a conical shape as the preferred form are shown below.

To help visualize what these entries might look like, two intersections are discussed below along with representative illustrations of what the enhanced gateway might look like after the re-design and landscaping.

Recommended Entry Tree Species

Deodar cedar
(*Cedrus deodora*)

Norfolk island pine
(*Araucaria heterophylla*)

Canary island pine
(*Pinus canariensis*)

Coast redwood
(Sequoia sempervirens)

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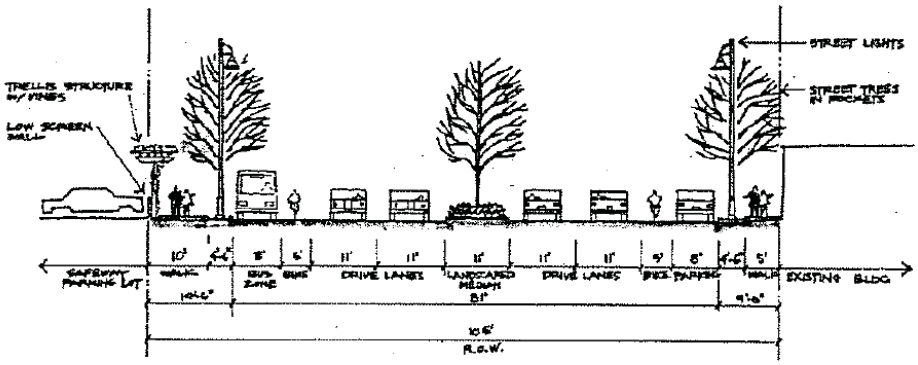
Forest Avenue (Highway 68) at Stuart Street

While the city limit boundary is actually located further south and west near Presidio Boulevard, the curve along Highway 68 (Forest Avenue) just south of Stuart Street provides an excellent opportunity to create a distinctive gateway entry. This area marks a transition point from the Monterey pine forest and adjacent residential areas to commercial land uses with considerably less tree canopy coverage.

The Forest Hill Specific Plan (City of Pacific Grove, 1998) identifies Forest Avenue as a key arterial street. The Specific Plan proposes to improve the function and appearance of the street with continuous street tree plantings on both sides of Forest Avenue; landscaped medians; new sidewalks, curbs, and gutters; a low screening wall in front of large parking lots; new street furnishings; and a community "gateway" feature on Forest Avenue at Stuart Street. The Specific Plan also calls for the re-alignment of Forest Avenue.

The street standards for Forest Avenue near Stuart Street include four 11'-0" travel lanes, one 11'-0" center turn lane or landscaped median, bike lanes, parking lanes, and a 9'-6" sidewalk within a 105' right-of-way (see section drawing below).



As shown in Figure 3-5: Forest Avenue Gateway Illustration, entry improvements on Forest Avenue could include:

- Tree planting along the west side of the tree to screen adjacent commercial use
- Installation of a narrow median with low-canopy trees
- Installation of a new monument entry sign on the triangular island (this parcel is currently owned by Caltrans) and vacated Forest Avenue roadway

Figure 3-5: Proposed Forest Avenue Gateway Illustration

Central Avenue at Eardley Avenue

Central Avenue is an important entry into Pacific Grove from the City of Monterey. It serves as a critical east-west arterial and includes a number of commercial businesses along both sides of the street.

The right-of-way roadway width along Central Avenue is approximately 56 feet wide. Two travel lanes are divided by a ~10 foot painted median, which serves as a turning lane near the intersection.

The parcel on the northeast corner of this intersection is the site of a tourist information center. At present, there is a small wooden informational sign on the northeast corner providing directions to various city amenities and neighborhoods. There is also a large, tall (~ 20 feet) "Tourist Information" sign at the corner of Central and Eardley Avenues, and one small (3' x 6') freestanding sign facing Eardley Avenue. This site could be re-designed and include a new monument entry sign and landscaping.

As shown in Figure 3-6: Central Avenue Gateway Illustration, entry improvements on Central Avenue could include:

- "Bulb-outs" at the corners
- Colored pavement treatment as part of the crosswalk
- "Thumbnail" island at the median
- Additional street trees planted on the sidewalks and in the parking lanes on both sides of the street
- A raised median with large canopy trees in the mid-block section after the end of the turning lane
- Installation of a new monument sign and landscaping on the northwest corner

Example of a crosswalk treatment to improve pedestrian safety.

Figure 3-6: Central Avenue Gateway Illustration

Neighborhood Urban Forestry Strategies

Introduction

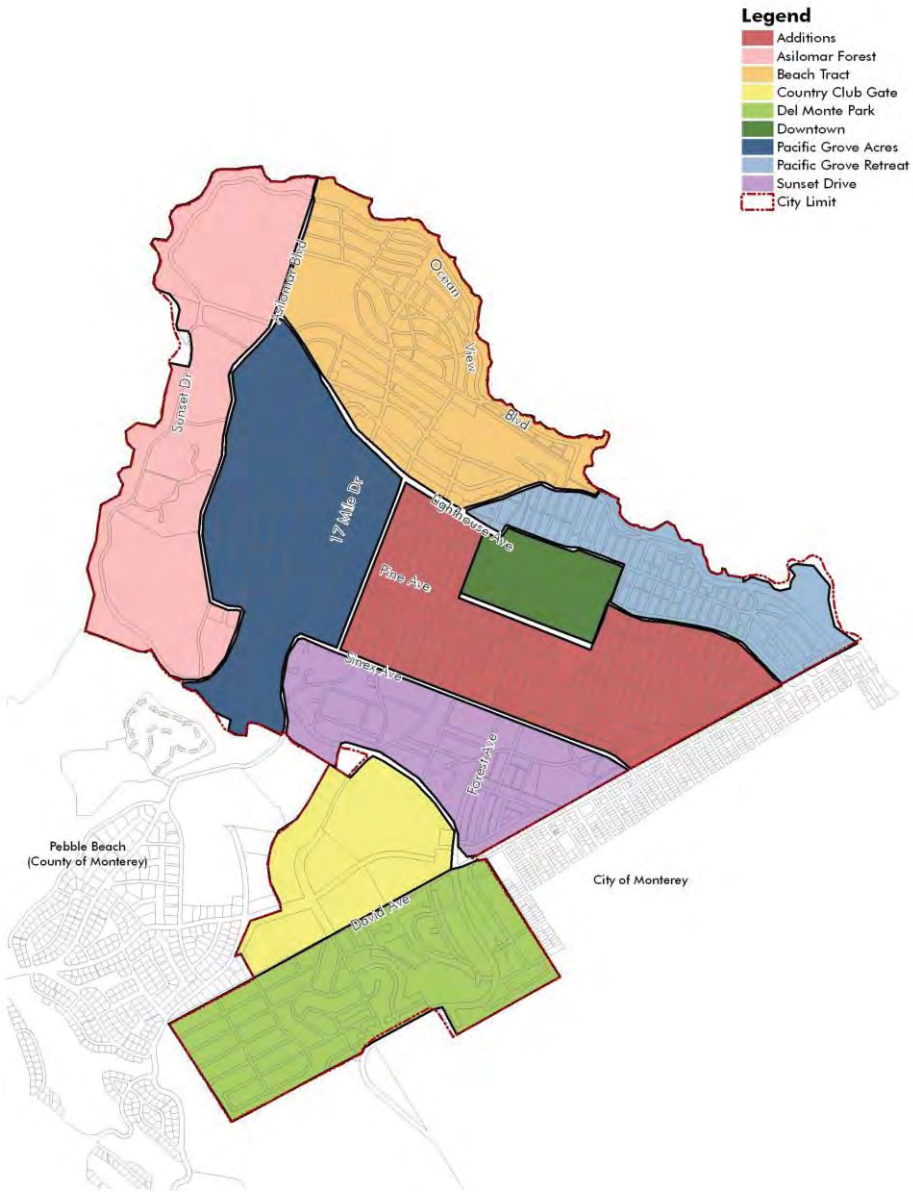
Urban forest management at the neighborhood level is a critical aspect of the UFMP. These "management areas" are used to define specific and focused strategies and actions that are planned for the future at the neighborhood level. There are ten neighborhood-level urban forest management areas which are listed below and shown in Figure 3-7: Pacific Grove Neighborhoods.

- Additions
- Asilomar Forest
- Beach Tract
- Country Club Gate
- Del Monte Park
- Downtown
- Forest Grove
- Pacific Grove Acres
- Pacific Grove Retreat
- Sunset Drive

Country Club Gate Neighborhood - Congress Avenue at David Avenue

Downtown Neighborhood - 17th Street north of Laurel Avenue

Figure 3-7: Pacific Grove Neighborhoods



Note: This map represents consolidated neighborhoods from the city's General Plan Land Use Map.

Additions

The Additions neighborhood derives its name from a series of five subdivision "additions" that were developed subsequent to the initial Pacific Grove Retreat by the Pacific Improvement Company. It is generally bounded by Sinex Avenue to the south, Alder Street/George Washington Park to the west, Lighthouse Avenue to the north, and David Avenue to the east.

Predominant tree species include Flowering plum, Coastal live oak, Red gum eucalyptus. There are approximately 2,300 trees (9% of city total) with a tree density of nine trees per acre (i-Tree, 2011).

Current Conditions & Issues

- Current tree coverage is very low. In many areas, the streetscape consists of impervious surfaces (concrete and asphalt) with no planting strips between sidewalks and roads and generally few trees or other vegetation.
- Small residential lots preclude opportunities for the planting of large canopy tree species
- Pine Avenue is a significant east-west corridor.
- Eardley Avenue is an important north-south arterial and generally marks the eastern boundary with the City of Monterey.
- Opportunity for gateway streetscape improvements at the roundabout at Eardley Avenue/ Ninth Street / Sinex Avenue
- Robert Down Elementary School is an opportunity site for additional tree plantings.

Goals and Actions

- Work with the Pacific Grove Unified School District to investigate opportunities for additional tree planting at appropriate locations at Robert Down Elementary School.
- Work with residents to plant street tree, particularly along Forest, Sinex, Junipero, Pine, and Lighthouse Avenues.
- Pursue grant funding and other opportunities to construct a Green Street along Pine Avenue.
- Encourage the planting of fruit trees.

Looking west on Pine Avenue toward 9th Street.

Asilomar Forest

Asilomar Forest is located along the westerly edge of Pacific Grove. It is bounded by the Monterey Bay and Sunset Drive on the west and Asilomar Boulevard to the east. It includes the 107 acre Asilomar State Beach and Conference Grounds, the back nine holes of the Pacific Grove Golf Links and adjacent Point Pinos Lighthouse, and single family residential units on relatively large lots (greater than 20,000 sf).

The seaside vegetation types include rocky shore, coastal bluffs, marsh and riparian scrub, and active dune and coastal dune scrub. Further inland, the forest is dominated by Monterey pine with some Coast live oak and planted Monterey cypress intermixed.

There are approximately 4,700 trees (9% of city total) with a tree density of 17 trees per acre (i-Tree, 2011).

Current Conditions

- Presence of Monterey pine pitch cancer has contributed to significant tree loss in recent years.
- The Asilomar State Beach and Conference Grounds have been aggressively replanting disease-resistant Monterey pines and removing invasive species within their property.
- Coastal influences including poor soils and wind limit the ability for extensive reforestation opportunities.
- Residential development has contributed to a loss of tree canopy coverage over the past 25 + years.

Goals and Actions

- Continue to work cooperatively with the Asilomar State Beach and Conference Grounds regarding their replanting efforts as identified in the Asilomar Forest Management Plan (2011).
- Ensure that future development proposals diligently protect the area's unique and sensitive coastal habitat.

- Educate and work proactively with land owners to minimize the adverse impacts associated with Pitch Canker disease on Monterey pines.
- Work with property owners to plant disease-resistant Monterey pine seedlings as part of the city-wide Urban Forest Restoration Program (PGreen).
- Seek opportunities to plant trees, appropriately sited, on the Pacific Grove Golf Links.

Beach Tracts

The Beach Tracts neighborhood is located in the northwest area of Pacific Grove and is bounded by the Monterey Bay and Ocean Boulevard to the north, Asilomar Boulevard to the west, Lighthouse Avenue to the south and Pacific Avenue to the east.

Public parks and open space include the front nine holes of the Pacific Grove Golf Links, a number of public parks including; Lovers Point Park, Pacific Grove Marine Gardens, Esplanade, and Perkins Parks.

Land uses include a number of hotels and motels, single family and multi-family residential, and the Monarch Pines mobile home park. Lot sizes average 5,000 to 10,000 sf and there are a number of lots up to 15,000 sf.

Urban forest conditions consists of a variety of native (Monterey pines, Coastal live oak and Monterey cypress) and ornamental tree species. There are approximately 1,050 trees (4% of city total) with a tree density of four trees per acre (i-Tree, 2011).

Current Conditions & Issues

- Loss of trees that have not been replaced on the front nine of Pacific Grove Golf Links.
- Preservation of coastal views from residential neighborhoods and presence of relatively small lots may preclude opportunities for the planting of large canopy tree species.
- Coastal influences including wind and poor soils conditions require special tree replanting considerations.

Goals and Actions

- Work with neighborhood residents and the Pacific Grove Golf Links to proactively plant new trees in appropriately sited locations as part of the Urban Forest Restoration Program (PGreen).
- Work with neighborhood residents and businesses to replant trees along Lighthouse Avenue to create a Green Street to improve neighborhood linkages and create a stronger pedestrian/bicycle link to the downtown.
- Identify opportunities to plant new Monterey cypress trees at Lovers Point Park to replace older existing trees over time.
- Evaluate view protection issues.

Country Club Gate

Country Club Gate is located in south Pacific Grove and is bounded by David Avenue to the south and Sunset Drive to the north. The western boundary extends through Rip Van Winkle Park. Land uses include a significant commercial area (Country Club Gate Shopping Center), Pacific Grove High School, Pacific Grove Elementary, and a variety of single-family and multi-family residential.

Urban forest conditions consists largely of native trees including Monterey pines, Coastal live oak and Monterey cypress. Combined with the Del Monte Park neighborhood (as this is how the i-Tree analysis was conducted), there are approximately 8,800 trees (34% of city total) with a tree density of 24 trees per acre.

Current Conditions & Issues

- Rip Van Winkle Park is a densely forested open space area and serves as an important informal recreation amenity for passive recreation activities including hiking and dog-walking. It serves as an important wildlife habitat area but also may have high risk tree.
- There are significant stands of Monterey pines which are subject to Pitch Canker disease and tree risks to residents and businesses.
- Significant development associated with commercial businesses and schools has resulted in the loss of tree canopy coverage.
- Portions of the neighborhood are susceptible to fire hazards.

Goals and Actions

- Pursue an aggressive program to plant Monterey pine seedlings in Rip Van Winkle Park as part of the city's Urban Forest Restoration Program (PGreen).
- Conduct an inventory of trees in public property to assess their potential for risk.
- Work with the Pacific Grove High School and Pacific Grove Elementary School to identify opportunity sites to replant native trees and to coordinate an education and volunteer outreach program supporting the enhancement of the urban forest.
- Encourage replanting and tree maintenance as part of any proposed commercial development.

Del Monte Park

Del Monte Park is bounded by David Avenue to the north, Pebble Beach to the west, unincorporated Monterey County to the south and the City of Monterey to the north. Highway 68 extends through this neighborhood and is the major southern entry to Pacific Grove.

This neighborhood is predominantly single family and multi-family residential. Lot sizes are generally smaller to the south (less than 5,000 sf) and larger to the north (5,000 to 10,000 sf).

The urban forest in this neighborhood is dominated by large stands of Monterey pines and Coastal live oaks. Combined with the Del Monte Park neighborhood (as this is how the i-Tree analysis was conducted), there are approximately 8,800 trees (34% of city total) with a tree density of 24 trees per acre.

Current Conditions & Issues

- Given the significant topography and the fact that the area is susceptible to high winds, there are considerable tree risks, particularly from Monterey pines which are aging and have been affected by Pitch Canker disease.
- Tree replacement requirements can result in an undue and onerous responsibility on private land owners.
- The relatively high tree canopy coverage consist of larger aging trees which are reaching the end of their life.
- There is a high rate of damage to houses and infrastructure, particularly from Monterey pines.
- Portions of the neighborhood are susceptible to fire hazards.
- Carefully consider visibility of businesses and signs when adding new trees.
- Carefully consider traffic and pedestrian safety when adding new trees.
- Balance the need for trees with the need for on-street parking.

Goals and Actions

- Create more a more cohesive and identifiable downtown streetscape that preserves existing healthy trees and on-street parking while encouraging the addition of appropriate new trees.
- Work cooperatively with private land owners to help resolve tree risks and infrastructure damage issues.
- Carefully consider site conditions and potential long-term effects on land owners when requiring tree replacement due to development or tree removal permitting.
- Work proactively with property owners to reduce fuel loads and minimize fire hazards.
- Work with private property owners to ensure the right tree is located in the right place.

- Work with neighborhood organizations to identify a suitable tree replanting program that carefully considers site conditions and suitable species selection.
- Create a new entry on Forest Avenue complete with significant tree planting and new monument entry sign.

Downtown

The Downtown neighborhood is the commercial center of Pacific Grove with Lighthouse Avenue extending through its center. It is bounded by Central Avenue to the north, 13th Street to the east, Pine Avenue to the south, and Cypress Avenue to the west.

Land uses are largely commercial business (retail, restaurants, hotels, etc.) and single-family residential. City Hall, and the Pacific Grove Police and Fire Departments are located in the Downtown neighborhood. Lot sizes are generally small (less than 5,000 sf) except in the downtown commercial center.

Predominant tree species include Monterey cypress and Christmasberry. There are approximately 300 trees (1% of city total) with a tree density of five trees per acre.

Current Conditions & Issues

- Lot sizes are relatively small minimizing opportunities for large canopy trees
- There is a significant amount of impervious surfaces due to dense development, surface parking lots and roadways.

Goals and Actions

- Work with local businesses and land owners to create a Green Street on Pine and Lighthouse Avenues.
- Seek opportunities to "green" city hall, the police and fire departments and public parking lots as initial pilot sites as part of the Urban Forest Restoration Program (PGreen) and thereby set an example as "model" community leaders in promoting the urban forest strategies associated with this UFMP including tree replanting and stormwater management.
- Work with local business owners and residents to create Green Streets along Lighthouse, Forest, and Central Avenues.

Pacific Grove Acres

The Pacific Grove Acres neighborhood was developed in the mid 1900s and represents a transition from small lot to larger lot development. It consists largely of single-family and multi-family residential and a number of hotels and motels. It includes significant park and open space features including George Washington Park, the Union Pacific Railroad ROW, and the Monarch Grove Sanctuary.

Outside of parks and open space, its neighborhoods also represent the highest density of tree canopy. Residential lot sizes in this neighborhood are larger, averaging 15,000 to 20,000 sf, and a number of lots are even larger.

Predominant tree species include Monterey pine, Coastal live oak, and Monterey cypress. There are approximately 3,200 trees (12% of city total) with a tree density of 13 trees per acre.

Current Conditions & Issues

- Western boundary is influenced by coastal marine conditions including winds and nutrient-poor soils.
- Potentially high risk tree conditions, particularly in George Washington Park.
- City does not own the Union Pacific Railroad ROW.
- Loss of habitat and management of the Monarch Grove Sanctuary.

Goals and Actions

- Work proactively with the community to further the goals and policies of the Pacific Grove Monarch Grove Sanctuary Management Plan (2011).
- Encourage the propagation of trees that provide wind breaks to the Monarch Grove Sanctuary with surrounding private land owners.
- Seek opportunities to acquire and/or manage the Union Pacific ROW to further the urban forest management strategies of this UFMP.
- Inventory trees within George Washington Park and establish a program to minimize tree risks.
- Minimize potential impacts associated with fire hazards by incorporating fuel management practices (as defined by CalFire)

CITY OF PACIFIC GROVE

Pacific Grove Retreat

Pacific Grove Retreat is part of the original Pacific Improvement Company subdivision plan for Pacific Grove and exemplifies the character and charm of Pacific Grove. Single-family residents and hotel accommodations (B&Bs) are the predominate land use. However, it also includes a number of important parks including Caledonia, Jewel, Greenwood, (and along the coastline) Berwick, and Andy Jacobson Parks. It is also the location the Hopkins Marina Station of Stanford University.

Predominant tree species include Monterey pine, Monterey cypress and California buckeye. There are approximately 2,550 trees (10% of city total) with a tree density of 19 trees per acre.

Current Conditions & Issues

- In many areas, the streetscape consists of impervious surfaces (concrete and asphalt) with no planting strips between sidewalks and roads and generally few trees or other vegetation.
- Small residential lots preclude opportunities for the planting of large canopy tree species.
- Existing parks represent a good opportunity for tree planting and stormwater management initiatives.
- Carefully consider traffic and pedestrian safety when adding new trees.
- Carefully consider viewshed protection when adding new trees.

Goals and Actions

- Actively pursue opportunities to acquire funding to mitigate stormwater impact infiltration projects to minimize water quality impacts to the Monterey Bay.
- Seek opportunities to plant additional trees and provide stormwater management in the various public parks.
- Work with local business owners and residents to create Green Streets along Ocean View Boulevard.

Sunset Drive

Sunset Drive is located in the south-central portion of the city and is in an area with the highest topography and spacious views of the city and Monterey Bay. It is bound by Sinex Avenue to the north, Eardley Avenue to the east, Sunset Drive (Highway 68) to the south, and 17 Mile Drive to the west.

Land uses are mostly single-family residential with some multi-family residential. Pacific Grove Middle School is also located in this neighborhood as well as the CalAm corporate yard. Lot sizes generally average between 5,000 to 10,000 sf.

Predominant tree species include Coastal live oak and Monterey pine. There are approximately 3,000 trees (11% of city total) with a tree density of 18 trees per acre.

Current Conditions & Issues

- The CalAm corporate yard represents a potentially significant opportunity site for new trees.
- Existing tree canopy coverage is fairly good, particularly given the relatively small lot sized.

Goals and Actions

- Maintain current levels of trees and replace aging and dead trees.
- Proactively manage the effects of pitch canker disease.
- Seek to expand the Monterey pine tree population.

4 MANAGEMENT PLAN

In this Chapter:

- City-wide Tree Canopy Cover Target
- Management Plan

City-wide Tree Canopy Cover Target

A good measure of the health and value of an urban forest is the percentage of land within the city that has tree canopy cover. To measure success in canopy cover enhancement, a canopy cover target must first be established. The target will help the City of Pacific Grove unite the community around a clear objective. It will also help to plan implementation steps that consider planting opportunities, planting limitations, and other priorities specific to individual land-use types. With canopy cover target, we can prioritize available funding to areas with the greatest potential for new trees or the greatest lack of trees. Finally, having canopy cover goals allows us to target new tree plantings to maximize the ecological services potential (e.g. stormwater mitigation, carbon sequestration) across the city.

In establishing a tree canopy cover target for Pacific Grove, a number of factors were considered. Firstly, it was important to establish a target that was aggressive, but realistically achievable. Secondly, a previous data point was thought to be useful to provide a point of reference that could be verified. Thirdly, it was thought that a point in time after the city was largely built-out was more realistic as land development has had a significant and largely now irretractable effect on the urban forest (as described in Chapter 1 – Pacific Grove's Urban Forestry History).

As a point of reference, American Forests, a leading urban forest management, conservation, and research group measured tree cover in 440 communities across the United States. Their research recommends that a canopy cover target of 40% would be appropriate for Pacific Grove and other cities in the western United States.

While this goal is plausible, in reality, it is very challenging and may not be realistically achievable. As of 2004, the national average of tree coverage in major U.S. cities was 27.1%. San Francisco's tree coverage is 12.0% and Seattle's is 25% (Watt & Gunther, 2010) (see Table 4-1: Tree Canopy Cover Percent in Selected Cities).

Table 4-1: Tree Canopy Cover Percent in Selected Cities

City	Tree Cover (%)
Atlanta, GA	36.7
Austin, TX	34.0
Boston, MA	29.0
National Average	*27.1*
Seattle, WA	25.0
Pacific Grove, CA	**19.0**
Los Angeles, CA	18.0
San Francisco, CA	12.0

Source: Watt & Gunther, 2010.

Within this context, 25 year city-wide canopy cover target has been established to increase existing canopy cover by two-fifths to a tree canopy cover of 33%. This number represents the estimated amount of tree canopy coverage that existed in 1986, based on an analysis of satellite data as described by Keady & Williams (2011).

Under current conditions, this increase in tree canopy would require the addition of approximately 20,000 trees. However, accounting for a 10% mortality rate of new plantings plus a 10% reduction of the existing canopy (due to the loss of mature trees, disease, etc.) over the next 25 years, an estimated 24,000 new trees will be required to be planted in Pacific Grove. This equates to the planting of nearly 1,000 new trees per year.

It is important to note that this target is just that, a high-level target that establishes a benchmark for urban forestry planning, budgeting, and measurement of progress over the next 25 years. It is anticipated that this target will be reviewed and possibly revised as part of future updates to this UFMP (e.g. every five or ten years).

Management Plan

Table 4-2: Guiding Principles and Objectives contains objectives that are tied to the guiding principles of the UFMP. These objectives are ongoing and should be used to guide incremental decision making. The heart of the management plan is a five-year strategy for implementation, with a series of implementing actions, responsible parties, time frame and cost estimates. Each strategy contains one or more implementing actions, identifies the parties responsible for implementation, sets a target year for implementation, and lastly an estimate of costs to be used during the annual budgeting process

To achieve the city-wide tree canopy target of planting at least 24,000 trees over the next 25 years, the City will need to consider innovative strategies to plant new trees, particularly in the public right-of-way. To help meet this goal, a number of both city-wide and neighborhood urban forestry long term strategies have been identified which will help the city reach its target and creates a vision that can be championed by the community.

The long term strategies will require implementation over time. This Urban Forest Management Plan establishes a path for success in both pursuing future funding opportunities, such as grants, as well as committing to a five-year management plan (see Table 4-3: Five-Year Management Plan) that will be periodically review to implement the longer-term strategies envisioned in this document.

Other related Management Plans, such as the Monarch Sanctuary Habitat Management Plan, are incorporated here by reference.

Table 4-2: Guiding Principles and Objectives

Tree Resource		
	Guiding Principle	**Objectives**
A	Preserve and enhance the visual and aesthetic uniqueness of Pacific Grove and of its neighborhoods.	1. Increase the tree canopy in Pacific Grove from 19% to 33% in the next 25 years. 2. Provide greater protection to native trees and heritage trees. 3. Expand plantings of large scale trees surrounding the Monarch Butterfly Sanctuary to recreate buffering structures (i.e. the Pacific Grove Acres and Beach Tract neighborhoods). 4. Encourage and promote the planting of fruit trees, particularly in neighborhoods that have small lot sizes (e.g. Pacific Grove Retreat and the Additions). 5. Plant appropriate trees on key pedestrian corridors and at community gateways/entries. 6. Create Green Streets throughout the city to create walkable pathways within neighborhoods and to commercial centers. 7. Ensure that street design and redesign projects include trees.
B	Protect against deterioration of the urban forest over time by establishing and maintaining a diverse mix of tree age and species.	1. Encourage a variety of tree species to be planted throughout Pacific Grove. 2. Use current and future modeling to determine resources required to adequately preserve, restore, and enhance the city's urban forest. 3. Maintain and replant additional Monterey cypress on public lands in anticipation of decline of existing trees, and define and implement a monitoring program. 4. Maintain and enhance forest systems that support the Monarch Grove Sanctuary.
C	Manage tree resources and minimize costs by ensuring the right tree is in the right place.	1. Proactively manage all trees on public property to reduce tree risks. 2. Conduct an annual inventory of street trees and tree in parks and public open space to manage tree risks and tracks community "due standard of

Tree Resource		
	Guiding Principle	Objectives
		care" performance. 3. Maintain existing street trees to ensure they remain healthy and contribute to the environmental and aesthetics benefits of the urban forest. 4. Allow the removal of trees on public right-of-ways if mitigating pedestrian and/or vehicle risks or infrastructure damage only when other cost-effective strategies are not viable. 5. Identify opportunity sites on public property that can accommodate new tree planting. 6. Require the implementation of CalFire standards for defensible space in areas designated as Very High Fire Hazard Severity Zones.
D	Maximize the ecological and environmental benefits of the urban forest, including for wildlife.	1. Protect trees and urban forest ecosystems to maintain and enhance plant and animal habitats throughout the city. 2. Work cooperatively with the Asilomar State Park to protect and enhance the environmental attributes of the Asilomar Dunes. 3. Balance the needs of habitat protection with risk management practices. 4. Manage the urban forest to encourage natural regeneration, particularly for Monterey pines. a) Underneath the forest canopy, consciously maintain patches of dense, low cover periodically for wildlife habitat without creating fuel ladders or other hazards. b) Reduce the cover of non-native annual grasses and other invasive through site preparation for tree regeneration and by active invasive eradication work. c) Collect native seeds to plant in forest restoration/replanting areas. Utilize pitch canker resistant seedlings when planting Monterey pines. Utilize species of known low palatability for deer. d) Utilize open-pollinated sourced seedlings wherever possible to maintain

Tree Resource		
	Guiding Principle	Objectives
		the broadest possible genetic base of tree species. 5. Maintain and enhance control and direction of pedestrian traffic away from undeveloped and sensitive habitats. 6. Prohibit the removal or pruning of trees during the nesting season for protected birds consistent with state and federal regulations.

Management Resource		
	Guiding Principle	**Objective**
E	Balance private property rights with the needs of the overall community.	1. Ensure equitable treatment for all private property owners and residents when defining protocols and standards that equalize benefits, responsibilities, and risks. 2. Allow for the removal of healthy trees on public and private properties with in-lieu fees to replant in designated "high priority" public properties using assessment criteria (as defined in Chapter 5) and where there is reasonable cause for removal. 3. Increase developers', builders', and private property owners' awareness about the value of trees and provide incentives for tree retention and management during the development process. 4. Preserve and protect existing trees, and encourage new tree planting, by improving management of trees on private property. 5. Encourage positive solutions to tree planting over punitive measures. 6. Discourage the planting of trees that can cause detrimental health effects, particularly allergies.
F	Apply the same, or more stringent, standards to the City as to private property owners.	1. Develop and implement urban forest management tools. 2. Conduct all city tree management practices in accordance with American National Standards Institute (ANSI) A-300 standards and International Society of Arboriculture (ISA) Best Management Practices or equivalent standards and require compliance by private industry through city license requirements. 3. Consistently follow up tree planting projects with maintenance reminders, training opportunities, and stewardship activities. 4. Ensure adequate funding for the Urban Forestry Department and other tree programs are identified in the city's annual budget. 5. Facilitate interdepartmental communications and cooperation regarding urban forestry management practices.

Management Resource		
	Guiding Principle	**Objective**
		6. Maintain public trees on a regular, more frequent cycle per industry standards for health and longevity.
G	Integrate urban forestry practices with stormwater management to reduce and improve the quality of urban runoff to the Monterey Bay and Pacific Grove Area of Special Biological Significance.	1. Improve stormwater quality and minimize runoff into the Monterey Bay by incorporate stormwater best management practices (BMPs) to increase infiltration potential, evapotranspiration, and surface storage, as well as increase travel time to reduce rapid concentration of stormwater runoff. 2. Maximize the use of trees and other "green" methods into the design of capital projects for streets, sidewalks, storm drains, sewer upgrades and city facility retrofits. 3. Plant tree species that maximize interception, filtration and capture where feasible and practical. 4. Educate and encourage private property owners to utilize LID practices and BMPs methods whenever possible.

Community Resource		
	Guiding Principle	**Objective**
H	Foster community support for, and stewardship of, the urban forest.	1. Enhance public awareness of the urban forest as a community resource. 2. Continually engage community stakeholders to identify opportunities and barriers for tree planting and preservation on private property. 3. Identify and develop funding sources to support and enhance the urban forest of Pacific Grove. 4. Engage the community in establishment of community-based volunteer organizations and active stewardship of the urban forest. 5. Establish and market Pacific Grove tree resources as a unique brand within the community. 6. Promote citizens-government-business partnerships.

Table 4-3: Five-Year Management Plan

#	Implementing Actions	Lead Staff or Lead Responsibility in Coordination with Other Groups	Target Year	Cost Estimate *based on staff time at avg rate of $65/hr
1.	Create an inventory of all trees growing on public property, including tree type, health/structure, risk and maintenance priority levels, to be incorporated into the development of an Urban Forest Maintenance and Monitoring program for city property. (Note: Funding applied for in Urban Greening Grant, September 2011).	City Arborist, PWD, consultant support	Year 1	$90,000
2.	Develop and fund an Urban Forestry Division to implement the Maintenance and Monitoring Program of trees on city property.			
a.	Maintain and fund a full time City Arborist/Urban Forester position.	City Arborist	Year 1 and ongoing	$80,000/year
b.	Staff or equip the Division, or task the City Arborist/Urban Forester with writing specifications and contracting necessary services for implementation of the Maintenance and Monitoring Program.	Forestry Division	Year 1 and ongoing	$90,000/year
c.	Remove high priority public trees that exceed community risk level tolerance thresholds.	Forestry Division	Year 1 and ongoing	$75,000/year
3.	Define and initiate an Urban Forest Maintenance and Monitoring and Restoration Program, which includes a Tree Risk Assessment (TRA), based on the inventory of trees on city property and in the public right of way.			
a.	Implement a system to require that all tree care and landscape companies/individuals doing tree planting, management/maintenance activities on city property are Qualified Professionals.	PWD & Finance	Year 1	$7,500
b.	Purchase and utilize software for tree inventory data base, permit tracking, maintenance schedules, and replanting documentation.	Public Works Superintendent	Year 1	$35,000

#	Implementing Actions	Lead Staff or Lead Responsibility in Coordination with Other Groups	Target Year	Cost Estimate *based on staff time at avg rate of $65/hr
c.	Develop a system to document time spent on tree maintenance.	City Arborist	Year 1	$5,000
d.	Determine the desired tree maintenance cycle appropriate for the type of land use and environmental conditions of each neighborhood.	City Arborist & CDD	Year 2	$7,500
e.	Develop performance metrics for city tree maintenance operations.	City Arborist	Year 2	$5,000
f.	Link tree inventory data with work record systems and GIS.	City Arborist	Year 2	$7,500
g.	Review building and development standards, and revise procedures and regulations (e.g. zoning) if necessary, for consistency with the UFMP.	Chief Planner & Environmental Programs	Year 1	$7,500
h.	Prepare and implement a Flammable Fuel Reduction Program for public forested park lands and open space.	PWD & Fire Department	TBD	TBD
4.	Develop a Public Tree Planting Program.			
a.	Identify public right-of-way and open space areas where space is available for and conditions to support public tree replanting appropriate to the neighborhood and streetscape, placing priority on key habitat areas, parks and corridors suitable for reforestation of native trees, as well as entryways into the city.	City Arborist, consultant support	Year 1	$10,000
b.	Apply for CalFire grant funding for replanting (concept grant for planting of 400 trees submitted October, 2011) and search for additional grant opportunities.	Environmental Programs	Year 1 and ongoing	$7,500
c.	Pursue additional funding opportunities to design and develop the Green Streets and Gateways and Entries long term strategies to use trees to enhance the visual character of the streetscape and entrances into the City, improve key pedestrian corridors, and implement storm water Best Management Practices (BMPs).	Environmental Programs	Year 2 and ongoing	$7,500

#	Implementing Actions	Lead Staff or Lead Responsibility in Coordination with Other Groups	Target Year	Cost Estimate *based on staff time at avg rate of $65/hr
d.	Establish and fund a city-owned nursery or partner with other agencies to support an Urban Forest Restoration Program.	Forestry Division, PWD, non-profit partners	Year 3	TBD, grants
e.	Work with area businesses and residents to select, plant and maintain 60 to 72-inch boxed trees at key gateways/entries identified in this UFMP.	City Arborist, PWD, Chamber, non-profit partners	Year 4	TBD
5.	Work with the Pacific Grove community to initiate the formation of PGreen, a non-profit entity, as a long term strategy to improve collaboration between the City, residents, and business community.	City Council, Natural Resources Commission, City Manager, PWD	Year 1 and ongoing	
a.	Develop a network of PGreen community volunteers to participate with inventories and assessments as part of future tree management activities as well as neighborhood planning efforts.	Urban Forestry Division, Environmental Programs, non-profit partner	Year 1-3	$20,000
b.	Work collaboratively with the Pacific Grove Unified School District to establish an urban forest education program for students.	Environmental Programs and PGUSD	Year 2 and ongoing	$7,500
c.	Create a “Pay for Planting” program where property owners who want to plant large trees on their property are paid a fee from in lieu funds for the purchase, planting and maintenance of a tree that will benefit the community.	PWD & Finance Department	Year 2	$10,000
d.	Work with the City Commissions, the Heritage Society of Pacific Grove and the Chamber of Commerce to create a self-guided tour and brochure of Pacific Grove that highlights the environmental, economic, and social benefits of the urban forest in conjunction with the City's Historic Resources.	Natural Resources Commission & Historic Resources Committee, Heritage Society, Chamber	Year 2	$10,000

#	Implementing Actions	Lead Staff or Lead Responsibility in Coordination with Other Groups	Target Year	Cost Estimate *based on staff time at avg rate of $65/hr
e.	Institute a program to acknowledge and publicize contributions to urban forestry by citizens, businesses, institutions, and neighborhood group organizations.	Non-Profit Partner, City Council	Year 3	$2,500
f.	Identify opportunities to incorporate information regarding the benefits of the urban forest into marketing materials to promote tourism and enhance community values and stewardship of/for tree resources in Pacific Grove.	Non-profit partner, Chamber, DBID, HID	Year 3	Estimated: $10,000
g.	Work collaboratively with the Pacific Grove Downtown Business Improvement District, the Pacific Grove Chamber of Commerce, and others to improve public street trees and within parking areas in downtown Pacific Grove.	Chamber, DBID	Years 3-5	TBD, grants, donations
6.	Improve public outreach and informational materials.			
a.	Coordinate with utility companies such as PG&E to develop a tree trimming program consistent with the goals and practice standards as described this UFMP.	City Arborist, Public Works Superintendent	Year 1 and ongoing	$5,000/year
b.	Update the City of Pacific Grove's *Landscape Trees for Pacific Grove -- A Guide to Selection, Planting and Care*, including identifying preferred tree species as well as trees that should be forbidden or discouraged, increasing species selection choices including fruit trees, and reflecting the variety of tree species and appropriate planting location consistent with goals and standards as defined in the UFMP.	Environmental Programs Mgr, consultant support	Year 1	$15,000
c.	Create informational materials to increase developers', builders', and private property owners' awareness about the value of trees, tree maintenance, protection during development and management, including printing of materials.	Environmental Programs Manager	Years 1-2	$15,000
d.	Update the city's web site to include a section specifically focused on urban forest management, permitting, and	TBD	Year 1	$7,500

#	Implementing Actions	Lead Staff or Lead Responsibility in Coordination with Other Groups	Target Year	Cost Estimate *based on staff time at avg rate of $65/hr
	community outreach.			
7.	Develop a program to integrate urban forestry programs with storm water management.			
a.	Incorporate the urban forest in watershed modeling and management approaches that include green retrofits and tree plantings as storm water management tools consistent with low impact development best management practices.	Environmental Programs, Forestry Division	Year 2	Grants
b.	Identify the most effective placement and planting site requirements to maximize trees as storm water capture and filtration systems for protection of water quality in the Monterey Bay National Marine Sanctuary, the Pacific Grove Area of Special Biological Significance, and Marine Protected Areas.	Environmental Programs, Forestry Division	Year 2	Grants
c.	Where feasible, seek methods to reduce the impervious surface coverage in the right-of-way in the Pacific Grove Retreat, Additions, and Downtown neighborhoods to create room for trees, if feasible and consistent with the criteria in the Urban Forestry Standards.	Environmental Programs, Forestry Division, PWD	Year 3 and ongoing	Capital Projects, Grants

5 URBAN FORESTRY STANDARDS

In this Chapter:

- Introduction
- Pacific Grove's Protected Trees
- Removal, Replacement and Planting of Trees
- Tree Protection and Preservation During Development
- Management Framework
- Growth & Development of the Pacific Grove Urban Forest
- Tree Reports

5.1. Introduction

The following Urban Forestry Standards (standards) are the city's primary regulatory tool to provide for orderly protection of specified trees, to promote the health, safety, welfare, and quality of life for the residents of the city, to protect property values and to avoid significant negative impacts on adjacent properties. By ensuring preservation and protection through the following standards of care, these resources will remain significant contributions to the landscape, streets, and parks, and will continue to help define the unique character of Pacific Grove.

These Urban Forestry Standards establish specific technical standards and specifications necessary to implement the city's tree ordinance (Municipal Code Title 12, see Appendix A), and to achieve the city's tree preservation goals.[2] These goals are intended to provide consistent care and serve as benchmark indicators to measure achievement in the following areas:

- Ensure and promote preservation and restoration of the existing tree canopy cover within the city limits.
- Provide standards of maintenance required for protected and city-owned trees.
- Provide a standardized content for evidence based tree reports required by the city.
- Establish criteria for determining when tree risk exceeds community tolerance thresholds and management strategies need to be implemented in order to preserve public health, safety and welfare.
- Provide standards for the replacement of trees that are permitted to be removed.
- Increase the survivability of trees during and after construction events by providing protection standards and best management practices.
- Enforcement of these standards and associated regulations by authorized City staff and public safety personnel.

Comment [SH21]: Not consensus that this term is needed

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5.1.1 Required Practices

All of the standards described in this chapter are required practices unless noted otherwise (e.g. "recommended"). These required practices are to be

[2] Sections of this chapter were inspired by the City of Palo Alto's *Tree Technical Manual* (2001) for which the City of Pacific Grove is greatly appreciative. Other sources include the city's previous Tree Preservation and Protection ordinance (Chapter 12.16 of the Pacific Grove Municipal Code), professional input, and current best management practices.

implemented by the property owner, project applicant, contractor or designee - and are the minimum standards by which the care of a Protected Tree is to be administered. These Required Practices are considered reasonable measures that are consistent with best management practices in the tree care industry and are intended to promote healthy, structurally sound trees.

In all such cases, the Community Development Department, Public Works or City Arborist, if justified by field conditions such as conflict with utilities or a public nuisance, has the discretion to modify or add to any condition, practice or standard mentioned within the standards with appropriate public notice.

Comment [SH22]: Not consensus that notice should be required in all circumstances

5.1.2 Recommended Practices

The Recommended Practices identified in this chapter are not mandatory. It should be noted, however, that a recommended practice may be required if it is so specified within the 'conditions of approval' for a development project or mitigation for injury or disturbance.

In all cases, the Director of Community Development, Public Works or City Arborist, if justified by changing field conditions such as conflict with utilities, has the discretion to modify, re-designate or add to any condition, practice or Standard mentioned within the standards.

5.1.3 Definitions

Certain terms that are unique to the arboricultural or construction industry are defined to provide a uniform understanding of the terms and concepts used and mentioned in this document. The following ~~D~~definitions are also ~~described~~ included in Appendix A --Pacific Grove Tree Ordinance, below.

Comment [SH23]: Include in both places?

"Building Coverage" has the meaning assigned in Chapter 23.08 (Zoning—Definitions).

"Community Tree Program Fund" means a dedicated city fund comprising donations, moneys appropriated by the city council, fines, Tree damage assessments, and in-lieu fees collected under the authority of this title and established by the city council in the city's master fee schedule. Community Tree Program Fund expenditures shall be used solely for the planting and maintenance of Street Trees and Trees on city property.

"Development" has the meaning assigned in Chapter 23.08 (Zoning—Definitions).

"Discretionary development approval" has the meaning assigned in Chapter 23.08 (Zoning—Definitions).

"Feasible" means capable of being implemented, taking into account such factors as safety of persons and property, the environment, aesthetics, and economic considerations.

"Hedge" means and includes any plant material, shrub or plant, when planted in a dense, continuous line or area, as to form a thicket or barrier.

"High-Risk Tree" means an imminent hazard or threat to the safety of persons or property.

"Invasive Tree" means a Tree that is not Native to the Monterey Peninsula and that has the ability to thrive and spread aggressively on the Peninsula. They tend to disrupt the natural habitat, squeeze out native plants and animals, and reduce biodiversity.

"Lower Canopy Tree" means a tree of a species that tends to be less than 40 feet tall at maturity. Lower Canopy Trees tend to have leaves and needles larger and softer than those of Upper Canopy Trees, better able to catch the available light and with less need to defend against the buffeting of the wind and rain. Most Lower Canopy Trees, including the ornamentals and fruit trees, are not native to the Monterey peninsula.

"Native Tree" means a species that was common on the Monterey Peninsula prior to the arrival of Europeans. These Trees, such as the Monterey pine and Monterey cypress, co-evolved over a very long period with other plants, animals, fungi, and microbes, to form the complex network of mutually reliant relationships found in the Peninsula's native ecosystems.

"Parks" means and includes all Parks to which names have been given by action of the city council.

"Person" and "Persons" means and includes any all individuals, partnerships, firms, associations, corporations, governmental agencies, and other legal entities, and the agents, employees, and representatives thereof.

"Plant" means and includes all other plant material, non-woody, annual, or perennial in nature, not necessarily hardy.

"Protected Tree" means those Trees as defined in Section 12.16.100 and described in more detail in the Urban Forestry Standards.

"Prune" or "Pruning" means to Remove dead growth, tip live branches, thin live foliage, or a combination. Pruning does not include topping.

"Prune Substantially" or "Substantial Pruning" shall apply to both above-surface and underground cutting or Removal. With reference to branches, either term shall mean cutting or Removal of more than 25 percent of the live branches of the entire Tree within a 12-month period; or Removal of foliage so as to cause the unbalancing of a Tree; and/or cutting or Removal of any live limb with a diameter of 6 inches or greater or a circumference of 19 inches or greater at any point on such limb. With reference to roots, either term shall mean cutting or Removal of any root 4 inches or greater in diameter.

"Public property" means and includes all grounds, other than Streets or Parks, owned by or leased to and under the control of the city of Pacific Grove or other governmental agency.

"Public Trees" means all Street Trees and all other Trees located on Public Property.

"Qualified Professional" means a Person who possesses the credentials, degrees, or qualifications that support the resource-specific skill required to adequately prepare and submit Tree Reports, including:

- A Person designated by the International Society of Arboriculture as a: Certified Arborist; Municipal Specialist; Board Certified Master Arborist; or Certified Tree Risk Assessor.
- A Person designated by the American Society of Consulting Arborists as a: Registered Consulting Arborist.
- A degreed Forest Ecologist.

"Remove" or "Removal" means any of the following:

- Complete Removal, such as cutting to the ground or extraction, of a Tree.
- Taking any action foreseeably leading to the death of a Tree or permanent damage to its health; including but not limited to excessive pruning, cutting, girdling, poisoning, overwatering, unauthorized relocation or transportation of a Tree, or trenching, excavating, altering the grade, or paving within the Tree Protection Zone.

"Review Authority" means the city official or body responsible for reviewing and making decisions on permit requests, either initially or on appeal.

"Root Crown" means the zone of transition between the Tree trunk and supporting roots.

"Shrub" means and includes any woody perennial plant, normally low, several-stemmed, and capable of being shaped and pruned without injury, within the area planted.

"Snag" means mean a dead tree, generally ranging between 12 and 30 feet high, from which the top and a majority of the branches have been removed, in order to provide wildlife habitat.

"Street" means and includes all land lying between the boundaries of property abutting on all public Streets, boulevards, alleys and walks.

"Street Tree" means any Tree whose trunk is located all or primarily within the Street easement or on public property between the Street right of way and a Street-facing property.

"Substantial Pruning"—see "Prune substantially."

"Suitable" shall mean appropriate to the situation, taking into account: safety of persons and property; environmental values such as wind break, soil erosion, and wildlife habitat; Tree density; Tree health; aesthetic results; and economic factors.

"Tree" means any woody plant that has a trunk four inches or more in diameter at four and one-half feet (54 inches) above natural grade level. For purposes of this title, a multi-trunk Tree shall be considered a single Tree and the circumference of that Tree shall be the sum of the circumferences of the trunks of that Tree.

"Tree Protection Zone" means that area around each Protected Tree whose outer edge is a circle, the radius of which equals the trunk diameter in inches (at 54 inches above grade) times 1.5 with the resulting product measured in feet (e.g., 8 inches x 1.5 = 12 feet), or the outer edge of the Tree's leaf canopy, whichever is larger.

"Tree Report" means a Tree assessment report meeting the standards specified in prepared by a Qualified Professional.

"Tree Service Contractor" means any Person providing tree trimming and removal services for a fee or other consideration.

"Upper Canopy Tree" means a Tree of a species that tends to be taller than 40 feet at maturity and is able to thrive (when mature) in circumstances providing greater direct exposure to the sun and wind. The leaves and needles of the upper canopy tree are often tough, to withstand drying without damage when moisture is less readily available. Upper Canopy Trees Native to the Monterey peninsula include Monterey pine, Monterey cypress, Monterey cypress, Monterey pine, and Torrey pine. Upper canopy trees provide shelter and shade for species lower in the canopy and on the ground.

"Urban Forestry Standards" means the regulations issued to implement this title, as found in the eponymous chapter of the Urban Forest Management Plan.

5.1.4 Coastal Zone Standards

The Local Coastal Program (LCP) Land Use Plan policies apply to tree management practices in the Coastal Zone. The LCP Land Use Plan is an element of the City's General Plan. Development of this Urban Forest Management Plan is a recommended action of both the General Plan and the LCP Land Use Plan. Within the coastal zone area of the City, the LCP Land Use Plan shall take precedence over the General Plan and Urban Forest Management Plan where policies are similar or conflict. All development projects must take into consideration the LCP Land Use Plan as well as the UFMP requirements. If policies within this plan overlap or conflict, the policy that is the most protective of coastal resources shall take precedence.

The coastal zone of Pacific Grove contains several land habitats that are considered environmentally sensitive in the LCP Land Use Plan, including the shoreline pine forest/sand dune association and the pine/eucalyptus overwintering habitat of the Monarch butterfly. Policies in the LCP Land Use Plan that address the urban forest include, but are not limited to:

- Designing new development in the Asilomar Dunes area (bounded by Asilomar Avenue, Lighthouse Avenue, and the boundary of Asilomar State Park) to protect existing and restorable native dune plant habitats, as well as the native oaks and pine forest which stabilize the inland edge of the high dunes along Asilomar Avenue southwards from the vicinity of its intersection with Pico Avenue.
- Designing new development within the scenic forest-front area along Asilomar Avenue to minimize loss of native Monterey pine and oak forest, and to retain public views towards the inland face of the high dunes.

- Retaining the scenic native forest within Asilomar Conference Grounds, along Asilomar Avenue, and within the abandoned railroad right-of-way, shall, to the maximum feasible degree.
- Protecting, or, when necessary, replanting, landscape trees which contribute to the scenic views in the City's coastal zone.

5.1.5 Assumptions and Limiting Conditions

- No responsibility is assumed by the City of Pacific Grove for matters legal in character regarding these standards. Any legal description that may be provided is assumed to be correct.
- Care has been taken to obtain reasonable information from reliable sources for these standards.
- Visual aids within the standards, such as sketches, diagrams, graphs, photos, are not necessarily to scale and should not be construed as engineered data for construction.
- These standards have been crafted to conform to current standards of care, best management practices, evaluation and appraisal procedures, diagnostic and reporting techniques and sound arboricultural practices.

5.2. Pacific Grove's Protected Trees

5.2.1 Pacific Grove Municipal Code

Title 12 protects specific trees on public or private property from removal or disfigurement. The standards establishes procedures and regulations for the purpose of encouraging the preservation of trees. Trees that fall within the following categories are considered "Protected Trees", and must be maintained in accordance with the standards and regulations described in this chapter. A permit from the Planning or Public Works Department is required prior to removal or ~~alteration~~substantial pruning of a Protected Tree. Trees that are not in any of these categories may be maintained or removed without city review or approval.

Comment [SH24]: Defined term

5.2.1.1 Protected Trees

Trees of the most importance to the community, because of their species, heritage, location, significant benefits or other factor shall be designated in the community's interest as Protected Trees. In making this determination, the City recognizes that it is identifying a shared responsibility regarding these resources. Suitable species planted in appropriate sites benefit both the owner of the property they grow on and the community as a whole. All property owners – both public and private – share a common responsibility for management of the City's overall urban forest, with special reference to Protected Trees.

The following tree species are protected in the City of Pacific Grove. All Protected Trees that require a permit for ~~alteration~~substantial pruning or removal are 6 inches or greater in diameter (~~36 inches in circumference~~ measured at 54 inches above natural grade).

Comment [SH25]: Recommendation to protect all tree species, not just native ones, based on tree size such as greater than six inches in diameter at 54" – UFAC consensus?

Oak

All Coast live oak (*Quercus agrifolia)*

The Coast live oak leaf (left) is oval-shaped with stiff prickly points.

Cypress

All Monterey cypress (*Cupressus macrocarpa)* ~~and Gowen cypress (*Cupressus goveniana)*~~

Monterey cypress columnar or cone-shaped when young, but becomes broad and spreading with age. The bark is fibrous and rough. The leaves are lemon scented, bright green, scale-like, 2-5 mm long.

Pine

All Monterey pine (*Pinus radiate*) ~~and Torrey pine (*Pinus torreyana)*~~

The Monterey pine grows to between 15–30 m (49–98 ft) in height in the wild, but up to 60 m (200 ft) in cultivation in optimum conditions, with upward pointing branches and a rounded top. The leaves ('needles') are bright green, in clusters of three. The bark is fissured and dark grey to brown.

Coast Redwood

All Coast redwood *(Sequoia sempervirens)*

Comment [SH26]: Not consensus that Redwoods are native or that they should be protected if limiting Protected Trees by species.

The "leaves" of the Coast redwood are needle-like and flat, measuring about half an inch long. The bark is quite thick, has a reddish color and quite fibrous.

5.2.1.2 Monarch Butterfly Habitat Trees

All trees growing in and within 100 yards of Monarch Grove Sanctuary and George Washington Park, defined as follows:

- Monarch Grove Sanctuary. That portion of land bordered on the east and west by Ridge Road and Grove Acre Avenue, respectively, on the south by Short Street, and on the north by the northerly boundary of assessor's parcel numbers 006-361-30-031, -032, -033, and -034, extended from Grove Acre easterly to Ridge Road.
- George Washington Park. That portion of land bordered on the east and west by Alder Street and Melrose Avenue, respectively, on the north by Pine Avenue, an on the south by the imaginary extension of Junipero Avenue westerly from Alder to Melrose Avenue.

Pruning or removal of trees in designated Monarch Butterfly Habitat Trees shall be prohibited except as prescribed in the Monarch Grove Sanctuary Management Plan or upon a finding by the City Council that such is necessary for proper maintenance of the site or for public health, safety or welfare.

Pruning or removal of trees in designated Monarch Butterfly Habitat Trees, or within 100 yards of any boundary of such site, shall be prohibited during the months of October through April unless deemed necessary by the city council for public health, safety or welfare, as required by City Code.

Private property owners surrounding the Monarch Grove Sanctuary are encouraged to plant trees to serve as windbreaks.

5.2.1.3 Public Trees

All trees growing within the public street right-of-way~~(publicly-owned)~~, outside of private property. In some cases, property lines lie several feet behind the sidewalks. A permit from the Public Works Department is required prior to any work on or within the tree protection zone of a public tree. See Figure 2-7, Public Lands and Open Space.

Standards to be followed in planting, maintaining, pruning, and removing trees on public property (other than street trees) include the following:

1. Planting shall occur at reasonably constant rates over time so as to ensure continual renewal of the urban forest.
2. The appropriate variety of tree species shall be planted, so as to ensure no single event (e.g., species-specific disease) can harm a large proportion of the urban forest.
3. Native trees shall be preferred, except where special circumstances warrant otherwise (e.g., a proportion of eucalyptus trees in the Monarch Sanctuary).
4. Best management practices shall be employed at all times. The standards to which the city adheres shall be as high as or higher than the standards that owners of private property within the city are expected to adhere. Best

Comment [SH27]: Add a size requirement for removal of Public trees (>6" diameter?)

Comment [SH28]: Need to clarify appropriate street tree species, based on location

Comment [SH29]: Definition added above and to ordinance

management practices should avoid conflicts with utilities and infrastructure, further discussed in Section 5.6.6.

5.2.1.4 Designated Trees

All trees, regardless of species, when substantial pruning or removal is associated with a development project, that are specifically designated by the city to be saved and protected on a public or private property which is subject to discretionary development review; such as a variance, architectural review, site and design, subdivision, etc. Approval from the Community Development Department is required to remove a Designated Tree.

5.2.1.5 Significant Trees

Add category for large trees that are not native or in a Protected tree category and develop a registry of significant trees (based on age, location, or size?) for protection.

5.3. Removal, Replacement and Planting of Trees

A Protected Tree may not be removed without city review and approval, except in certain emergencies. The purpose of city review is to verify that the removal is allowed under city regulations and requirements, and to prevent unnecessary tree removal. For standards related to High Risk Trees, see Section 5.2.

This section describes the type and size of tree required for replacement, and the planting techniques to be used. It also describes how to determine the replacement value of a tree that cannot be replaced in its original location, and the circumstances in which the city may require a bond, in the amount of the appraised value of the trees to be preserved, to be posted to assure the survival of trees during development projects.

The ~~alteration~~substantial pruning ~~(pruning)~~ of any Protected tree that does not conform to the most current American National Standards Institute (ANSI) A-300 Standards or International Society of Arboriculture Best Management Practices shall require a City permit. This includes excessive pruning, topping or pruning that damages branch structure, crown shape and/or stability beyond repair.

5.3.1 Tree Removal

5.3.1.1 Allowable Removal

A permit is required to remove or ~~significantly~~ substantially prune a Protected Tree, except in emergency situations outlined in high risk trees (see below).

5.3.1.2 Tree Removal Criteria

Standards and criteria to be observed during tree removal and ~~alteration~~substantial pruning are as follows:

Comment [SH30]: UFAC concern with who should be the appropriate Department or staff for approving tree removal associated with development.

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Comment [SH31]: Further discussion needed, concern about administration and practicality of bonding

Comment [SH32]: Consider a separate section on pruning and clarify when it can be done without a permit

Comment [SH33]: Add criteria for removal of multiple trees under 6" diameter (consensus?)

1. A tree shall not be removed or substantially pruned for the primary purpose of securing or improving a view, for acquiring more sunlight or air, or to reduce litter.
2. A tree that serves as part of the windbreak system, or assists in drainage or the avoidance of soil erosion, or serves as a component of a wildlife habitat, is to be preserved if at all feasible.
3. No tree can be pruned to an extent that destroys its identity as a tree, unless conditions for removal exist.
4. Tree Condition criteria:
   a) The tree is dead with no living foliage and in falling would conceivably strike a use area, personal/public property or a Protected tree.
   b) The tree poses a high risk to the immediate area that cannot be mitigated through prescriptive treatments.
   c) Tree Risk Assessment Level (defined in Section 5.2) is greater than 6 and alternative risk reduction treatments have been considered, are not feasible, or ~~and are unable to be implemented~~would not mitigate the risk to an acceptable level, including:
      i) Risk reduction pruning
      ii) Cabling or bracing
      iii) Propping
      iv) Relocating the target
   d) The tree is irretrievably infested with insects that vector disease or result in mortality and may infect/attack adjacent trees that cannot be preventatively treated.
   e) The tree is infected with Pitch Canker and crown damage exceeds 50% of total canopy volume.
5. Trees that are causing or starting to cause significant damage to hardscape (house foundations, driveways, retaining walls, patios etc.), utility service lines or infrastructure (streets, curb, sidewalk, storm drain etc) that cannot be mitigated with cost effective, low risk, remedial solutions (see Section 6.6 – Trees and Infrastructure).
6. Trees identified as a nuisance and causing illness or emotional distress as verified by a Medical Doctor.
7. Trees with high pollen counts that cause incurable allergies if verified by a Medical Doctor.
8. Trees with heavy cones or fruit drop that cannot be reasonably cleaned or targets relocated.
9. Trees in densely planted areas where thinning is the proper forestry practice.
10. Healthy trees with equal sized trees or full appraised value as mitigation.

Comment [SH34]: Clarify that dead branches can be removed without a permit, if less than "substantial" pruning

Comment [SH35]: This should be voluntary, not required

Comment [SH36]: Change to 90% - not consensus

Comment [SH37]: Criteria not consensus

Comment [SH38]: Criteria not consensus

11. Invasive species as identified by Landscape Trees for Pacific Grove, California Invasive Plant Council and/or the California Invasive Species Advisory Committee.

12. The visual prominence and function of each tree on the site will be considered prior to a decision on the removal or ~~alteration~~substantial pruning.

13. The City Arborist may refer permit applications to the Natural Resources Commission for review and recommendation.

14. Trees of unusually large size, high visibility, or extraordinary aesthetic quality may be required to be replaced by specimen trees as deemed appropriate by the City Arborist.

15. All work done under a permit shall be performed according to the standards of the International Society of Arboriculture.

5.3.2 Tree Replacement

In order to maintain and enhance current benefits and canopy coverage levels, replacement of removed trees shall be required to restore the size, benefits and functions of the removed tree(s).

At the discretion of the City Arborist, replacement tree planting may occur offsite, on public lands when lot size or the property owner does not support tree planting.

Required tree replacement may also be achieved by paying in-lieu fees to the Pacific Grove Tree ~~Trust~~ Fund.

Replacement trees species ~~shall~~ may be selected from *Landscape Trees for Pacific Grove, A Guide to Selection, Planting and Care,* incorporated herein.

5.3.2.1 When Tree Replacement is Required

The following conditions determine whether or not a protected or designated tree must be replaced:

Protected Trees

If the city authorizes removal of a protected tree because it is dead, dangerous, or a nuisance, as verified and documented in the field, ~~no~~ tree replacement is required but no fee will be charged. In all other cases, the tree must be replaced.

Monarch Butterfly Habitat Trees

See Section 12.16.100(2) of the Pacific Grove Municipal Code.

Public Trees

If the city authorizes removal of a Public Tree in connection with a development project or city funded improvement project, it shall specify the replacement requirements in the permit authorizing removal. In no case shall the replacement be less than the existing number of trees.

Comment [SH39]: Criteria not consensus – clarify types of situations where this may occur

Comment [SH40]: Not consensus

Comment [SH41]: Consider revising this document to only list prohibited or discouraged trees. Don't require replacement of same species if not right tree in right place

Comment [SH42]: Not consensus that a permit or notice should be required for dead tree removal

Designated Trees

When authorizing removal of a Designated Tree, the City Arborist shall require tree replacement if it is necessary or desirable to implement the intent of the original site design. The number and nature of the replacement trees will be determined by the City Arborist, taking into consideration the value of the tree removed and the site design.

5.3.2.2 Tree Replacement Criteria

Tree Species and Placement

The right tree in the right place maximizes the net benefits to the property owner and community and minimizes the risks associated with trees. Inappropriate tree selection and placement is often the underlying cause for trees that become high risk, are prone to breakage, or develop recurring pest or disease problems. Inadequate planting sites are often responsible for poor tree growth and survival, or excessive hardscape damage.

Number of Trees

Residential Properties

The community benefits when properties -- both public and private -- share equitably in the burden of providing Protected Trees. Meeting the tree canopy coverage goals established in this UFMP applies to both public and private property owners. Thus, the following minimum standards are established as best representing the nature and scope of tree replacement:

Table 5-1: Tree Canopy Coverage Goals for Residential Properties

Lot Size (SF)	Upper Canopy Trees	Lower Canopy Trees
Up to 4,000	0-1	1-2
4,001-6,000	2	2-3
6,001-8,000	3	3-4
Over 8,000	As determined by the appropriate Review Authority	As determined by the appropriate Review Authority

Comment [SH43]: Further discussion needed. Clarify that this is the rule, not the exception. Need to add requirement to document and validate any deviations from these standards. Add maximum number of trees to be replaced?

Comment [SH44]: Quantify?

Commercial and Public Properties

One tree per 30 feet of frontage, with a minimum of two trees, if space is available.

These tree density-per-lot standards are intended to achieve a mixed, healthy forest, and may be adjusted by the City Arborist or Review Authority in individual circumstances, taking into consideration individual site constraints and opportunities.

Parking Lots

Three trees per 25 spaces or in conjunction with low impact development landscaping for stormwater management.

Comment [SH45]: Insert pictures to illustrate

Other Considerations

While the above Standard shall serve as a general threshold for tree replacement, the City Arborist shall determine the final tree replacement requirements (number, size, species and placement) based on the following factors and taking into consideration the needs of the property owner:

- The tree canopy coverage target as described in this UFMP
- Neighborhood, use or district objectives
- Existing canopy coverage on the lot
- Land use
- Lot size
- Available space
- Topography and soil conditions
- Stormwater management
- Viewshed protection
- Long-term health potential of the replaced tree
- Existing infrastructure and potential for adverse impacts
- Adjacent properties and uses
- Condition of the removed tree. Dead trees do not require replacement. Diseased or structurally unsound trees may be replaced at lower levels.

Native species are required as replacement trees on lots greater than 4,000 square feet. On lots less than 4,000 square feet, replacement tree species should be selected from the most recent edition of the *Landscape Trees for Pacific Grove – A Guide to Selection, Planting and* Care. The replacement trees may be the same species or may be another species that is considered by the City Arborist to be more suitable for the location.

In order to maintain the existing coniferous tree cover, particularly in the area between Sunset Drive and Seventeen Mile Drive, replacement planting are required to be with pitch canker resistant Monterey pines if available and where feasible. Otherwise, Monterey cypresses and other species of pines as recommended by the City Arborist may be used.

5.3.2.3 Alternatives When Trees Cannot Be Replaced on Site

In some circumstances, crowding or other physical constraints make it impossible or undesirable to replace a tree on site. In that case, the value of the tree shall be ~~determined using the most recent edition of the *Guide for Plant Appraisal* published by Council of Tree and Landscape Appraisers or the *Form for Northern California* established by the International Society of Arboriculture~~ a fixed fee based on size.

Once the value has been determined, that sum of money (an in-lieu fee) will be deposited in a city-maintained Tree ~~Trust~~ Fund to be used, as approved by the City Arborist: 1) to provide additional trees elsewhere on the site; 2) to add or

Comment [SH46]: Concern about the amount of arborist discretion – not consensus

Comment [SH47]: Reconsider – not consensus

Comment [SH48]: Encourage? Not consensus

Comment [SH49]: Remove? Further discussion needed

Comment [SH50]: Delete entire section? Not consensus

replace Public trees or other public landscaping in the vicinity, 3) to add trees or other landscaping to other city property, 4) to assess and mitigate high-risk trees, 5) to execute tree replanting consistent with the goals and implementation strategies identified in this UFMP.

5.3.2.4 Maintenance and Monitoring of Replacement Trees

The City Arborist shall verify replacement trees have been replanted or in-lieu fees collected within 60 days of permit issuance or prior to final ~~project~~building inspection, for tree removal associated with development projects.

Locations of replacement tree plantings for both public and private properties shall be verified, with photographic documentation or in the field, identified on map (in GIS) and input to the City Tree Inventory database by the City Arborist, or their designee.

To ensure the survivability, proper growth and maintenance in perpetuity of the replacement trees, success criteria is defined to meet an 100% survival rate, implemented as follows:

A qualified professional shall monitor the newly planted tree at ~~six (6) month intervals for a period of five years~~a one year and five year interval.

Comment [SH51]: Also require monitoring at year 10? Not consensus

- Tree health and growth rates will be assessed.
- Trees suffering poor growth rates or declining health will be identified.
- Invigoration treatments will be provided.
- Dead trees or trees in an irreversible state of decline will be replaced with the next larger container size.
- At the end of the five-year period the status of replacement plantings will be assessed to make certain that success criteria has been met and all mitigation trees planted are performing well.
- The "Qualified Professional" shall submit by annual monitoring reports to the City Arborist in order to verify replacement trees are viable.

5.3.2.6 Tree Planting in New Subdivisions

Before any street improvements in any ~~new subdivision~~ major development of real property in the city are accepted by the City Council, the applicant shall pay to the city the total cost for purchasing and planting of all trees to be planted along all streets. ~~The value of the tree will be determined using the most recent edition of the *Guide for Plant Appraisal* published by Council of Tree and Landscape Appraisers.~~

After receipt of payment, the city will plant the trees at the proper time as determined by the City Arborist, but not more than 3 months following issuance of the final building permit.

~~5.3.2.7 Public Trees and Adjacent Private Property Owners~~

~~Public Tree plantings will be considered first from the perspective of the people passing on or using the streets, the benefits to storm water management, the extension of pavement life as a result of the shade they provide, and from the other broader community benefits. Of secondary consideration is the~~

~~enhancement, embellishment, or other benefits to the properties abutting the street.~~

~~No Public Tree shall be planted, topped, substantially pruned, transplanted, removed, or otherwise damaged, without the approval of Public Works Superintendent. Planting of Public Trees shall be in conformance with an approved landscaping street plan, where applicable.~~

~~The city is responsible for maintaining all Public Trees along city streets not planted by private property owners.~~

~~A property owner's responsibility for Public Tree maintenance of trees planted by the property owner includes irrigation, pruning, keeping the right-of-way planting area free from weeds, debris, or other obstructions inimical to public safety and/or contrary to the street tree plan, and otherwise maintain such areas in a neat, clean, and orderly manner.~~

~~Any person intending to use material for the planting of tarpaper, plastic, or other impermeable material over the ground, or the use of materials or chemicals intended to permanently sterilize the soil of these areas, shall seek out the advice and proper installation and/or application of these materials from an expert or consultant prior to planting.~~

~~Private property owners may remove any dead, high risk, or diseased tree not protected by this section, or device necessary for the protection thereof, from public streets along street frontages on or adjacent to their property.~~

5.4. Tree Protection and Preservation during Development

5.4.1 Introduction

The objective of this section[3] is to preserve and protect existing trees by reducing negative construction impacts to a less than significant level. Trees vary in their ability to adapt to altered growing conditions. Mature trees have established stable biological systems in the preexisting physical environment. Disruption of this environment by construction activities interrupts the tree's physiological processes causing depletion of energy reserves and a decline in vigor, often resulting in the tree's death. Since construction impacts are cumulative and long term, this reaction may develop from one to twelve years or more after disruption. These standards define protocol to identify the condition of existing tree resources, distinguish trees suitable for preservation, inform design that retains and protects the maximum number of suitable trees, assess project impacts, preserve and protect trees during construction, maintain and monitor trees post construction.

These standards shall define criteria for tree protection to guide a construction project to insure that appropriate practices will be implemented in the field to eliminate negative impacts that may result from uninformed or careless acts, and preserve both trees and property values.

Typical negative impacts that may occur during construction include: mechanical injury to roots, trunk, or branches; soil compaction, which degrades the functioning roots, inhibits the development of new roots, and restricts drainage which desiccates roots and enables water mold fungi to develop; changes in existing grade which can cut or suffocate roots; alteration of the water table - either raising or lowering; microclimate change; exposing sheltered trees to sun or wind; and sterile soil conditions associated with stripping off topsoil. For these reasons it is imperative that the commitment to tree protection begins in the planning stages of a project.

These standards shall apply to all Protected Trees in the City of Pacific Grove. These standards do not apply to unprotected trees or trees previously approved for removal.

5.4.2 Assessment of the Tree Resources

1. During the conceptual stages of a development project, prior to project design and submittal of a permit application, a Tree Resource Assessment shall be performed by a Qualified Professional. This Qualified Professional will be designated the Project Arborist for the duration of the project, from planning stages through final inspection. The Project Arborist should be

[3] This section was adapted from City of Palo Alto Tree Technical Manual and Trees and Development, Adapted from County of Monterey Tree Report Requirements, City of Monterey Tree Protection Guidelines, James P. Allen & Associates and City of Scotts Valley Municipal Code Section 17.44.

familiar with the tree species affected and experienced with procedures necessary to construct the project. In the event the Project Arborist is desired to be replaced by the property owner or the City, the replacement arborist shall be approved by the City prior to replacement. All costs associated with the Project Arborist shall to be borne by the applicant.

2. The initial Tree Resource Assessment is to be completed during the conceptual planning stage to inform the project design, prior to submittal of a permit application.
3. Trees that are suitable for preservation, with Risk Ratings less than 5 and capability to tolerate moderate construction impacts, should be considered for incorporation into the final project design.
4. The project shall preserve, or mitigate for, the maximum number of suitable individual trees that exist on the site pre-development.
5. Tree Resource Assessment Report Requirements.
6. Numerically tag, map and identify the location of individual trees on a site plan.
7. Submit tree inventory table or spreadsheet, including the following information:
   a) Assigned tree number, corresponding to mapped location
   b) Common name
   c) Botanical name
   d) Tree Condition using an excellent/good/fair/poor rating system
   e) Health
   f) Structure
8. Preservation Suitability rating system evaluating tree health, structure, species characteristics, age and potential longevity.
   a) Trees with a “good” rating have adequate health and structure with the ability to tolerate moderate impacts and thrive for their safe, useful life expectancy.
   b) A “fair” rating indicates health or structural problems that have the ability to be corrected. They will require monitoring with an expectation that their lifespan will be shortened by construction impacts.
   c) Trees with a “poor” rating possess health or structural defects that cannot be corrected through treatment. Trees with poor suitability can be expected to continue to decline regardless of remedies provided. Species characteristics may not be compatible with redefined use of the area. Species which are non-native and unusually aggressive are considered to have a poor suitability rating.
9. Factors to be considered or included:
   a) Condition of root crown, base and roots.
   b) Condition of trunk including decay, injury callusing or presence of fungus or spores.
   c) Condition of limbs and twigs (identify) including strength of crotches,

amount of deadwood, whether excessive weight is borne by limbs, and need for trimming.

d) Condition and growth rate history including pest damage and diseases.

e) Leaf appearance.

10. Describe the surrounding site, forest composition.
11. Critical Root Zone (CRZ) extents will be determined and mapped - Individual tree root systems provide anchorage, absorption of water/minerals, storage of food reserves and synthesis of certain organic materials necessary for tree health and stability. The Critical Root Zone is the tree-specific amount of roots necessary to continue to supply these elements essential for this tree to stand upright and maintain vigor. This distance (CRZ) reflects the minimum measurement from the trunk required for the protection of the tree's root zone.
12. Construction activities proposed within these CRZ areas are subject to specific review and the implementation of recommended special treatments.
13. Canopy extents will be mapped.
14. Risk Rating will be determined per Section 5.2.
15. A summary report shall be submitted to the Planning Division of the Community Development Department to be used to determine where improvements and utilities can be positioned to preserve or minimize impacts to suitable trees.
16. The Project Arborist shall work closely with the design team (architect, landscape architect, or project designer) prior to submittal of the permit application. Tree permits associated with development are reviewed and approved by the same Review Authority as for the related planning permit and processed concurrently.
17. Disclosure of Information Regarding Existing Trees: Any application for discretionary development approval, or for a building or demolition permit where no discretionary development approval is required, shall be accompanied by a statement by the property owner or authorized agent which discloses whether any Protected Trees exist on the property which is the subject of the application, and describing each such tree, its species, size, tree protection zone, and location. This requirement shall be met by including the information on plans submitted in connection with the application.
18. In addition, the location of all other trees on the site and in the adjacent public right-of-way which are within thirty feet of the area proposed for development, and trees located on adjacent property with canopies overhanging the project site, shall be shown on the plans, identified by species.
19. The city may require submittal of such other information as is necessary to further the purposes of this chapter including but not limited to photographs, and condition of the trees (e.g. structural deficiencies, disease, infrastructure impacts, etc.), as determined by a certified arborist.
20. Disclosure of information pursuant to this section shall not be required when the development for which the approval or permit is sought does not involve any change in building footprint nor any grading or paving.

21. Removal or ~~alteration~~substantial pruning of a tree(s) is considered development activity when it is for the purposes of: (1) erecting or adding to a structure, including, but not limited to, fences, sheds, decks and retaining walls, (2) providing parking, (3) grading, trenching, or lot clearance, or (4) any other activity requiring a building permit or any discretionary land use entitlement.

5.4.3 Construction Impact Analysis

1. Prior to issuance of a planning or building permit, the Project Arborist shall review grading, drainage, utility, building and landscape plans to determine impacts to individual trees.
2. Recommendations for alternative construction methods and preconstruction treatments shall be made.
3. Tree protection and preservation specifications including a protection-fencing plan shall be completed.
4. Mitigation requirements for trees removed due to construction impacts shall be determined.
5. The appraised value of trees to be preserved shall be calculated.
6. A Construction Impact Assessment Report, accompanied by a Tree Location Map/Preservation Plan, shall be submitted to the Planning or Building Division of the Community Development Department, depending on the permits required, and reviewed by the City Arborist.
7. All procedures recommended by the Project Arborist through review of planning or building permits shall be Conditions of Project Approval or delineated on construction drawings for the Building Permit.

5.4.4 Minimum Tree Protection Standards during Construction

1. All development projects shall adhere to the most current version of the "American National Standards Institute A-300 (Part 5) Management of Trees and Shrubs During Site Planning, Site Development and Construction".
2. To avoid beetle infestation, the lower six feet of Monterey pine trees scheduled for preservation shall be sprayed with an appropriate pesticide as recommended by a licensed pest control adviser.
3. All improvement plans for the project shall include accurate trunk locations, Critical Root Zones (CRZ), and Canopy Extents of all trees, or groups of trees, to be preserved within the development area. Tree Protection measures, fencing locations, and Special Treatment Areas are to be clearly defined on approved architectural/site plans to be used in the field and to be on file with the Community Development Department.
4. The Project Arborist shall verify, in writing with photo verification, that all preconstruction conditions have been met (tree fencing, erosion control, pruning, pre-construction treatments, etc.) and is in place. Written verification shall be submitted to, and approved by, the Building Division of the

Community Development Department prior to any demolition, grading or building permit issuance.

5. The demolition, grading, and underground contractors, construction superintendent, and other pertinent personnel are required to meet with the Project Arborist at the site prior to beginning work to review procedures, tree protection measures, and to establish haul routes, staging areas, contacts, watering requirements, etc.
6. All tree protection measures recommended in the Tree Resource Evaluation/Construction Impact Analysis are to be clearly presented in the building plans.
7. The City Arborist will inspect project specific Tree Protection measures.

5.4.5 Bonding of Protected Trees

1. All Protected Trees on proposed development sites to be preserved shall be valued using Trunk Formula Method or Replacement Cost Method consistent with the national standards authored by the Council of Tree and Landscape Appraisers and published in the year 2000 by the International Society of Arboriculture in the *Guide for Plant Appraisal, Ninth Edition*.

2. The developer shall post a retention bond representing the appraised value of the trees to be preserved to be held in trust by the City of Pacific Grove until project completion. In the event project management fails to implement recommended procedures or damages trees, the contract cost of implementation of recommended tree preservation treatments, or appraised value of damage to these preserved trees, whichever is greater shall be determined by the Project Arborist. Monetary fines shall be assessed and deducted from the retention funds or bonds.

5.5. Management Framework

This section assigns responsibility for the care and management of the urban forest resources and defines responsible parties/departments, assessment protocol and best management practices.

5.5.1 Standards of Care

Trees growing in the City of Pacific Grove require regular inspection to identify needs, assess condition, potential risk factors and provide a Due Standard of Care.

The City Arborist shall maintain all trees growing on public lands in order to provide a Due Standard of Care.

Private property owners should engage a Qualified Professional to assess the condition of trees growing on their property.

Tree removal or maintenance required on public or private lands shall be performed by a company with a valid Pacific Grove Urban Forest Tree Care license.

All trees in the City of Pacific Grove, public or private shall be maintained in adherence to the most current versions of the following industry standards and practices:

- American National Standards Institute (ANSI) A-300
- International Society of Arboriculture, Best Management Practices

5.5.1.1 City Arborist

The City shall hire a qualified professional City Arborist. This City Arborist will be responsible for the implementation of the Urban Forest Management Plan, including:

1. Promoting the value of trees within the community on both public and private properties.
2. Implementing the Tree Risk Management program and assessing and mitigating high-risk trees.
3. Managing the Urban Forestry Department (yet to be established).
4. Consulting with constituents on tree related matters.
5. Resolving (or administering the resolution of) tree related conflicts within the community.
6. Conducting public outreach and educational programs.
7. Overseeing the application of herbicides, pesticides and fungicides.
8. Managing the city tree inventory (yet to be compiled) to a "current" level.
9. Providing a Due Standard of Care (defined in Section 4.2) for all trees on public lands
10. Administration of the city Tree Ordinance.
11. Administer the tree permit process.
12. Maintaining all related records.
13. Producing reports when requested.
14. Giving presentations and submitting written reports to the City Manager, Natural Resources Commission and City Council.
15. Responding to tree related inquiries or requests for service.
16. Certification by the International Society of Arboriculture is the minimum qualification for this position. Preferred designations are:
    - Certified Urban Forester, California Urban Forest Council
    - Municipal Specialist, International Society of Arboriculture

A background in tree risk management, Urban Forestry and forest ecology is necessary.

5.5.1.2 Urban Forestry Division

The city shall authorize a budgeted Division to Provide a Due Standard of Care to all trees on city owned lands, manage tree inventories and administer the Urban Forest Management Plan.

The City Arborist staff the Urban Forestry Division with qualified professionals capable of meeting objectives defined in the Urban Forest Management Plan with a combination of city staff, volunteer services, and private sector contracting.

5.5.1.3 Qualified Professional

The City Arborist shall compile and maintain a list of "Qualified Professionals" to review tree related issues and prepare and submit assessment reports when necessary.

The list of "Qualified Professionals" should be compiled through a review and screening process to determine experience, capability and demonstrated objective, unbiased behavior.

The "Qualified Professional" should possess resource specific skills and education to accurately opine on the issue at hand; if there is an assessment of a Native Monterey pine forest required, a forest ecologist may be the most "Qualified Professional." If a risk assessment is required, an ISA Certified Arborist/Board Certified Master Arborist or an ASCA Registered Consulting Arborist may be the most "Qualified Professional." If a timber harvest plan is required, a Registered Professional Forester is the most "Qualified Professional."

A "Qualified Professional" shall possess credentials, degrees or qualifications that supports the resource specific skill required to adequately prepare and submit assessment reports such as:

- International Society of Arboriculture
  - Certified Arborist
  - Municipal Specialist
  - Board Certified Master Arborist
  - Certified Tree Risk Assessor
- American Society of Consulting Arborists
  - Registered Consulting Arborist
- Forest Ecologist

"Qualified Professionals" shall not be a principal or employee of a tree service or other contract service provider that has a vested interest or conflict of interest in the subject project.

5.5.1.4 Pacific Grove Urban Forest Tree Care License

All companies performing tree related work that are not a governmental or non-profit organization conducting work in the City of Pacific Grove shall be licensed by the City to perform tree work for hire, including landscaping crews performing young tree pruning and planting of trees. Personnel performing tree pruning shall be ISA certified arborists, certified tree workers or those with parallel professional designations/registrations/certifications. In order to obtain a Tree Care License, applicants shall pay the annual license fee and sign an agreement to perform work according to these Urban Forest Management Plan Urban Forestry Standards. Licensees shall provide proof of appropriate consumer protection standards such as workers compensation and liability insurance, business license, state contractor's license and identification of company vehicles and other responsible practices for their constituency.

Pacific Grove Urban Forest Tree Care License shall be valid for 1 year (or more). The licensing fee and timeline shall be set by resolution of the City Council.

5.5.1.5 Tree Inventory

The City shall compile and maintain an inventory of individual trees on all public lands. The inventory should be cataloged at a minimum by street trees, park trees, and facility trees segment-able by land use. The inventory shall objectively evaluate tree resources to aid in decision making for maintenance, planting, and budgeting.

The inventory should include a land use specific canopy analysis identifying current coverage levels. This baseline data will be used to determine existing canopy coverage, available planting sites and measure success of tree-growing objectives.

The inventory should include all vacant available planting sites, and should provide the data needed to calculate the costs and benefits of the community's tree resources.

The inventory should be updated and managed with the most recent information each time a tree is inspected or maintained.

The inventory should be developed as an online resource with mapping features depicting locations and specific information; attributes, weaknesses, age class, risk rating and photos. This can be used a community engagement and educational tool.

5.5.2 Tree Risk Assessment

The City intends to meet or exceed all arboricultural industry standards including *American National Standards Institute A-300 (Part) 9 Draft 1 Version 1Tree Risk Assessment a. Tree Structural Assessment*.

The Pacific Grove Community Defined Risk Threshold is any tree with assigned Failure Potential Ratings of 6 or greater.

The City Arborist shall administer the Tree Risk Assessment Program and achieve a Due Standard of Care through the implementation of this policy as follows:

Qualified Professionals trained in tree risk assessment shall perform systematic inspections of all trees on City lands on a determined cycle.

5.5.2.1 Levels of Assessment

The level of assessment required for Tree Risk Rating shall be determined by prominence of weak structural conditions according to the following assessment criteria.

Level 1 assessment shall be a limited visual assessment of an individual tree or a population of trees near specified targets, such as along roadways or utility rights-of-way, to identify specified conditions or obvious defects. Assessment methodology shall be specified by the Qualified Professional.

Level 2 assessment shall include a 360-degree, ground-based visual inspection of the tree crown, trunk, trunk flare, above-ground roots, and site conditions around

the tree in relation to targets. When sounding is specified, a mallet or equivalent tool should be used to detect large hollows and loose bark in the trunk, root collar, and above ground buttress roots Use of hand tools, trowels, binoculars, or probes, shall not be precluded from a Level 2 assessment. An assessment should include the identification of conditions indicating the presence of structural defects.

Level 3 assessment shall include, but are not limited to, one or more of the following tree assessment methods:

- Aerial assessment of branch or stem defects;
- Drilling;
- Evaluation of target risk;
- Increment boring;
- Investigation of tree or site history related to possible or defined defects;
- Lean assessment;
- Probing;
- Pull testing;
- Radiation assessment (e. g. radar, x-ray, gamma ray);
- Resistance drilling;
- Sonic assessment;
- Sounding; and,
- Sub-surface root and/or soil assessment.

Risk levels shall be rated using the PNW International Society of Arboriculture (ISA) *Hazard Tree Evaluation* form following PNW ISA Tree Risk Assessment Program criteria. The *Hazard Tree Evaluation* rating system is based on three categories:

a. Failure potential	1 to 5 points
b. Size of the Defective Part	1 to 3 points
c. Target Area	1 to 4 points

Inspection results shall be documented within the City Tree Inventory. Risk levels that meet or exceed the Community Defined Risk Threshold of 6 shall be pro-actively managed using the following table:

Table 5-2: Overall Risk Rating and Action Thresholds

The Overall Risk Rating and Action Thresholds

Risk Rating	*Risk Category*	*Interpretation and Implications*
3	Low 1	Insignificant - no concern at all.
4	Low 2	Insignificant - very minor issues.
5	Low 3	Insignificant - minor issues not of concern for many years yet.
6	Moderate 1	Some issues but nothing that is likely to cause any problems for another 10 years or more.
7	Moderate 2	Well defined issues - retain and monitor. Not expected to be a problem for at least another 5 - 10 years.
8	Moderate 3	Well defined issues - retain and monitor. Not expected to be a problem for at least another 1 - 5 years.
9	High 1	The assessed issues have now become very clear. The tree can still reasonably be retained as it is not likely to fall apart right away, but it must now be monitored annually. At this stage it may be reasonable for the risk manager/owner to hold public education sessions to inform people of the issues and prepare them for the reality that part or the entire tree has to be removed.
10	High 2	The assessed issues have now become very clear. The probability of failure is now getting serious, or the target rating and/or site context have changed such that mitigation measures should now be on a schedule with a clearly defined timeline for action. There may still be time to inform the public of the work being planned, but there is not enough time to protracted discussion about whether or not there are alternative options available.
11	High 3	The tree, or a part of it has reached a stage where it could fail at any time. **Action to mitigate the risk is required within weeks rather than months.** By this stage there is not time to hold public meetings to discuss the issue. Risk reduction is a clearly defined issue and although the owner may wish to inform the public of the planned work, he/she should get on with it to avoid clearly foreseeable liabilities.
12	Extreme	This tree, or a part of it, is in the process of failing. **Immediate action is required.** All other, less significant tree work should be suspended, and roads or work areas should be closed off, until the risk issues have been mitigated. This might be as simple as removing the critical part, drastically reducing overall tree height, or taking the tree down and cordoning off the area until final clean up, or complete removal can be accomplished. The immediate action required is to ensure that the clearly identified risk of harm is eliminated. For areas hit by severe storms, where many extreme risk trees can occur, drastic pruning and/or partial tree removals, followed bv barriers to contain traffic, would be an acceptable first stage of risk reduction. There is no time to inform people or worry about public concerns. Clearly defined safety issues preclude further discussion.

The Table shown above outlines the interpretation and implications of the risk ratings and associated risk categories. This table is provided to inform the reader about these risk categories so that they can better understand any risk abatement recommendations made in the risk assessment report.

5.5.2.2 Stumps, Snags and Slash Management

Stumps, snags (dead and topped trees with trunks remaining standing) and slash may provide food storage and nesting structures for wildlife.

Stumps, snags (dead and topped trees with trunks remaining standing) and slash should be left if they do not increase fire hazard, create a risk to public safety or disturb view sheds.

Snags should be left no taller than the distance to of a target; use area, structure that would be struck in the event the snag fell.

Snags should be assessed at regular intervals to determine risk levels and managed when risk levels exceed 6, the Community defined Risk Tolerance Threshold.

5.5.2.3 Wildlife Protection

Tree pruning and removal activities shall take place outside of nesting periods or other timeframes that disrupt wildlife.

No trees shall be pruned or removed in or within 100 yards of Monarch Sanctuaries between the months of April and October.

When tree work is proposed in areas where wildlife is present, it may be necessary for a qualified professional to conduct a survey and determine if negative wildlife impacts would result from the proposed pruning/removal

5.5.2.4Flammable Fuel Management

Fuel management is the planned manipulation or reduction of living or dead vegetation to prevent the ignition of wildland fires and to reduce the spread and intensity of any wildfire.

The Rip Van Winkle Open Space area and southern and eastern boundaries of the Del Monte park district are identified as Very High Fire Hazard Severity Zone VHFHSZ) by CalFire (see Figure 2-15).

The City of Pacific Grove Urban Forestry Department and private property owners shall manage flammable fuel loads on their respective properties per the guidelines provided below and CalFire *General Guidelines for Creating Defensible Space*.

Grasses

1. Once annual grasses cure (beginning early to mid-June) they are to be maintained at or about 4 inches in length within the 100' fuel management zone.
2. Multiple grass mowing/cutting may be necessary following wet winters.
3. Technique used (mower v. weed eater) should be sensitive to slope and potential for erosion.

Trees

1. Within the 100' fuel management zone, remove from mature trees: all vines, dead branches and all live branches less than 3 inches to 8 feet above the ground.
2. Small trees and tree-form shrubs (to 15 feet) should be pruned-up 1/3 their height. The space between tree foliage and shrubs should be 3 times the height of the shrub. This can be accomplished by pruning the tree, shrub, or both.

Shrubs and Shrub Patches

1. Shrubs and shrub patches located under the canopy of trees should not exceed 18 inches in height.
2. Dead limbs should be removed from shrubs.
3. Individual shrubs and shrub patches outside of the canopy of trees should be managed to allow for adequate horizontal spacing. Individual shrubs or grouping of shrubs should be maintained in a form so their diameter does not exceed 2 times their height.
4. Whenever possible it is recommended that Scotch Broom (*Genesta sp)* Coyote bush and invasive species be removed during the fuel management process to promote the restoration of native plant communities.

Disposition of pruned vegetation

1. The preferred option should be to chip the native plant material on site and use for mulch in the landscape or distribute in the open in key erosion prone areas. Chipped material can also be spread within the landscaped areas where appropriate to reduce compaction and rebuild soil biota.
2. The alternative option should be to haul plant material off site and dispose of properly. This procedure is required for non-native, invasive and disease affected material. These materials should be hand loaded onto a truck and tightly covered with tarps for transport and disposal off-site

5.6. Growth and Development of the Pacific Grove Urban Forest

This section includes materials adapted from *Up by the Roots, James Urban*.

In order to develop trees that grow, reach maturity and provide maximum benefits, a comprehensive growing plan is necessary.

All tree growing elements in the City of Pacific Grove should adhere to the most current versions of *ANSI A-300 Standards and Landscape Trees for Pacific Grove, A Guide to Selection, Planting and Care*.

5.6.1 Site Selection

A thorough site analysis should be performed for all proposed plantings on public and private lands.

1. Adequate below and above-ground space should be required for the space to be identified as an appropriate planting site. If there is insufficient space to allow the tree to grow to full size, a different site or a smaller growing tree species should be chosen.
2. Tree planting sites should allow adequate distance between the tree trunk and hardscape elements that may be damaged by root development. A general distance to maintain is 10 to 20 feet for mature trees.
3. Tree planting sites should contain adequate soil volumes to allow tree root growth. Below ground space requirements should be twice the area of the above ground canopy coverage extents.
4. Soils shall have sufficient drainage capabilities as verified by a simple percolation test; dig a hole 24 inches in depth, fill with water, and monitor the time it takes for the water to drain. If water moves from the hole into the surrounding soil at a rate less than two inches per hour or pools at the bottom of the whole, drainage capabilities are poor.
5. Trees planting sites in poorly draining soils shall be dug shallow, to a depth that equals two-thirds to one-half the height of the container. This results in a "mounded" type-planting site.
6. Irrigation water supply should be tested to ensure there are no toxic elements or high salt concentrations.

5.6.2 Species Selection

Species planted in the City of Pacific Grove shall be selected from the *Landscape Trees for Pacific Grove, A Guide to Selection, Planting and Care*.

The Natural Resources Commission in partnership with the City Arborist, and knowledgeable community members shall update the *Landscape Trees for Pacific Grove, A Guide to Selection, Planting and Care* as needed.

Tree species selected shall respect land use and rebuild native systems where space allows. Native Monterey pine shall be the species of choice for reforesting

Rip Van Winkle Open Space and some sections of George Washington Park. Species chosen for neighborhood districts shall meet Community wide goals for diversity and lot size limitations (see Chapter 4 - Neighborhood Urban Forestry Initiatives)

5.6.3 Nursery Stock Selection

The selection and procurement of high quality, nursery grown trees is of paramount importance in Growing the Urban Forest.

All nursery grown trees planted in the City of Pacific Grove shall adhere to criteria defined in *Guideline Specifications for Nursery Tree Quality* authored by The Urban Tree Foundation (see Appendix D).

5.6.4 Tree Planting

Trees planted in the City shall adhere to the most current version of *American National Standards Institute (ANSI) A-300 (Part 6) Transplanting* (Tree Planting Cue card by the Urban Tree Foundation) and *Landscape Trees for Pacific Grove - A Guide to Selection, Planting, and Care* (see Appendixes C and D).

5.6.4.1 Selecting quality trees

Planting quality trees begins by choosing vigorous, structurally sound trees from the nursery. Strong trees have straight roots, a thick trunk, and one central dominant leader growing straight to the top (see Appendix C, Figure 1) The root collar (the uppermost roots) should be in the top 2 inches of the root ball.

5.6.4.2 Digging the hole

A firm flat-bottomed hole will prevent trees from sinking. Dig the hole only deep enough to position the root collar even with the landscape soil surface (see Appendix C, Figure 2) Use the rototiller or shovel to loosen soil in an area three times the size of the root ball. This loose soil promotes rapid root growth and quick establishment.

5.6.4.3 Installing the tree

Remove soil and roots from the top of the root ball to expose the root collar; cut away any roots that grow over the collar (see Appendix C, Figure 3). Also cut any roots that circle or mat along the sides and bottom of the root ball (see Appendix C, Figure 4). The root collar should be even with the landscape soil after planting (see Appendix C, Figure 3). Backfill with soil removed from the hole. Minimize air pockets by applying water and packing gently. Build a berm 4 inches tall around the planting hole to help force water through the root ball.

5.6.4.4 Staking

Staking holds trees erect and allows the root ball to anchor. Secure the trunk at the point where the tree stands straight. A second stake tied directly to the trunk made of bamboo may be required to straighten the upper trunk.

5.6.4.5 Mulching

A layer of organic mulch, such as leaf litter, shredded bark, or wood chips, helps protect tree roots from temperature extremes and conserves soil moisture. Mulch

also helps prevent grass from competing with the tree for water and nutrients. The mulched area makes it easier to operate mowers and weed eaters without hitting the trunk and compacting soil. Apply mulch to a depth of 3 to 4 inches (slightly thinner on top of the root ball).

5.6.4.6 Irrigating

Consistent irrigation is critical for establishment. 1. Apply about 3 gallons irrigation per inch of trunk diameter to the root ball 2 or 3 times a week for the first growing season. 2. Increase volume and decrease frequency as the tree becomes established. 3. Weekly irrigation the second year and bimonthly irrigation the third year should be sufficient for establishment. 4. Once established irrigation requirements depend on species, climate and soil conditions. 5. Irrigation devises should be regularly checked for breaks and leaks.

5.6.4.2 After Planting Care

Aftercare is essential to ensure new plantings succeed and grow. Newly planted trees shall be monitored weekly for the first three months, monthly during the next year's growth and then at six (6) month intervals for a period of five years or until they acclimate to their new environment.

5.6.4.7 Pruning

Training young trees promotes structurally sound growth and overall tree health. Cut back or remove codominant stems (stems that compete with the central leader) to encourage growth in the central leader (below).

5.6.4.3 Early Training Pruning

1. Directing the growth of young trees is essential if mature trees are to perform properly in the landscape. Early training pruning will establish proper structure and form.

2. Shade trees that grow to be large should have one relatively straight central leader. Heading the tree is acceptable provided the central lead is retrained.

3. Main branches should be well distributed along the central leader, not clustered together. They should form a balance crown appropriate for the cultivar or species.

4. The diameter of branches that grow3 from the central leader, or trunk, should be no larger than two-thirds (one-half is preferred) the diameter of the trunk measured just above the branch.

5. The largest branches should be free of bark that extends into the branch union, known as included bark (see A and B).

6. Temporary branches should be present along the lower trunk below the lowest main branch. These branches should be no larger than 3/8 inch in diameter. The trunk should be free of wounds, sunburned areas, conks (fungal fruiting bodies), wood cracks, bleeding areas, signs of boring insects, cankers, or lesions. Properly made recent pruning cuts are acceptable.

7. The trunk caliper (thickness) and taper should be sufficient so that the tree remains vertical without a stake.

8. The root collar (the uppermost roots) should be within the upper 2 inches of the solid media (substrate). The root collar and the inside portion of the root ball should be free of defects, including circling, kinked, and stem grinding roots. You may need to remove soil near the root collar to inspect for root defects.

9. The tree should be well rooted in the soil media. Roots should be uniformly distributed throughout the container. The tree's structure and growth should be appropriate for the species or cultivar. When the container is removed, the root ball should remain intact. When the trunk is lifted, both the trunk and root system should move as one.

10. The root ball should be moist throughout at the time of inspection and delivery. The roots should show no signs of excess soil moisture as indicated by poor root growth, root discoloration, distortion, death, or foul odor. The crown should show no signs of moisture stressed as indicated by wilted, shriveled, or dead leaves or branch dieback.

5.6.5 Tree Maintenance

Tree Maintenance in the City of Pacific Grove shall be performed to specifications written in accordance with American National Standards Institute (ANSI) A300 (Part 1) Tree Management Standards in accordance with International Society of Arboriculture Best management Practices.

Trees on Public Property and within the city right-of-way shall be pruned by the Urban Forestry Department to maintain a Due Standard of Care. Vertical clearance shall be maintained at a minimum height of 13'6" for all roads, streets throughways etc. Tree with a Risk Rating of 6 or greater shall be managed.

Trees on Private Property shall be pruned to maintain a Due Standard of Care at the expense of the Property owner.

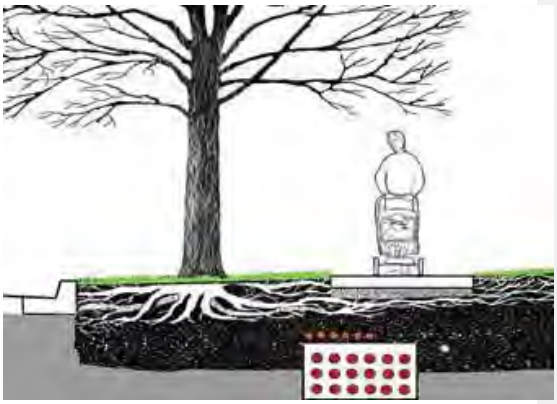
5.6.6 Trees and Infrastructure

Adapted from work by Jim Urban, Nina Bassuk and Jason Grabowsky.

5.6.6.1 Introduction

Trees and hardscape/infrastructure elements are often in conflict when tree roots damage curbs, gutters, sidewalks, utility/drainage lines, foundations and retaining walls on both public and private properties. The most effective long-term planning strategy to avoid these conflicts is to dedicate larger planting sites for tree planting. Since a mature tree requires a minimum distance of 10 to 20 feet between the trunk and hardscape elements, this distance is impossible to maintain in streetscape settings. Soil conditions affect tree root trajectory and depth. The required compaction and site stabilization beneath roads and sidewalks creates a perfect environment for small roots to penetrate the concrete/asphalt and base material interface and grow to cause damage.

5.6.6.2 Locating Trees



Large scale trees planted on private property, public rights of way, in public parks and open space shall be positioned a proper distance from hardscape elements in order to decrease damage potential from root development.

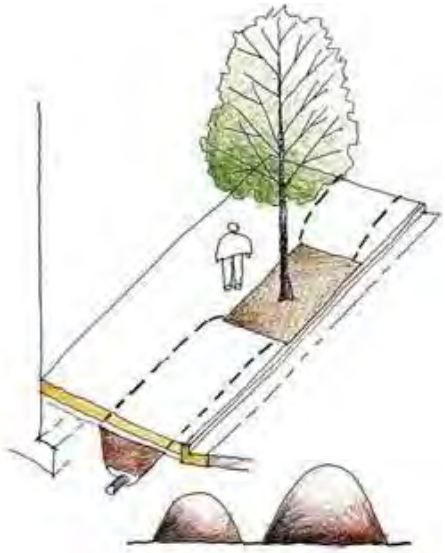
A standard detail, depicted at the right will result in significant damage to the sidewalk, curb/gutter and street as the tree grows.

As the tree develops, roots grow toward and beneath the sidewalk and street.

Street tree and right-of-way plantings near infrastructure shall be placed in locations where root /soil volumes can be expanded below or to the side of infrastructure elements. Some of the methodologies available include planting in the easiest places first. Make use of the spaces that currently have the largest soil volumes.

Expand “root paths” by extending and deepening the soil trench, creating more soil volume or root growth. This increases soil volume from 115 cubic feet to 365 cubic feet, two and one half times the volume

Soil trenches can be extended and connect street trees to further develop “root paths.”



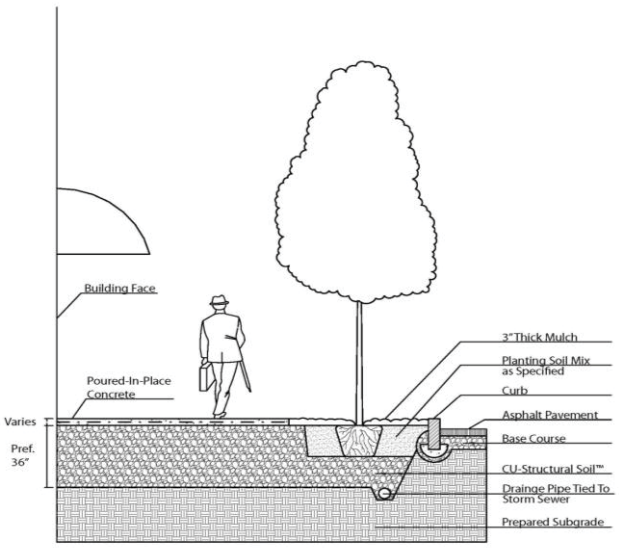
5.6.6.3 Structural Soils

Another innovative concept is Structural Soil (CU-Structural Soil) developed at Cornell University about 15 years ago.

The development of CU-Structural Soil was driven by the need for a load-bearing soil under pavement that can be compacted to 100% dry density (proctor density or modified proctor density) to bear the load of a pavement while allowing tree roots to grow through it. Previously, soils compacted to meet engineering specifications for load bearing restricted tree root growth.

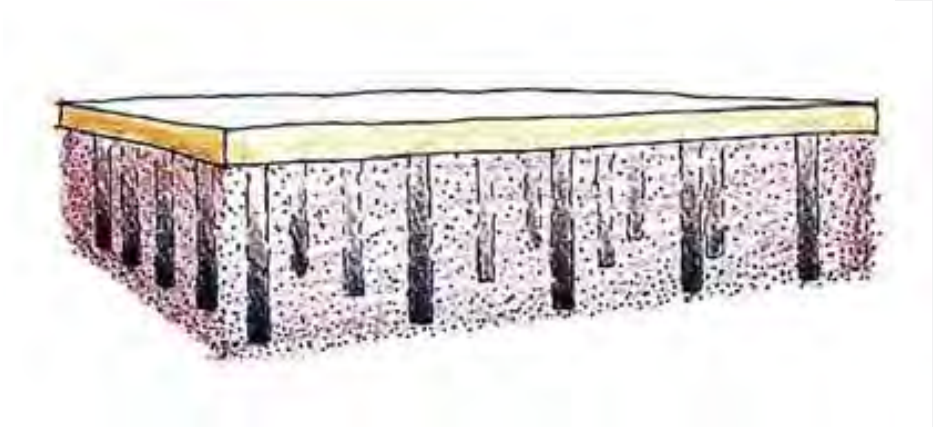
CU-Structural Soil is a mixture of crushed gravel and soil with a small amount of hydrogel to prevent the soil and stone from separating during the mixing and installation process. The keys to its success are the following: the gravel should consist of crushed stone approximately one inch in diameter, with no finer particles, to provide the greatest porosity. The soil needed to make structural soil should be loam to clay loam containing at least 20% clay to maximize water and nutrient holding capacity. The proportion of soil to stone is approximately 80% stone to 20% soil by dry weight, with a small amount of hydrogel aiding in the uniform blending of the two materials. This proportion insures that each stone touches another stone, creating a rigid lattice or skeleton, while the soil fills the large pore spaces that are created between the stone. This way, when compacted, any compactive load would be borne from stone to stone, and the soil in between the stones would remain uncompacted.

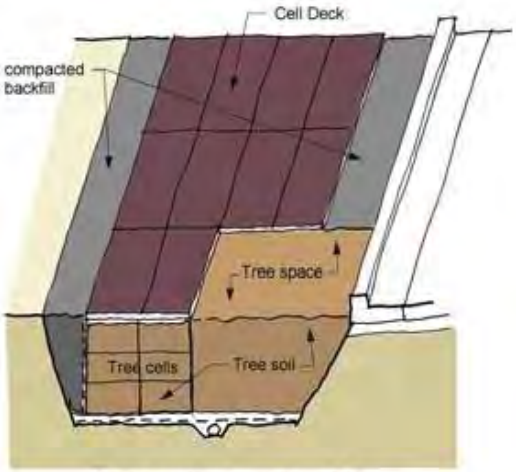
CU- Structural Soil requires, approximately 2 cubic feet of soil for every square foot of envisioned crown diameter. A 36" soil depth is recommended although several projects have been successful using as shallow as 24". We would not recommend any less than 24". CU-Structural Soil has an available water holding capacity between 7% and 12% depending on the level of compaction. This is equivalent to a loamy sand or sandy loam. (See the table below for soil volume recommendations). Because of its well-drained nature, trees that prefer well-drained soils do best in CU-Structural Soil. Depending on the stone type used to make it, the pH of the soil may be affected (e.g. limestone vs. granite). Good tree selection practices and establishment procedures should be used with CU-Structural Soil as would be done with any tree installation. It is important to maximize the water infiltration through the pavement to replenish CU-Soil as with any soil. This feature serves a dual purpose to expand stormwater infiltration



functions and decrease hardscape damage.

Another system is a structural cell configuration that is engineered to support above ground elements while increasing soil volume by 80%.





Completed cell and backfill installation

5.6.6.4 Strategies to Reduce Infrastructure Damage Potential

Adapted from *Strategies to Reduce Infrastructure Damage Potential,* Costello and Jones.

Alternative design methods to reduce tree/infrastructure conflicts include:

1. Curving sidewalks
2. Pop-outs
3. Reconfigured sidewalk alignment
4. Monolithic sidewalks
5. Increasing Right of Way
6. Build root paths, narrow trenches installed in compacted sub-grade material filled with root friendly material to encourage rooting
7. Root channels, directing root growth to areas of larger soil volume
8. Elimination of Sidewalks
9. Narrower Streets
10. Tree Islands
11. Bridges and Ramps
12. Lowered sites
13. Gravel layer between roots and concrete
14. Concrete with extra reinforcement/Thicker slabs
15. Pervious concrete promotes deeper rooting
16. Recycled rubber sidewalk panels
17. Root control diversion barriers

5.6.6.5 Trees and Infrastructure, Remedial Treatments

Once damage to infrastructure elements occurs, there are alternatives to tree removal including:

1. Grinding pavement to eliminate uplifted that cause trip hazards
2. Root pruning and the installation of root control diversion barriers
3. Mudjacking, lifting and resetting concrete slabs
4. Alternative materials for walkways that are either: thinner, modular, re-usable, easily replaced, and don't require complete root removal beneath the material

5.7. Tree Reports

5.7.1 Introduction

A tree report is needed for development projects and tree removal permits. The report must be prepared by a certified arborist for the applicant and submitted to the city for the purpose of providing accurate information and opinion regarding the condition, welfare, maintenance, preservation or value of a protected or designated tree.

5.7.1.1 When a Written Report is Required

Generally, there are two circumstances in which tree reports are required: 1) When a tree removal permit is sought, and 2) To complete and verify a site plan, assess tree impacts and establish tree protection for property development when within the tree protection zone of a protected or designated tree.

5.7.1.2 Who May Prepare the Report

The tree report is to be prepared by a certified arborist retained by the applicant or property owner. This person shall possess a current ISA certification, be a member of the American Society of Consulting Arborists; or a member of good standing in another nationally recognized tree research, care, and preservation organization.

5.7.2 Types of Reports

There are four types of reports, each of which are discussed below, namely:

1. Letter Report
2. Tree Survey Report
3. Tree Protection and Preservation Report
4. Tree Appraisal

5.7.2.1 Letter Report

A brief format is acceptable for removal and development related activities (described below), and can generally be used for assessing one or two trees. The report is to be on letterhead stationery of the individual preparing the report, including their ISA Certification number.

<u>Removal</u>

For a tree removal, not in connection with a property development, the report shall provide information and determination whether the tree is dead, High risk or constitutes a nuisance under the Pacific Grove Municipal Code Section 12.16.X.

<u>Development</u>

For development on a single family residential lot (not a subdivision), the report shall also clearly indicate whether or not any Protected or Designated tree is so close to the building area or building footprint that it will be killed or permanently injured by disturbance. The report must make specific recommendations to protect and preserve the tree during the course of construction consistent with the specifications within these standards.

Submittal Requirements

Standard information

All letter reports shall contain the following information:

- Arborist name and certification number;
- Purpose of the report and for whom;
- Site address; date of the inspection(s);
- A to-scale diagram of the tree(s) location;
- Accurate size of the trunk diameter (measurement taken at 54-inches above natural grade);
- Perimeter of leaf canopy;
- Proximity to structures;
- Condition of the tree health (and/or decay presence);
- Condition of the tree structure;
- Imminent danger of failing (ISA Hazard Rating, see High risk Trees, above);
- Interface with utility services;
- Conclusion and recommendation(s);
- Photographs (encouraged); and,
- Tree protection instructions (if applicable).

Specific Situations

Other conditions may require the following additional information on an as needed basis if requested by the reviewing city staff: tree protection plans; appraised value (see Tree Appraisal, below); and any other supporting information, photographs, diagrams, etc. that may be necessary.

5.7.2.2 Tree Survey Report

A more extensive Tree Survey Report is required for all development projects except those identified above (Letter Report). The Tree Survey Report shall inventory all trees that are greater than 4-inches in diameter (measured at 12-inches above natural grade) on site, including trees to be removed, relocated and retained on the property (including trees on neighboring properties that overhang the project site) and all Public trees in the right-of-way within 30-feet of the project site. In addition to the information required in a Letter Report, the Tree Survey Report shall also include an inventory of the trees, site plan, appraised value (see Appraisals, below) of the trees and any other information pertinent to the project.

Submittal Requirements

Items to include:

All Tree Survey Reports shall contain all items required for a Letter Report (identified above) as well as the following information:

- Cover letter;
- Title page;
- Table of contents (if necessary);
- Date of the inspection(s);
- Site plan (showing each tree location by number that correlates with the tree inventory on plans;
- A separate list of all Protected Trees with location numbers;
- Tree inventory data (include tree species, size, health, structure, etc. for all trees on the project site, including those to be removed (tables may be used);
- Condition of the trees (include information with respect to health, structure, decay, imminent danger of falling, existing property lines, structures and utility services);
- The monetary value that each tree contributes to the real estate value of the property shall be determined and listed separately. The formula used should be noted (see Tree Appraisal, below); and,
- Conclusion, recommendation(s) and ratings for suitability for preservation.

If necessary, other supporting information, photographs, diagrams, etc. may be required or provided.

5.7.2.3 Tree Protection and Preservation Plan

All Protected or Designated Trees to be retained on a development site shall be shown on approved sets of civil, building and landscape plans and shall be protected during the construction process. A Tree Protection and Preservation Plan submitted for review by the Community Development Department and the City Arborist is required when trees to be saved may be injured by disturbance.

The Tree Protection and Preservation Plan shall assume compliance with the standards described in this UFMP (see Protection of Trees During Construction, above). In addition, the following submittal information must be included in the report:

<u>Submittal Requirements</u>

<u>Disclosure of All Trees On and Near the Site</u>

The property owner or designee shall provide accurate information to the project arborist to develop the tree protection measures and to enable accurate recommendations to insure their survival. This site plan shall accurately show the surveyed location, species, size of trunk and leaf canopy; show the tree protection zone of any neighboring trees that may overhang the site and Public trees that are within 30 feet on each side of the project. Failure to show a tree on

the plans and later determined to be affected by construction may require the work to stop until mitigation can be agreed upon by the property owner and the city.

Final Improvement Plans

In addition to the above information, final improvement plans shall include and show the following information: show the tree protection zone of any tree to be retained and the protective fencing around the protected zone of each tree or group of trees (to be clearly identified as such on all plans as a bold-dashed line); permeable paving located within the tree protection zone area; approved utility pathways; grade changes; surface and subsurface drainage and aeration systems to be used; walls, tree wells, retaining walls and grade change barriers, both temporary and permanent; landscaping and irrigation within tree protection zone of trees.

5.7.3 Tree Appraisal

Landscape value may contribute from seven to 20 percent of the real estate property value. An individual tree has an inherent value to the real estate that can be determined by an appraisal prepared by a certified arborist.

An appraisal is a process for determining a monetary opinion of the value of a tree as it relates to either the property, a group of trees and/or the immediate community. A qualified certified arborist is required to determine this value, and must exercise good and fair judgment by adjusting the basic value by the tree's condition and location.

The certified arborist must prepare the appraisal by using the most current edition of the 'Guide for Plant Appraisal', published by the Council of Tree and Landscape Appraisers.

There are two methods to determine tree value; 1) the Replacement Method, based upon the size and availability of the replacement tree or, 2) the Trunk Formula Method, if the tree cannot be replaced (e.g. not sufficient room on site or it is too large to replace). In all cases, the type of formula used must be identified.

5.7.3.1 The Replacement Cost Method

This method applies to smaller trees with a trunk size up to 4 inches in diameter or, 48 inch box size trees replaceable. The appraised value is determined by combining: price quote + transportation + planting + other costs and applying the condition and location value to the tree. The sum of these is the appraised replacement cost.

5.7.3.2 The Trunk Formula Method

This method applies to trees that are too large for practical replacement (transplanting) and shall be appraised by: determining the basic tree value and adjusting this value by a condition and location ratings. The appraised value shall be determined by using the most recent edition of the 'Guide for Plant Appraisal', published by the Council of Tree and Landscape Appraisers.

The Trunk Formula or Replacement Method Forms for Northern California established by the International Society of Arboriculture must be used to

compute the appraised value. All trees with a stem larger than 4 inches in diameter when measured at 12inches above natural grade shall be calculated in this manner.

6 | REFERENCES / BIBILIOGRAPHY

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APPENDIX

In this Appendix:

Appendix A – Pacific Grove Tree Ordinance
Appendix B – Definitions
Appendix C – Tree Planting Specifications
Appendix D – Tree Maintenance

Appendix A
Pacific Grove Tree Ordinance

Appendix B
Definitions

The following definitions apply to the Urban Forest Management Plan, including the Urban Forestry Standards described in Chapter 5, and the Pacific Grove Municipal Code Title 12 -- Trees and Vegetation.

To be inserted if Appendix A – Tree Ordinance is separated from this UFMP.

Appendix C
Landscape Trees for Pacific Grove -- A Guide to Selection, Planting, and Care

To be inserted in final document - discuss with UFAC

Appendix D
Tree Planting Specifications

Planting Stock and Materials

Planting specifications apply for trees and shrubs that are: 1) Planted as a replacement for a Regulated Tree, 2) To be planted as a Street Tree within the city right-of-way or other public land; or 3) Planted as part of a landscape plan subject to non-residential development approval. Using the following specifications will result in consistent city-wide plantings, and superior tree growth and vitality. To achieve this, the landscape architect shall incorporate these items into their specifications.

Quality

It is the contractor's responsibility to supply stock that meets ANSI 760.1-1996 and these Urban Forestry Standards.

- All plants and trees installed within the City of Pacific Grove shall conform with American Association of Standards, ANSI Z60.1, Specifications for Acceptance of Nursery Trees at the Time of Delivery, in all ways.
- Plants must be sound, healthy, vigorous, and free of plant disease and insect pests and their eggs.
- Container stock is to be grown for at least 8-months in containers in which they are delivered and shall not be root bound or have girdling roots.
- Trees shall not have been topped or headed.
- The project arborist or contractor is required to inspect and verify, in writing, that all plant material to be installed on the site meets the above standards and is acceptable. The written verification must be forwarded to the City Arborist within one week of acceptance per the Inspection Schedule, as described above. Inspection by the project arborist or contractor is to occur after delivery of stock to the project site.
- Plants and trees with broken tops, branches or injured trunks are to be rejected.

Miscellaneous Materials

The following materials are to be used unless otherwise specified:

- Tree stakes. Support stakes shall be treated 2-inch diameter Lodge pole Pine, two stakes per tree, or approved equivalent. No cross brace should be used. After installation, stakes should be trimmed so that the branches clear the top of the stake.
- Tree Ties. VIT Products Inc. tree supports (recommended) or equivalent, twist brace, fabric-reinforced rubber (3/8-inch minimum), or equivalent approved by the City of Pacific Grove should be used and installed in a figure eight fashion to support the tree to the stakes.
- Mulch. Screened untreated wood chips 1/2- to 1-inch in size, spread to a 2-inch depth out to the edge of the root ball. The mulch should be kept

at least two inches away from the trunk and should be applied to each tree (see Mulching, below).

- Root Control Barriers. Use along all public sidewalks, and indicate on approved plans and drawings. 18-inch Linear Barrier (LB18-2) root control barrier should be used. Unless specified otherwise, a 10-foot length should be placed on center with the tree and on the sidewalk side only. Root barrier boxes are not approved.
- Mower guards. For trees in turf areas requiring regular mowing, the tree stem should be protected with TreeGuard or equivalent.
- Tree Grates. Where sidewalk width is less than 8-feet and new trees will be installed in a tree well, metal tree grates shall be used and approved by Public Works. Minimum size grates shall be 4' x 4' unless specified otherwise. All tree grates are to be mounted in frames, frames inset into a concrete foundation within the sidewalk or surface material and flush with the surrounding surface.

Planting Site Preparation

Soil Preparation and Conditioning

All debris, wood chips, pavement, concrete and rocks over 2- inches in diameter should be removed from the planting pit to a minimum of 24-inch depth, unless specified otherwise.

Planter Pit

Trees in a confined planter pit or sidewalk area should be excavated to a minimum of 30-inches deep and the sides of the pit scarified. Soil beneath the rootball is to be compacted to prevent settling.

Trees in all other areas should be excavated to a minimum width of three times the diameter of the container, and deep enough to allow the root ball of the container to rest on firm soil. Scarify the sides and the bottom of the pit.

The height of the container root ball should be 1-2-inches higher than grade level, except when structural urban tree soil mix is used (see Alternative Base Course Materials, below), in which case the tree may be planted at level grade.

Drainage

For discretionary development projects, a percolation test is required to ensure there is adequate drainage for planting new trees. A minimum of one test per development site is required. Additional tests may be needed as required by City Arborist.

Fill planting hole with water and ensure that drainage is greater than 2-inches per hour. If percolation is less, one or more of the following mitigation measures must be implemented for tree planting:

- Install a French drain that radiates away from the tree with a minimum of 18-inches in depth filled with drain rock. The grade should fall away from the tree trunk.
- Install drain tiles or perforated pipe directing water away from the tree.

- Install a drain chimney at the bottom of the planting pit, a minimum of 4-inches in diameter and filled with medium sand or fine gravel to ensure percolation of all water from the filled planter pit. Auger bore drain holes to penetrate hard pan or cileechee clay a minimum of 12-inches into undisturbed pervious soil. Angle the boring as close to vertical as possible.

Aeration Tubes for Trees

Street Trees

Street trees planted in the city right-of-way, sidewalk planter pits, planting strip, medians or designated trees when specifically required in development plans, are required to use 4-inch diameter perforated aeration piping (rigid or flexible), circling the bottom of the planter connected to a 'T' fitting to two riser tubes with grated caps and wrapped with filter fabric. This detail shall be shown on the approved landscape plans.

All Other Trees

All other trees are required to be planted with 4-inch diameter perforated aeration tubes with grated plastic caps placed at the edge of the root ball to the bottom of the pit per Table D-1: Aeration Tubes Requirements . Irrigation heads may not be installed inside the aeration pipes.

Table D-1: Aeration Tubes Requirements

Tree Size	Number of Tubes
15 gallon	1
24' box	2
36' box	2
48' box	4 or as needed

Source: City of Palo Alto Tree Technical Manual, 2001.

Any of the above holes, pipes, grates or fixtures are to include the installation of filter fabric wrap over the side openings and secured as recommended by manufacturer when connected to an approved aeration system.

Tree Planting

Watering the Hole

If the soil is dry, add a few inches of water in the hole. Let the hole drain before planting the tree.

Depth

To check the proper depth of the rootball, place the tree in the hole and lay a pole or shovel across the original grade - the top of the root ball should be 1 to 2-inches higher.

Container and Roots

Remove tree from the container and trim the root ball in the following way:

- Thick circling roots: straighten and/or cut cleanly.
- Thin roots: make three to four vertical cuts 1/2-inch deep around root ball, spread the bottom out if necessary.

Placing the Tree

Locate the tree in the hole, and rotate the tree to direct the main branches away from the street side, if possible.

Filling the Hole

Place the aeration tubes, fill the hole halfway up with original soil (amended soil only when approved), and gently tamp out air pockets with a pole or shovel handle. Add about 1-inch of water, and let drain. Fill the rest of the hole to grade, water the fill soil, and let drain.

Staking

Place the stakes at the edge of the root ball (drive them 2-feet into undisturbed ground), and avoid contact with the branches. If in a windy area, set the stakes in a plane at right angles to the wind. Remove the nursery stake. Loosely place two ties in a figure eight around the trunk, as low as needed to hold the tree upright and nail to the stake. Stakes should be trimmed so that the branches clear the top of the stake. Do not install a cross-brace.

Berm, Mulch and Water

In non-turf areas, form a soil berm 3 to 4-inches high at the outermost edge of the root ball. Place 1 to 2-inches of mulch or bark over root ball and berm, keeping the mulch away from the trunk a minimum of 2-inches. Fill the berm with water to capacity.

Planting in Difficult Soil Conditions

Turf Areas

In turf areas that receive regular watering, the watering berm may be eliminated. It is recommended (not required) that the turf be maintained a minimum of one foot from the new tree stem, and mulch placed on top of the rootball. Avoid mulch touching the tree stem. In turf areas, install tree guards (TreeGuard or equivalent)

Alternate Specifications

Occasionally, tree planting must occur in poor or difficult soil where standard planting techniques will result in poor-to-average performance or mortality (such as unique or unusual regional geology, slope, soil volume, restrictive physical or chemical properties, poor drainage, etc.). In this case, it is recommended (not required) that the responsible party investigate alternative solutions to enable long term tree growth. Alternative planting specifications or plans that vary from the native or typical soil conditions should be submitted to the City Arborist for approval prior to installation.

Alternative or specified soils, such as engineered, amended or structural urban tree soil mix, including written specifications and physical samples, should be

submitted for approval from the City Arborist (see also Alternative Base Course Materials, below).

Tree Conflicts with Infrastructure

Whenever possible, large-scale trees planted on private property, public rights-of-way, in public parks and open space are to be positioned a sufficient distance from hardscape elements to decrease potential damage from root development.

For existing trees, conflicts may occur when tree roots grow adjacent to paving, foundations, sidewalks or curbs (hardscape). Improper or careless extraction of these elements can cause severe injury to the roots and instability or even death of the trees. The following alternatives must first be considered before root pruning within the TPZ of a Regulated Tree.

Removal and Replacement of Pavement or Sidewalk

Removal of existing pavement over tree roots shall include the following precautions:

- Break hardscape into manageable pieces with a jackhammer or pick and hand load the pieces onto a loader.
- The loader must remain on undisturbed pavement or off exposed roots.
- Do not remove base rock that has been exploited by established absorbing roots.
- Apply untreated wood chips over the exposed area within one hour, then wet the chips and base rock and keep moist until overlay surface is applied.

Replacement of pavement or sidewalk: An alternative to the severance of roots greater than 2- inches in diameter should be considered before cutting roots. If an alternative is not feasible remove the sidewalk, grind roots only as approved by the City Arborist and replace sidewalk using #3 dowels at the expansion joint if within 10-feet of a street tree. Use a wire mesh reinforcement within if within 10-feet of the trunk of a protected or street tree.

Note: Any work in the right-of-way requires a street work permit from Public Works Department.

Alternative Method to Prevent Root Cutting

The following recommended remedies should be considered before cutting tree roots that may result in tree instability or decline:

- Grinding a raised sidewalk edge.
- Ramping the walking surface over the roots or lifted slab with pliable paving.
- Routing the sidewalk around the tree roots.
- Install flexible paving or rubberized sections.
- On private property, new sidewalk or driveway design should consider alternatives to conventional pavement and sidewalk materials. Substitute

permeable materials for typical asphalt or concrete overlay, sub-base or footings to consider include but are not limited to: permeable paving materials, interlocking pavers, flexible paving, wooden walkways, porches elevated on posts and brick or flagstone walkways on sand foundations.

Avoiding Conflict

Conflicts and associated costs can be avoided or reduced by the following recommended planting practices:

- Plant deep rooted trees that are proven to be non-invasive.
- Over soil that shrinks and swells, install a sidewalk with higher strength that has wire mesh and/or expansion slip joint dowel reinforcement.
- Follow soil loosening planting techniques to promote deep rooting.
- Install root barrier only along the hardscape area of the tree (but allow roots to use open lawn or planter strip areas).
- Dedicate at least 10-linear feet of planting space for the growth of each tree.

Alternative Base Course Materials

When designing hardscape areas near trees, the project architect or engineer should consider the use of recommended base course material such as an engineered structural soil mix and/or structural cells which will allow a long term cost effective tree and infrastructure compatibility. These types of materials are particularly well suited for the following types development projects:

- Repair or replacement of sidewalk greater than 40-feet in length;
- Subdivisions with new street tree plantings;
- Planting areas that are designed over structures or parking garages;
- Confined parking lot medians and islands or other specialized conditions as warranted.

City of Pacific Grove

Urban Forest Management Plan

APPENDIX B: EXISTING CITY GOALS RELEVANT TO URBAN GREENING

FROM GENERAL PLAN:

Transportation Section (chapter 4):

Transportation Goal 7. Promote pedestrian and bicycle travel as alternatives to automobile use.

Transportation Policy 10: Encourage design for new and expanded development that facilitates access by transit, walking, bicycles, and carpools.

Transportation Policy 25: Create and maintain a safe and convenient system of pedestrian and bicycle pathways throughout the city.

Parks and Recreation Section (chapter 5):

Parks and Recreation Goal 1. Maintain a public park system and recreation facilities suited to the needs of all Pacific Grove residents.

Parks and Recreation Goal 2. Designate adequate land for developing parks and recreation facilities.

Parks and Recreation Goal 3. Establish recreation programs suited to the broad needs and diverse interests of Pacific Grove residents of all ages.

Parks and Recreation Policy 5: Where practical, foster the use of drought-tolerant and drought resistant landscaping in City parks.

Natural Resources Section (chapter 6):

Natural Resource Section Goal 1. Comprehensively manage Pacific Grove's vegetation and wildlife habitat

Natural Resource Section Goal 2. Protect Pacific Grove's coastal resources

Natural Resource Section Goal 3. Preserve public visual access to the ocean

Natural Resource Section Goal 4. Protect Pacific Grove's water and marine resources.

Natural Resource Section Goal 5. Protect Pacific Grove's biological resources.

Natural Resource Section Goal 6. Protect endangered species.

Natural Resources Policy 2: Develop a vegetation and wildlife habitat management program.

Natural Resources Policy 3: Actively promote tree planting to maintain and renew the urban forest.

Natural Resources Program B: Prepare and adopt a comprehensive and citywide urban forest management plan.

Natural Resources Program C: Work with citizens to encourage tree planting on private property.

Natural Resources Program D: Encourage the restoration and maintenance of native plants.

Natural Resources Policy 5: Manage the use of publicly-owned environmentally sensitive areas.

Natural Resources Policy 7: Develop procedures to more effectively focus the abundance of environmental and other volunteerism available to the City.

Natural Resources Policy 8: When reimbursement is available, cooperate with State and federal agencies in reducing impacts from urban runoff.

Natural Resources Program I: Adopt citywide, comprehensive pollution, erosion, and drainage control ordinances.

Natural Resources Policy 9: Prohibit the unsafe use of chemical pesticides and herbicides.

"Public access is one of the major goals of the Coastal Act."

- PG Land Use Plan, 2016

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APPENDIX C: COMMUNITY WORKSHOP PRESENTATION

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URBAN GREENING IN PACIFIC GROVE

Community Meeting

September 16, 2016

10:00 A.M.

PRESENTED BY:

CITY OF PACIFIC GROVE, CA. INC. 1889

FALL CREEK ENGINEERING, INC.

JONI L. JANECKI & ASSOCIATES

INTRODUCTION

URBAN GREENING PLAN CONNECTIONS:

- Area of Special Biological Significance (ASBS)
- National Pollution Discharge Elimination System (NPDES)
- Local Coastal Program (LCP)

WORKSHOP OVERVIEW

TODAY'S GOAL: Community input on the Urban Greening Plan development and potential project locations.

TODAY'S SCHEDULE:

Part 1 - Key Concepts

Part 2 - Feedback

Part 3 – Review Potential Sites and "Voting"

WHAT IS URBAN GREENING?

BENEFITS:

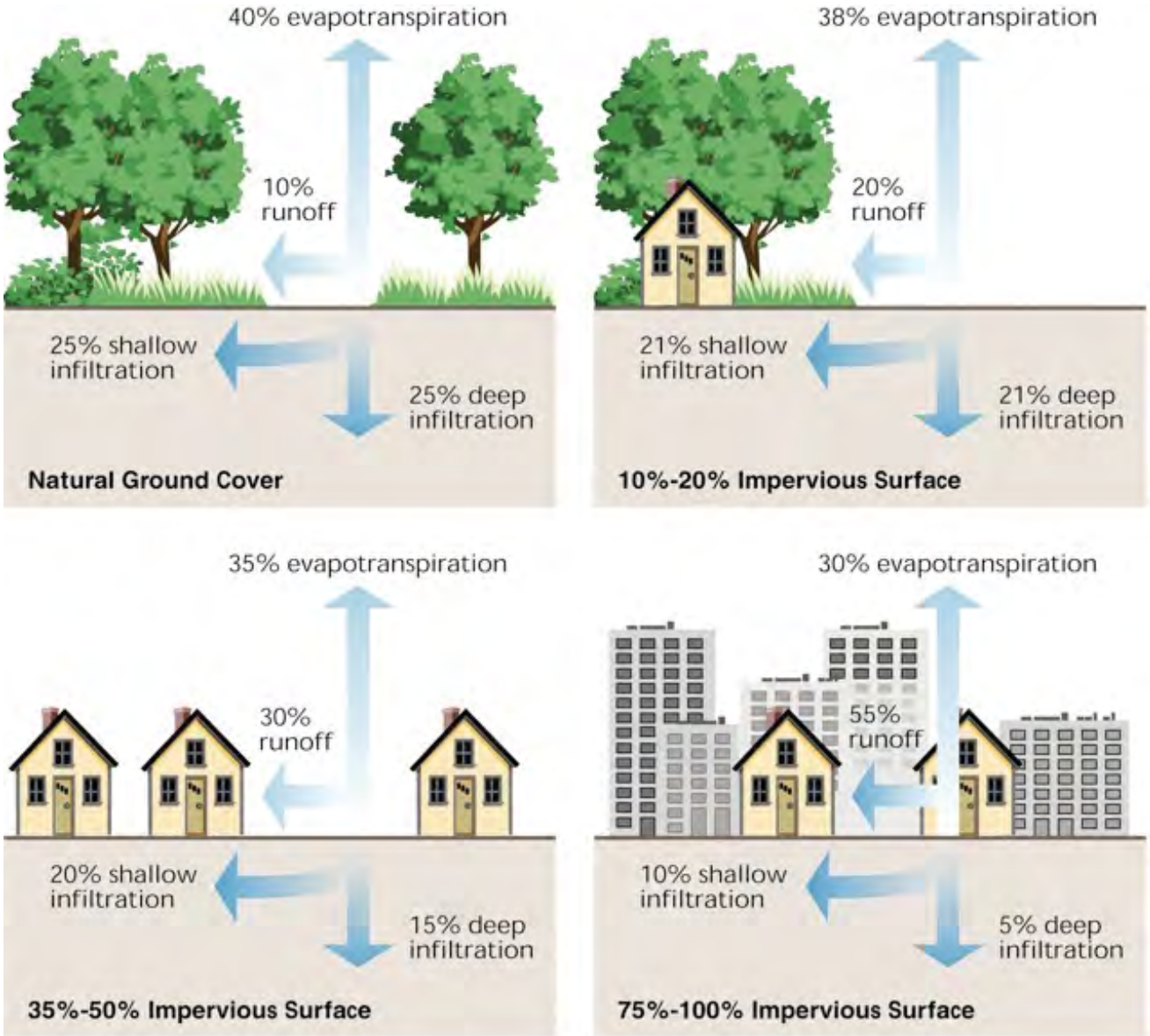
- Reduce flooding
- Improve stormwater quality
- Provide wildlife habitat
- Help maintain air quality
- Reduce urban heat islands
- Provide open space for the community

WHAT IS URBAN GREENING?

before

after

IMPERVIOUS SURFACE EFFECT



WHAT IS LID?

LOW IMPACT DEVELOPMENT (LID) =

A strategy to restore natural ecological and hydrological function

GOALS:

- **Reduce runoff rates**
- **Filter pollutants**
- **Facilitate infiltration**

LID SITE DESIGN

CONCEPTS:

- Reduce impervious surfaces
- Integrate water conserving landscaping
- Preserve habitat and plant trees
- Naturalizes engineered features

LID PRACTICES

APPLICATIONS:

- **Downspout Disconnection**
- **Bioretention/Rain Gardens**
- **Permeable Pavement**
- **Grass/Dry Swales**

LID SITE CONSIDERATIONS

LOCATIONS WITH:

- **Connected downspouts?**
- **Drainage patterns towards existing open space?**
- **Existing concrete or asphalt in poor condition?**
- **Tree planting or turf replacement opportunity?**

URBAN GREENING PLAN

Identify projects, plans, policies, and programs to achieve Urban Greening Goals

Goal 1: Stewardship of Environmental Resources

Goal 2: Maintain and Enhance City Identity

Goal 3: Promote Alternative Transportation

Goal 4: Implement Sustainable (Re)Development

PLAN COMPONENTS

1. Public Tree Inventory
2. Landscape Trees for Pacific Grove
3. Landscaping Guidelines and Policies
4. Watershed Modeling
5. Stormwater LID Assessment

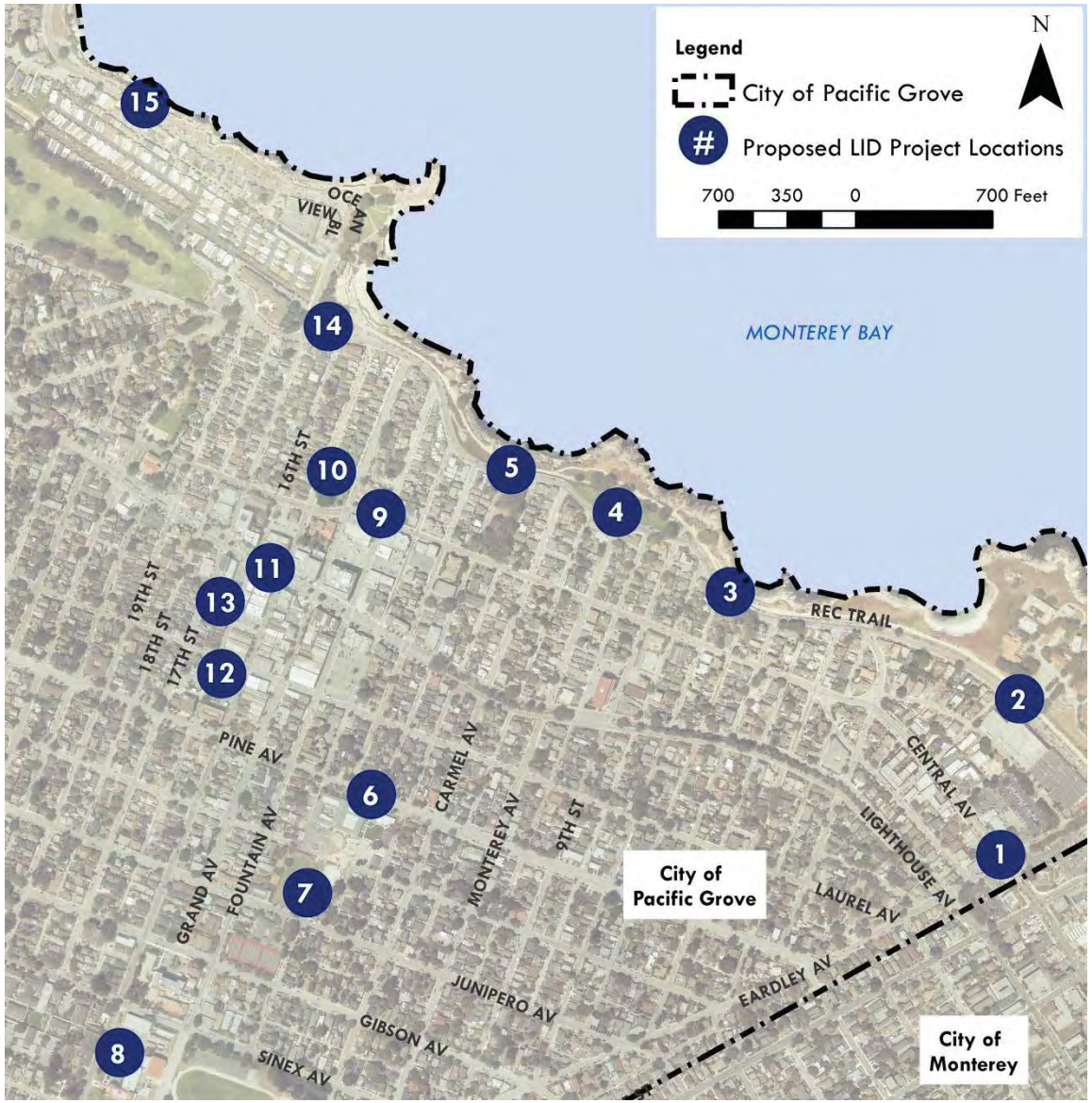
PART 2: FEEDBACK

- Comments?
- Questions?
- Input?

PART 3: POTENTIAL PROJECT SITES / VOTING

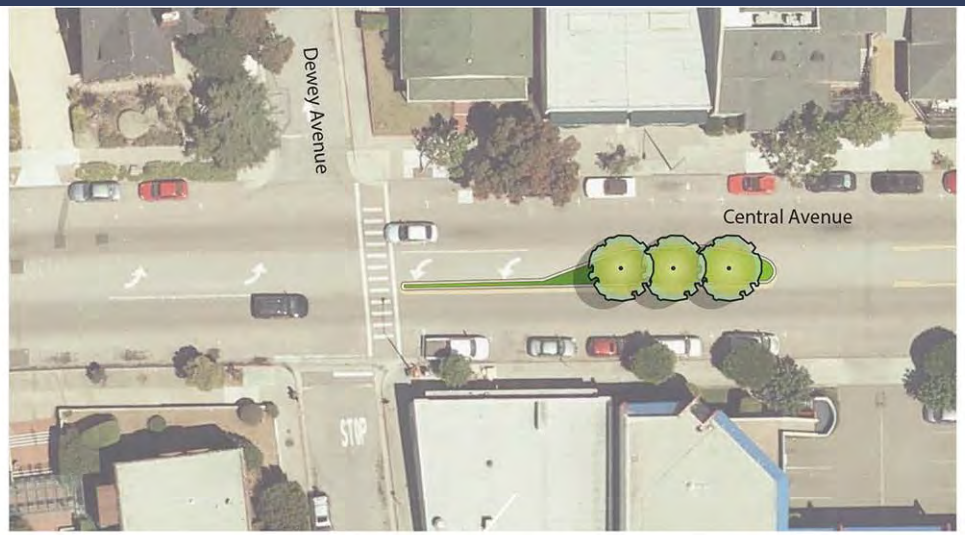
- Review project locations
- Community feedback / questions
- Voting

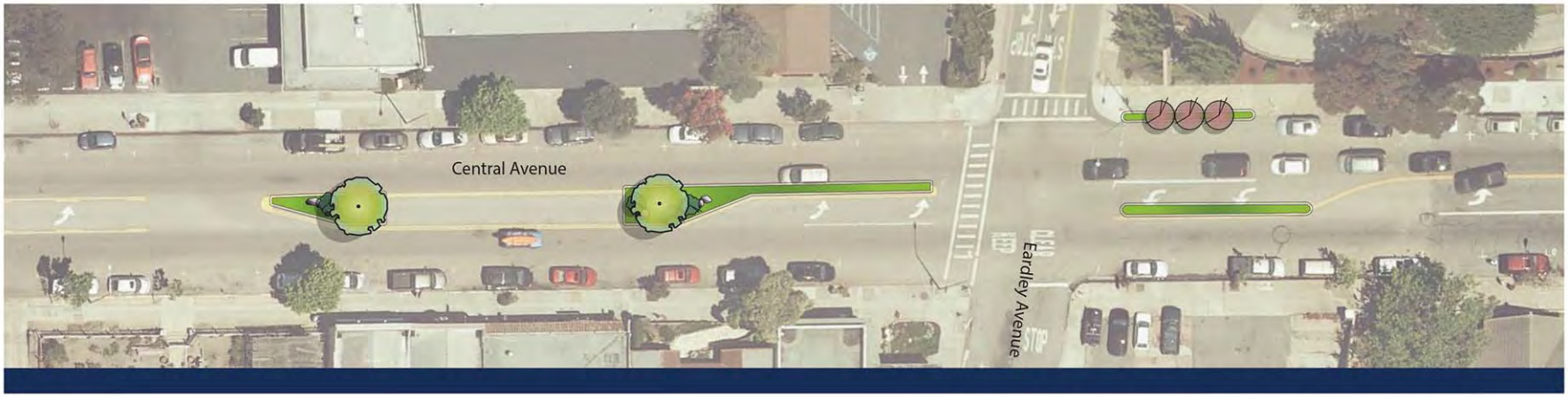
POTENTIAL SITES



NOTE: Numbering South to North, not by priority

CENTRAL AVENUE – BULB RETROFITS





LEGEND

BIORETENTION PLANTERS WITH BOULDERS AND MIXED PLANTINGS

PROPOSED NEW TREE AND SHRUB PLANTING

CENTRAL AVENUE - BULB RETROFITS

1

DEWEY AVE. TO EARDLEY AVE. – DRY SWALE

LEGEND

BIORETENTION WITH NATIVE GRASSES

BOULDERS

DEWEY AVENUE TO EARDLEY AVENUE - DRY SWALE

2

7TH STREET - BIORETENTION

LEGEND

BIORETENTION WITH
NATIVE GRASSES AND BOULDERS

7TH STREET - BIORETENTION

BERWICK PARK - BIORETENTION

LEGEND

BIORETENTION WITH NATIVE GRASSES AND SHRUBS

BOULDERS

PATH BETWEEN BIORETENTION PLANTING AREAS

BERWICK PARK - BIORETENTION

4

12TH TO 13TH STREET - BIORETENTION

LEGEND

BIORETENTION WITH NATIVE GRASSES AND SHRUBS

BOULDERS

12TH TO 13TH STREET - BIORETENTION

PINE AVENUE – GREEN STREET

PINE AVENUE - GREEN STREET

ROBERT DOWN ELEMENTARY

LEGEND

TURF WITH STORMWATER STORAGE (EPIC SYSTEM)

ROBERT DOWN ELEMENTARY

P.G. MIDDLE SCHOOL, DOWNSPOUT DISCONNECT

LEGEND

BIORETENTION WITH NATIVE GRASSES AND BOULDERS

DOWNSPOUT DISCONNECTION

PACIFIC GROVE MIDDLE SCHOOL DOWNSPOUT DISCONNECT

P.G. PUBLIC LIBRARY BIORETENTION – LANDSCAPE BULBS

LEGEND

BIORETENTION LANDSCAPE BULBS WITH TREE PLANTING

PACIFIC GROVE PUBLIC LIBRARY BIORETENTION - LANDSCAPE BULBS

JEWELL PARK - BIORETENTION

LEGEND

BIORETENTION WITH MIXED NATIVE SHRUBS, GRASSES AND BOULDERS

TREE PLANTING

PATHWAY THROUGH PLANTING AREA WITH EDUCATIONAL SIGNAGE

JEWELL PARK - BIORETENTION

LIGHTHOUSE AVENUE – GREEN STREET

LEGEND

BIORETENTION PLANTERS WITH BOULDERS AND MIXED PLANTINGS

PERMEABLE PAVING

PROPOSED NEW TREE AND SHRUB PLANTING

LIGHTHOUSE AVENUE - GREEN STREET

CITY HALL – COURTYARD PLAZA RETROFITS

LEGEND

BIORETENTION WITH NATIVE GRASSES AND BOULDERS

PERMEABLE PAVING

DOWNSPOUT DISCONNECTION

CITY HALL - COURTYARD PLAZA RETROFITS

FANDANGO PARKING LOT RETROFIT

LEGEND

- BIORETENTION PLANTERS WITH BOULDERS AND MIXED PLANTINGS
- PROPOSED NEW TREE AND SHRUB PLANTING
- PERMEABLE PAVING
- DOWNSPOUT DISCONNECTION

FANDANGO PARKING LOT RETROFIT

LOVERS POINT PARKING LOT RETROFIT

LEGEND

BIORETENTION PLANTERS WITH BOULDERS AND MIXED PLANTINGS

PROPOSED NEW TREE AND SHRUB PLANTING

PERMEABLE PAVING

LOVERS POINT PARKING LOT RETROFIT

OCEAN VIEW CURB CUTS TO RAIN GARDENS

LEGEND

BIORETENTION WITH NATIVE SHRUBS, GRASSES AND BOULDERS

OCEAN VIEW CURB CUTS TO RAIN GARDENS

URBAN GREENING PLAN TIMELINE

OCTOBER:

DRAFT Plan Available On-line for Community Review & Comment *

NOVEMBER:

DRAFT Plan to City Beautification & Natural Resources Committee

DECEMBER:

FINAL Plan to City Council

** When draft is posted, notice will go out to those who provide emails today*

THANK YOU FOR COMING!

ADDITIONAL INFORMATION:

http://www.cityofpacificgrove.org/living/green-pg/environmental-programs-grants/urban-greening

QUESTIONS:

Daniel Gho
dgho@cityofpacificgrove.org
(831) 648-5722

PROJECT FUNDING:

This plan was made possible through funding provided by Prop. 84 to improve the sustainability and livability of California's communities.

Date: Friday September 16, 2016

Time: 10:00 am

Location: Community Center

Participants: City of Pacific Grove (PG): Daniel Gho & Anastazia Aziz
Fall Creek Engineering (FCE): Emily Corwin and Robyn Cooper
Joni L. Janecki & Associates (JLJA): Amy West

Meeting Objectives: A public workshop was held for community members to provide valuable input on the LID and Urban Greening Plan development. The workshop provided an overview of the DRAFT Urban Greening Plan, including the approach, possible LID retrofit locations, and timeline.

Attachments:

- PDF of Workshop Powerpoint Presentation
- Workshop Community Sign-in Sheet

Action Items in **Bold.**

Public Workshop Format. The public workshop was divided into three parts: (1) a power point presentation and introduction to key Urban Greening Plan and LID concepts, (2) an opportunity for facilitated feedback on concepts, criteria, and projects, and (3) individual review and "voting" on priority projects. The following feedback and questions were raised by the community during each of the three workshop segments.

Part 1: Presentation: The complete presentation in PDF format is attached, with minor corrections to the Introduction slide from the version that was presented on 9/16 (ASBS and NPDES definitions corrected).

Part 2: Facilitated Feedback:

Community Question (CQ): What is a swale?

Response (R): Eardley Avenue cross section provided as a swale example, with an emphasis that swales are typically LID features with the ability to convey stormwater with a linear/stream like function.

CQ: What is the City's ability to maintain the proposed projects?

R: Not a lot of additional maintenance is expected. LID projects can be less or equal to the maintenance of traditional curb/gutter stormwater systems.

CQ: Concern that bioretention features are too boggy or too dry.
R: Irrigation is typically recommended to establish plants within a new Bioretention feature, but the irrigation demand is less than turf. The engineered soil media is designed for quick infiltration and overflow or underdrain elements can be incorporated at the design/construction phase to prevent water from ponding for more than 24 hours.

CQ: How will the City know if the new LID or stormwater projects are helping to improve water quality in the ASBS?
R: The recently completed Central Coast Regional Monitoring Program sets a baseline for water quality conditions over the last 4 years. Future monitoring after project implementation will attempt to demonstrate project effectiveness.

CQ: Should new driveways be installed or existing driveways replaced with more permeable surface alternatives?
R: Replacement of existing driveways with permeable alternatives is already encouraged by the City.

CQ: Is the existing storm drain system already overwhelmed? Specifically a section of Forest Drive where surface water is regularly observed?
R: In this area there are "bubble ups" that safely convey water beneath Forest Avenue and allow groundwater and sediment to accumulate. The City vacuums these locations once a month to maintain operability.

CQ: Are there mechanical systems to remove oils, pollutants, and debris from stormwater? Is the debris disposed of at landfills?
R: The City has a two pronged approach to clean stormwater before it enters the Monterey Bay and the Ocean. Mechanical units have been installed at four locations (with a fifth coming this fall) throughout the ASBS drainage area. These systems are regularly maintained and the debris appropriately disposed of. This Urban Greening Plan and the potential LID projects complement the mechanical "grey" systems.

CQ: Does the City have a policy to discourage curb cuts or are they illegal?

R: There is no policy that prevents the installation of curb cuts. The location needs to be carefully considered to prevent tripping hazards and meet ADA standards. Curb cuts are often placed in parking areas without introducing a tripping hazard.

CQ: With these LID projects or the Urban Greening Plan effect the future redevelopment of the American Tin Cannery?
R: The City understands that the redevelopment project will be designed to LEED Platinum standards which would require zero stormwater runoff from the site.

CQ: Where will the money for the plants come from? How will these projects be funded?
R: Funding is possible with State input or grant funding. Many of the proposed projects are relatively low cost.

CQ: For the projects that don't move into the next phase of schematic design, do they still have potential to be implemented?
R: All 15 projects will be included in the Urban Greening Plan, and in that way will continue to be a part of the Cities CIP planning process.

CQ: Where will this information be located?
R: The Draft Urban Greening Plan will be available on the City's website in October for community review and input.

Part 3: Comments/Discussion on Specific Projects:
(Includes notes from discussion and those placed on "stickies to individual project posters")

Dewey/Eardley Dry Swale

- Work around the existing Cypress tree located in the vicinity of the proposed swale.
- Note that the ditch across from the trail is not on City property.
- "We're great re: educating tourists concerning water conservation. Let's educate the tour bus industry re: cigarette butts, etc. within our area."
- "Maybe the City could partner with Project Bella"

Berwick Park Bioretention

- "Add permeable sidewalks along Ocean View"
- "Consider buffering park activities with streetscape. Preserve turf area for park activity, minimize square footage of bioretention."

12/13th Street Bioretention

- "We need a picture of this area now, before improvement"

Pine Avenue Green Street

- **The existing schematic is confusing; the description says the road will be clear to accommodate community events, whereas the graphic shows a center median.**
- The City has existing funds to start evaluating this project.

PG Middle School

- Use for students to do the math to calculate the sizing and amount of irrigation that can be provided.
- **The City will need to revisit its Cistern policy to be consistent with a project like this.**
- "Utilize school arts programs, to "decorate" the cisterns, etc."

PG Library Bioretention Bulbs

- Development is proposed on this corner, so this project could be well timed.
- This is a busy corner in terms of kids, farmers market, and community activities so it has very high visibility for public education and awareness.
- Also can provide a traffic calming effect.
- "Needs green zone here - an island with a large tree (Oak) to fill this large space wasted in the street intersection" (Sticky placed at Fountain and Central)

Jewell Park

- The garden could be themed, though if edibles are included, consideration will need to be given to deer protection.

Fandango Parking Lot

- "This project is a simple solution that would result in huge benefit for the ASBS and visual quality"

Ocean View Curb Cuts

- " This would be my #6 but I am afraid it won't make it past the Magic Carpet devotees"

- "Many people access the parks "accessing" from the road. Can the green areas be located closer to the cliff (or the other parts) toward rest work as well?"