Machado Lake Nutrient TMDL Implementation Plan

Prepared for:

City of Carson

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1. Introduction

The city of Carson Implementation Plan (IP) was developed in compliance with the Machado Lake Eutrophic, Algae, Ammonia, and Odors (Nutrient) Total Maximum Daily Load (TMDL) which was adopted by the Los Angeles Regional Water Quality Control Board (Regional Board) on May 1, 2008. The TMDL was subsequently approved by the State Water Resources Control Board (State Board) on December 2, 2008, and Office of Administrative Law on February 19, 2009. The TMDL was then approved by the United States Environmental Protection Agency (US EPA) and became effective on March 11, 2009. Among those cited as responsible jurisdictions to attain Waste Load Allocations (WLAs) for the TMDL was the city of Carson. A small portion of the southwestern quadrant of the city drains to the Wilmington Drain which is tributary to Machado Lake. The other parties cited as responsible in this TMDL include the unincorporated County of Los Angeles, the Los Angeles County Flood Control District, California Department of Transportation (Caltrans), and the cities of Lomita, Los Angeles, Palos Verdes Estates, Rancho Palos Verdes, Redondo Beach, Rolling Hills, Rolling Hills Estates, and Torrance. These other responsible parties will not participate in this IP and will provide alternative approaches for compliance within their respective jurisdictions.

1.1 Purpose

The purpose of the IP is to outline the city's approach and implementation activities to address potential nutrient sources that may discharge from the city's subwatersheds and flow to Machado Lake. The IP describes a proposed phased iterative adaptive program of combined public education and outreach and nutrient source reduction controls to meet the city's objective of complying with TMDL requirements, interim and final WLAs, and reducing nutrient loadings in the city's discharges to Machado Lake.

1.2 Objectives

The purpose of this document is to establish an IP and apply Best Management Practices (BMPs) and other pollution prevention practices to meet Water Quality Objective as set forth in the Machado Lake Nutrient TMDL. Named as a responsible jurisdiction, the city of Carson's objective is to comply with the interim and final numeric concentration-based WLAs for total nitrogen and total phosphorous in accordance with the TMDL IP schedule as approved by the Regional Board Executive Officer. This IP outline's the city of Carson's compliance approach, public outreach and education efforts, and nutrient source reduction controls.

2. Machado Lake Subwatersheds

2.1 Machado Lake and Wilmington Drain

Machado Lake is located in the Ken Malloy Harbor Regional Park, which is a 231 acre Los Angeles City Park serving the Wilmington and Harbor City areas. The park is located west of the Harbor Freeway (110) and east of Vermont Street, between the Tosco Refinery on the south and Pacific Coast Highway on the north. Machado Lake is approximately 103.5 acres in size. The upper portion of the lake, which includes the open water area, is 40 acres and the lower wetland portion is 63.5 acres. The lake and park are important recreational and natural area resources for Harbor and South Bay residents who use the area for picnicking, fishing, bird watching, boating, canoeing, and hiking.

Figure 2-1 Machado Lake

The Wilmington Drain is a channelized stream that conveys urban runoff and stormwater flows to Machado Lake and ultimately to the Los Angeles Harbor. Originally a natural stream, most of it is now concrete-lined and managed by the Los Angeles County Flood Control District as a flood control channel. The lake and drain have both been identified as impaired water bodies as a result of pollution in urban and stormwater runoff flowing from its 22.7 square mile subwatershed of the Dominguez Channel Watershed. The Wilmington Drain conveys 88% of the urban and stormwater runoff that flows into Machado Lake, so its water quality is of great importance.

2.2 Geographic Description

The city of Carson is located in southern Los Angeles County, surrounded by the cities of Compton, Long Beach, and Los Angeles, and Los Angeles County unincorporated areas and communities. While the city is 18.9 square miles in size, only a small portion of the southwestern quadrant is tributary to the Wilmington Drain and Machado Lake.

The city's tributary drainage area is approximately 1.9 square miles and has been divided into three distinct subwatersheds[1]. Figure 2-2 illustrates the city's three tributary subwatersheds. Drainage Area No. 1 (DA 1) consists of mixed runoff from the cities of Carson, Los Angeles, and Torrance, unincorporated County areas, and Caltrans right-of-way. Discharges from Drainage Area No. 2 (DA 2) are from the cities of Carson, Lomita, Los Angeles, and Torrance, unincorporated County areas, and Caltrans. All city of Carson runoff within this area is from the Sanitation Districts of Los Angeles County Joint Water Pollution Control Plant (JWPCP) facility. Runoff from Drainage Area No. 3 (DA 3) is almost exclusively from the city of Carson with the exception of a small area in the upper portion of this subwatershed, approximately 34.56 acres, and another small downstream area, approximately 108.44 acres, both from the city of Los Angeles. This drainage area best represents the discharges likely to emanate from the city's different land use types. The reason for this is that DA 3 is predominantly

[1] Los Angeles County Department of Public Works Spatial Information Library, Watershed Sub Basins 2011.

from the city of Carson and the composition of land use types within this drainage area are similar to those of DA 1 and 2 combined. Table 2-1 shows the city's size in relation to the overall size of each drainage area.

Table 2-1 Subwatershed Drainage Area Sizes

Drainage Area Composition	DA 1 (Acres)	DA 2 (Acres)	DA 3 (Acres)
City of Carson	468	192	547
Others Jurisdictions	644	820	143
Total Area	1,112	1,012	690
Carson as a Percentage of Total Area	**42.1%**	**19.0%**	**79.3%**

Figure 2-2 delineates the city's drainage areas discharging to Machado Lake.

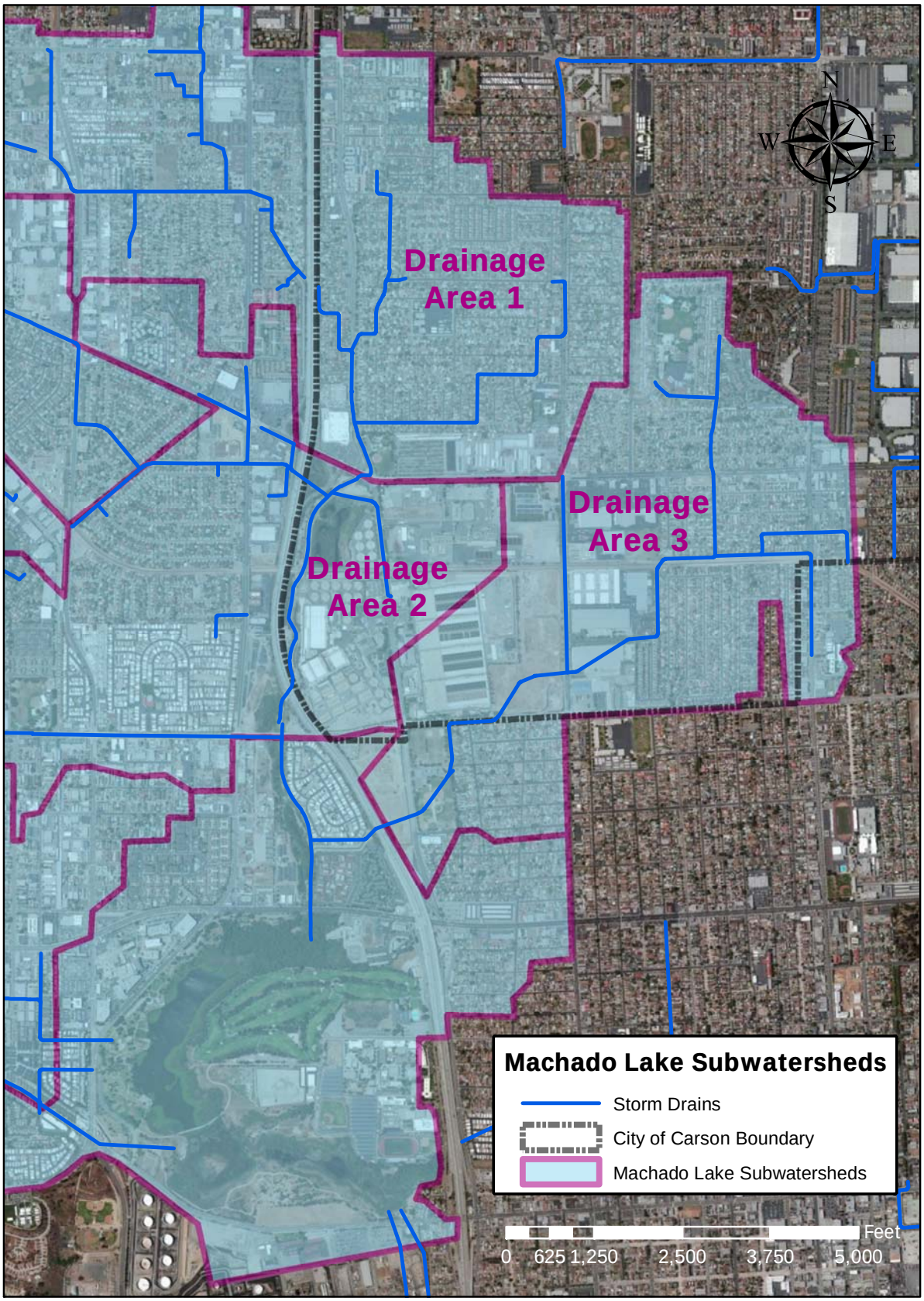

Figure 2-2 Machado Lake Subwatersheds – City of Carson Drainage Areas

2.3 Land Uses

The city of Carson provides a sustainable balance of land uses, including residential, commercial, industrial, educational, recreational, and open space. Table 2-2 provides a breakdown of land use designations within each of the Machado Lake subwatershed drainage areas within the city of Carson.

Table 2-2 Machado Lake Subwatershed Drainage Area Land Use Designations

Land Use Designations	DA 1 (Acres)	DA 2 (Acres)	DA 3 (Acres)	Total Area (Acres)	Percentage of Drainage Area (%)
Commercial Storage	3.58	-	-	3.58	0.30
Developed Local Parks and Recreation	5.87	-	12.79	18.66	1.55
Duplexes, Triplexes, and 2- or 3-Unit Condominiums	-	-	28.48	28.48	2.36
Elementary Schools	18.14	-	6.57	24.71	2.05
Freeways and Major Roads	8.12	6.82	-	14.95	1.24
High-Density Single Family Residential	351.12	-	213.62	564.75	46.78
Liquid Waste Disposal Facilities	1.12	136.05	83.37	220.54	18.27
Low- and Medium-Rise Major Office Use	4.92	-	-	4.92	0.41
Low-Rise Apartments, Condominiums, and Townhomes	16.00	-	21.41	37.41	3.10
Manufacturing, Assembly, and Industrial Services	0.33	7.93	32.28	40.55	3.36
Mixed Residential	-	-	18.64	18.64	1.54
Modern Strip Development	8.35	-	19.26	27.61	2.29
Natural Gas and Petroleum Facilities	-	-	44.46	44.46	3.68
Nurseries	35.54	2.12	0.15	37.82	3.13
Older Strip Development	-	-	0.18	0.18	0.01
Open Storage	-	2.71	0.41	3.12	0.26
Religious Facilities	-	-	3.61	3.61	0.30
Retail Centers	10.97	-	36.55	47.52	3.94
Vacant Undifferentiated	3.57	26.75	1.72	32.04	2.65
Water Storage Facilities	-	9.76	-	9.76	0.81
Wholesaling and Warehousing	-	-	23.93	23.93	1.98
TOTALS	**468**	**192**	**547**	**1,207.24**	**100.00**

The city of Carson drainage area tributary to Machado Lake is dominated by the low, medium, and high density residential land uses. These land use designations encompass approximately 54% of the entire area. The next most dominant land use type is Liquid Waste Disposal Facilities making up 18% of the tributary drainage area. The Liquid Waste Disposal Facilities designation covers most of the Sanitation Districts of Los Angeles County JWPCP facility.

Figure 2-3 illustrates the land use designations within each of the three drainage areas tributary to Machado Lake.

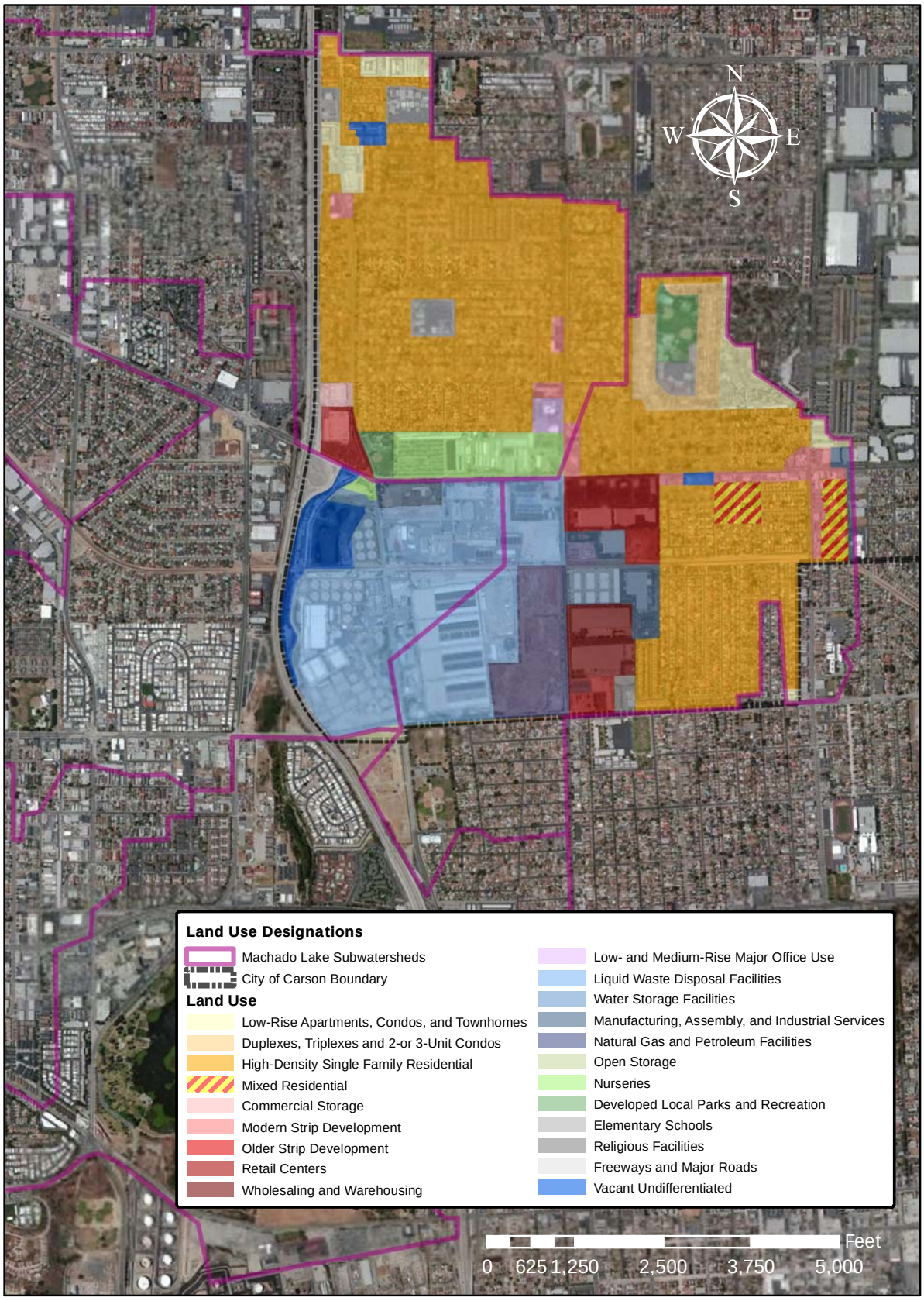

Figure 2-3 Land Use Designations within City of Carson Drainage Areas

3. TMDL Requirements

Machado Lake was designated as an impaired water body on the 1998, 2002, 2006, and 2010 Federal Clean Water Act (CWA) Section 303(d) lists due to eutrophic conditions, algae, ammonia, and odors. Excessive loadings of nutrients, in particular nitrogen (including ammonia) and phosphorus, cause eutrophic effects, including algae and odors, which impair the beneficial uses of Machado Lake. The nutrient enrichment results in high algal productivity and algal blooms have been observed in the lake during summer months[2]. In addition, high nutrient concentrations contribute to excessive and nuisance macrophyte growth. Algae respiration and decay depletes oxygen from the water column creating an adverse aquatic environment. The CWA requires that a TMDL then be developed to restore the impaired water bodies to their full beneficial uses. The beneficial uses of Machado Lake that are impaired as a result of nutrients include:

- Recreation (REC 1 and REC 2);
- Aquatic life (WARM, WILD, RARE, and WET); and
- Water supply (MUN).

On May 1, 2008, the Regional Board adopted Resolution No. R08-006 amending the *Water Quality Control Plan: Los Angeles Region Basin Plan for the Coastal Watersheds of Los Angeles and Ventura Counties* (Basin Plan) to incorporate a Nutrient TMDL for Machado Lake. The TMDL is designed to protect the beneficial uses of Machado Lake and achieve applicable Water Quality Objectives which include narrative objectives for Biostimulatory Substances and Taste and Odor, and numeric objectives for Dissolved Oxygen and Ammonia. The TMDL was adopted by the U.S. Environmental Protection Agency (US EPA) and became effective on March 11, 2009. This TMDL sets forth stringent numerical limits for nitrogen and phosphorus, as well as numerical targets for ammonia, dissolved oxygen, and chlorophyll a which will help assess the overall water quality in the lake.

3.1 Machado Lake Numeric Targets

The Machado Lake Nutrient TMDL established numeric targets for water quality indicators for the impaired receiving water body. These numeric targets are summarized in Table 3-1.

Table 3-1 Numeric Targets

Indicator	Numeric Target
Total Phosphorus	0.1 mg/L monthly average
Total Nitrogen (TKN + NO_3-N + NO_2-N)	1.0 mg/L monthly average
Ammonia – N	5.95 mg/L one-hour average
Ammonia – N	2.15 mg/L 30-day average
Dissolved Oxygen	5 mg/L single minimum measured 0.3 meters above the sediments
Chlorophyll a	20 µg/L monthly average

[2] Staff Report for Machado Lake Eutrophic, Algae, Ammonia, and Odors (Nutrient) TMDL, Attachment A to Resolution No. R08-006, May 1, 2008.

3.2 Waste Load Allocations

The Machado Lake Nutrient TMDL established and assigned dry- and wet-weather interim and final WLAs to urban stormwater dischargers subject to a Municipal Separate Storm Sewer System (MS4) discharge permit. The city of Carson is named in the TMDL as an MS4 Permittee that is responsible for discharges to Machado Lake.

The TMDL outlines three options for compliance. Interim and final WLAs are summarized in Table 3-2 and can be demonstrated through one of the following methodologies:

- Concentration-based WLAs with in-lake monitoring.
- Concentration-based WLAs with monitoring at the end of the city of Carson's drainage system (end-of-pipe).
- Mass-based WLAs with end-of-pipe monitoring.

Table 3-2 Interim and Final Waste Load Allocations

Compliance Date	Interim Total Phosphorus WLAs (mg/L)	Interim Total Nitrogen (TKN + NO3-N + NO2-N) WLAs (mg/L)
March 11, 2009	1.25	3.50
March 11, 2014	1.25	2.45
Sept. 11, 2018 (Final WLAs)	0.1	1.00

The city of Carson has determined that the best option for compliance is concentration-based WLAs with end-of-pipe monitoring. However, the storm drain systems which convey drainage from the city of Carson are intertwined and cross-connected with other upstream jurisdictions. Drainage from these other cities mixes with city of Carson runoff and ultimately discharges to Machado Lake. To demonstrate compliance with the concentration-based WLAs, the city of Carson decided to select one end-of-pipe monitoring location which is representative of the three Machado Lake subwatersheds within its city boundary and has minimal mixing of runoff with other jurisdictions.

The city understands that this TMDL was developed with limited data from the storm drains entering the lake and the inherent seasonal and annual variability in delivery of phosphorus and nitrogen from external sources and nutrient cycling within the lake, and therefore a conservative approach was taken to provide an implicit margin of safety. Consequently, the city is approaching this IP with a structure that allows for reevaluation of WLAs when the TMDL is reconsidered.

3.3 Implementation Schedule

Table 3-3, below, summarizes the TMDL requirements and respective dates by which the city of Carson needs to comply.

Table 3-3 TMDL Implementation Schedule for End-of-Pipe Concentration-Based WLAs Jurisdictions	
TMDL Requirement	**Compliance Date**
Meet 1st interim WLA for total nitrogen and total phosphorous.	March 11, 2009
Submit a Monitoring and Reporting Program (MRP) to the Regional Board Executive Officer for approval.	March 11, 2010
Begin monitoring as outlined in the approved MRP.	60 days from date of MRP approval
Submit Annual Monitoring Report.	Annually from date of MRP approval
Submit a TMDL IP to the Regional Board for approval.	March 11, 2011
Begin implementation of BMPs as outlined in the approved IP.	60 days from date of IP approval
Meet 2nd interim WLA for total nitrogen and total phosphorous.	March 11, 2014
Meet final WLAs and numeric targets for total nitrogen, total phosphorous, ammonia, dissolved oxygen, and chlorophyll a.	September 11, 2018

4. Potential Nutrient Sources

4.1 Potential Nutrient Source Locations

The primary sources of nitrogen and phosphorus can be found in any watershed and are not unique to the city of Carson's drainage area tributary to Machado Lake. Potential nutrient source locations identified as a result of a comprehensive Machado Lake Nutrient TMDL Source Identification Study, included in Appendix A, are summarized in Table 4-1.

Table 4-1 Potential Nutrient Source Locations				
Location/Facility	**Land Use Designation(s)**	**Recognized Nutrient Source Category**	**Area Size (Acres)**	**Percentage of Drainage Area (%)**
Residential Areas	(1) Low-Rise Apartments, Condominiums, and Townhomes; (2) Duplexes, Triplexes, and 2- or 3-Unit Condominiums; (3) Mixed Residential; and (4) High-Density Single Family Residential	Landscaping and Pet Waste	649.28	53.78%
Carriage Crest Park	Developed Local Parks and Recreation	Landscaping and Pet Waste	5.87	0.49%
General Scott Park	Developed Local Parks and Recreation	Landscaping and Pet Waste	12.55	1.04%
Color Spot Nurseries	Nurseries	Agricultural and Livestock Activities	35.64	2.95%
DA 1, 2, and 3	All land use designations	Atmospheric Deposition	1,207.24	100.00%

To establish a basis for focusing and prioritizing implementation strategies, order-of-magnitude estimates have been developed for the known anthropogenic sources of nutrients within the city of Carson's Machado Lake subwatersheds. These estimates were calculated based on land use information, field

investigations, and available literature information and are documented in the Source Identification Study. These estimates do not attempt to consider the assimilative capacity of the subwatersheds for nitrogen and phosphorous, rather they are similar to nutrient land application rates and should be considered representative of the relative pollutant potential of a source without considering active controls or natural assimilation which is already acting to mitigate the sources. These estimates are used as a means to prioritize potential sources for attention within this IP.

Once several years of data on dry- and wet-weather runoff quality from the city of Carson's Machado Lake subwatersheds have been collected, these order-of-magnitude estimates will be reevaluated in comparison with the water quality data to obtain an understanding of the subwatersheds' capacity for nutrient assimilation at baseline, and to further develop implementation activities, if needed, to more precisely focus on the sources which require additional control.

4.2 Estimated Pollutant Load Summary

A comparison of the potential major sources of anthropogenic nitrogen and phosphorus within the Machado Lake subwatersheds of the city of Carson is summarized in Table 4-2. Comparison of these estimates indicates that landscaping fertilizer (residential areas, parks, and nurseries collectively) and dry atmospheric deposition represent potential nitrogen sources of the same order-of-magnitude, while pet waste is lower, though still potentially significant. Significant sources of phosphorus are landscaping fertilizer and leaves and grass clippings accumulated in gutters and catch basins. Dry atmospheric deposition and pet waste do not represent significant sources of phosphorus.

Table 4-2 Estimated Nutrient Pollutant Loads

Nutrient Source	Estimated Nitrogen Source in City of Carson Subwatersheds (lbs/yr)	Estimated Phosphorus Source in City of Carson Subwatersheds (lbs/yr)
Residential Areas		
Landscaping	26,495	5,299
Pet Waste – Cats	729	18
Pet Waste – Dogs	2,619	86
Parks	2,763	553
Color Spot Nurseries	5,346	1,069
Atmospheric Deposition	17,314	-
TOTALS	**55,266**	**7,025**

These estimated nutrient pollutant loads do not consider assimilation, attenuation, sequestration, or removal processes.

5. Implementation Approach

Due to the implementation schedule mandated in the Machado Lake Nutrient TMDL, this IP was developed without the benefit of baseline monitoring data that will provide an understanding of the geographic and seasonal extent of compliance or non-compliance of stormwater discharges from the city of Carson subwatersheds tributary to Machado Lake. As a consequence of the lack of baseline data, this IP proposes an iterative adaptive approach to implementation that is phased. Once several years of monitoring data have been collected, in accordance with the city of Carson MRP Plan for compliance with the Machado Lake Nutrient TMDL, additional phases of the plan will be developed in more detail in order to focus implementation efforts on measures that will best achieve compliance with the TMDL targets.

The city has developed a framework for this IP built upon source control techniques as the most reliable, cost effective, and environmentally sensitive means for controlling pollutants. This IP is designed to develop nutrient source reduction controls that best address the significant nutrient sources within the city of Carson.

To effectively carry out the city's IP and meet TMDL requirements, the city will develop an initial anthropogenic nutrient sources list based on land use activities, watershed activities, and available data, and evaluate their potential risk. The list will be used in the development of public education and outreach activities and source reduction controls to increase public awareness, change behavior, and reduce nutrient loading. Controls and activities that were developed in anticipation to the adoption of the Machado Lake Nutrient TMDL will be implemented immediately.

As each phase is completed, its effectiveness will be assessed and evaluated based on measurable outcomes. Public awareness and behavior change will be measured using questionnaires and surveys via social networking, and monitoring results will be reviewed to verify that the city is on target to comply with the interim and final WLAs.

5.1 Landscaping Fertilizer Management Approach

The nutrients of primary concern are nitrogen and phosphorus compounds added through the application of inorganic and organic fertilizers. As discussed in the Machado Lake Nutrient TMDL Source Identification Study, included in Appendix A, approximately 353 acres of the residential area's 565 acres is planted in turf and exotic plants. The misuse and overuse of fertilizers within the subwatersheds may contribute to the excessive fertilization of Machado Lake. Excessive fertilization of water bodies is recognized as one of the major causes of the impairment of the beneficial uses of Machado Lake through the excessive growth of biota, phytoplankton, and other aquatic plants.

Cutting back on unnecessary fertilizer use is the first step toward preventing water pollution associated with lawn and garden maintenance. This can be accomplished through soil testing to establish the fertilizer needed for a landscaped area and then following recommended application rates and frequencies. Applying fertilizer according to need will greatly reduce the discharge of nitrogen and phosphorus into the city of Carson subwatersheds associated with Machado Lake. To yield the highest nutrient pollution reduction, the public education and outreach program executed will need to be a comprehensive set of outreach activities to target city homeowners and local businesses within the three Machado Lake subwatershed drainage areas.

The city intends to focus public outreach efforts on the following target audiences:

- Homeowners
- Landscape/Garden Maintenance Firms
- Municipal Landscape Maintenance Activities
- Garden Clubs
- Homeowners Associations
- Landscape Designers
- Commercial Property Management Companies
- Schools and Institutions

Concurrent to the city's public outreach efforts, nutrient source reduction controls will be implemented to directly reduce nutrient loading to Machado Lake. These controls include training of city personnel, frequent street sweeping, installing catch basin curb screens, and reviewing municipal codes to ensure the city possesses the proper authority to enforce pollution prevent measures.

5.1.1 Phase I

5.1.1.1 Public Education and Outreach Activities

During Phase I the city intends to develop a Landscaping Fertilizer Outreach Program and utilize existing outreach materials, workshops, and community programs. The city will review previously developed outreach materials and work to enhance outreach materials as necessary. In addition, the city intends to work more closely with community groups and businesses to reach target audiences.

This phase will include forming new partnerships with garden centers/nurseries and home improvement stores in order to place outreach materials at the fingertips of consumers. The campaign will focus on "pollutant specific outreach," since the majority of nutrient pollution is created by certain pollutants such as fertilizers, herbicides, and pesticides. Educational materials will promote simple pollution prevention behaviors associated with nutrient pollutants and will be placed in the proximity of products containing the potential pollutants. Outreach materials can include tear sheets, tip cards, shelf talkers, and posters. Tear sheets will list the locations of household hazardous waste collection centers, as well as hours of operation, and be placed on counters and checkout stands. Tip cards will provide easy-to-follow pollution prevention tips and be placed on counters in the appropriate section. Shelf talkers, with tear sheets attached, will provide the same information and be placed in the appropriate aisles relating to the nutrient pollutant. This will allow customers to tear off individual sheets and take the information with them. Additionally, the program will utilize posters to encourage the proper disposal of nutrient pollutants in order to prevent pollution.

In addition, owners, managers, and employees will be educated on stormwater pollution prevention. Once educated, the staff, seen as experts by the customers, can serve as catalysts to spread the stormwater pollution prevention message to "do-it-yourselfers" who may be unintentionally engaged in various polluting activities during their home improvement projects. By having staff deliver the stormwater pollution prevention message, the program has the advantage of "the messenger" constantly being at the customers' disposal, thereby being able to effectively reach and educate a large group of potential polluters.

During the first phase, the city will utilize existing opportunities and materials to disseminate the fertilizer/landscape message. Upon the evaluation of collected monitoring data, the city will evaluate materials and programs for future enhancements.

5.1.1.2 Source Reduction Controls

The city of Carson has in place institutional controls and municipal codes and ordinances that work together to achieve the goals of this plan. The following items highlight the actions that the city has implemented to ensure compliance:

- Municipal Code Article IX Planning and Zoning, Chapter 1 Zoning, Part 2 Residential Zones, Division 6 Site Development Standards §9126.21 (Ground Coverage) requires that in the Residential, Multiple Dwelling (RM) Zone, the ground area included within the exterior walls and/or supporting columns of all roofed structures shall not exceed forty percent (40) of the net lot area, except when a parking structure or subterranean parking is proposed, the ground area shall not exceed seventy (70) percent of the net lot area. This ensures that lots preserve sufficient pervious land surface area to allow for rainfall to be retained onsite and infiltrate into the ground.
- Municipal Code Article V Sanitation and Health, Chapter 8 Storm Water and Urban Runoff Pollution Control §5807(b) states that runoff of water used for irrigation purposes shall be minimized to the maximum extent practicable. Runoff of water from the permitted washing

down of paved areas shall be minimized to the maximum extent practicable. This code helps to minimize the wash off of nutrient pollutants that have accumulated on landscaping and impervious surfaces.

- Municipal Code Article V Sanitation and Health, Chapter 8 Storm Water and Urban Runoff Pollution Control §5805(c) states that it is prohibited to dispose of leaves, dirt, or other landscape debris into the MS4. The elimination of vegetative debris will help reduce the nutrient pollutant load.

To reduce the likelihood of nutrient laden discharges from city park facilities, park operations and maintenance personnel will continue to receive annual training on the use and application of fertilizers, herbicides and pesticides.

Park maintenance personnel will be encouraged to adopt similar strategies to those developed by the International Fertilizer Industry Association for using Fertilizer BMPs (FBMPs). The basic principle behind FBMPs, is the "4Rs" – use the right fertilizer product(s) at the right rate, right time, and right place. FBMPs are techniques and practices developed through scientific research and verified in the field to achieve economic, social, and environmental goals. FBMPs are aimed at managing the flow of nutrients in the course of using fertilizers in a sustainable manner that protects the environment and conserves natural resources. With FBMPs, users implement, under specific site and soil conditions, the concepts and elements of balanced fertilization, site-specific nutrient management, and integrated plant nutrient management. Through FBMPs, the benefits that can be derived from fertilizers are maximized while the losses and negative effects of over, under, or misuse of fertilizers are minimized. Implementing such a strategy will help the city of Carson reduce the potential nutrient pollutant load that would be associated with stormwater discharges from its parks.

5.1.2 Phase II

5.1.2.1 Public Education and Outreach Activities

For Phase II, the city intends to utilize the data collected during Phase I to develop and implement controls and activities that require additional time to develop and implement. The city will identify landscape and gardening firms operating within the city and hold a workshop, mandatory if permissible, focusing on fertilizer application and soil testing, watering practices, plant selection and maintenance, and proper organic debris management and control. Below are additional outreach activities that will be considered for incorporation into the program:

- Enhance the city's website to include additional, more specific information regarding landscaping and gardening.
- Host garden/landscape firm workshops, focusing on:
  - Soil testing
  - Fertilizer application
  - Plant selection – drought tolerant plant selection
  - Irrigation system design, water efficient systems
  - General stormwater pollution prevention BMPs

5.1.2.2 Source Reduction Controls

City owned catch basins within the Machado Lake subwatersheds already have curb screens to reduce the introduction of plant matter, leaves, clippings, and other vegetative debris. The city of Carson intends to install additional curb screen BMPs within the city's three Machado Lake subwatersheds on County of Los Angeles owned catch basins. Catch basin curb screens combined with the city's weekly street sweeping program will formulate an effective approach to prevent vegetative materials from

entering catch basins and storm drains which can decompose over time and contribute to nutrient pollutant loads.

5.1.3 Phase III

Phase III program enhancements will be developed following the review of the first four to five years of monitoring and the Phase I and II program activities. Phase III outreach activities will be developed in conjunction with on-going source reduction controls undertaken by the city.

5.2 Pet Waste Management Approach

As mentioned in Section 4.2, it is estimated that pet waste generates approximately 3,348 pounds per year of total nitrogen and approximately 104 pounds per year of total phosphorus in the city subwatersheds that drain into Machado Lake. In order to control the discharge of nitrogen and phosphorus associated with pet waste, a public outreach campaign will be targeted at pet owners and focus on the following messages:

- Leaving pet waste on the ground is against the law and punishable by fines;
- Pick up after your pet and properly dispose of the waste;
- Always obey the leash laws to ensure pet waste occurs where it can be easily cleaned up.

5.2.1 Phase I

5.2.1.1 Public Education and Outreach Activities

During Phase I of the pet waste outreach program, the city will utilize existing opportunities to disseminate the campaign message. This phase will also explore new ways to reach the pet owner community and include cultivating relationships with pet-related businesses to identify target audiences that may not be addressed through the current outreach efforts.

Similar to the landscaping fertilizer outreach program, the city will enhance existing and develop new outreach materials targeting pet owners. The City will distribute the material by forming new partnerships with pet facilities, placing the material at the fingertips of consumers. Outreach material will also include tear sheets, tip cards, shelf talkers, and posters. Owners, managers, and employees from the pet facilities will be educated on the stormwater pollution prevention measures related to pets so they may play the role of "the messenger" and educate their customers.

The city will implement online outreach programs and activities, enhancing its existing city stormwater pollution web page and social media accounts to encourage engagement and behavior change through interactions with the community. The existing city website will be updated to include resources for residents to obtain news and information on the program's efforts to reduce stormwater pollution associated with pet waste. The website will be revised to include:

- General information on pet waste;
- Pet owner tips;
- Media and activity resources for download; and
- Links to other related pet owner websites

The city of Carson has active accounts on Facebook and Twitter where it interacts with residents about activities and events within the city. During Phase I, the city will incorporate stormwater pollution prevention education elements to its Facebook and Twitter accounts to generate conversations, gain

feedback through the use of polling, and share information for sound pollution prevention practices relating to the proper disposal of pet waste.

5.2.1.2 Source Reduction Controls

The city is currently implementing measures to address pet waste and pet care activities by:

- Developing and distributing outreach materials at City Hall public counters and the city's website to address BMPs for pet owners.
- Hosting a free annual dog vaccination program where educational materials and free pet waste disposal bags are distributed to individual pet owners to inform them about pet waste and its impact on the environment.

5.2.2 Phase II

The second phase of outreach will require more coordination and time to implement. In addition to enhancing the existing program described in Phase I, the activities described below can be developed to reach the target audience.

During Phase II, the city will work with the local school district to implement a K-12 outreach program. The K-12 outreach implemented could provide opportunities to coordinate with educators to include stormwater related content in their curriculums. This would provide an opportunity to target children and teenagers who may not shop for pet related items, but are active in the care of these animals.

The city will continue to actively update its online outreach efforts and provide links to educational material that raises stormwater pollution awareness. Surveys and quizzes will also be posted to engage site visitors to think about their behaviors and the importance of preserving local water bodies. The city will take the results from the surveys and quizzes provided during Phase I to serve as a baseline for program effectiveness assessment.

The city will also consider installing additional pet waste disposal stations at high use areas and track the utilization of these stations. Adding additional pet waste disposal stations will make it more convenient for pet owners to pick up after their pets and reinforce the message that it's important to properly dispose of pet waste.

5.2.3 Phase III

Phase III program enhancements will be developed following the review of the first four to five years of monitoring and the Phase I and II program activities. Phase III outreach activities will be developed in conjunction with on-going source reduction controls undertaken by the city.

- The city will consider the adoption of an ordinance requiring the removal of pet waste from public places.

5.3 Atmospheric Deposition

As mentioned in Section 4.2, it is estimated that approximately 17,314 pounds per year of total nitrogen is deposited within the city subwatersheds. Because the majority of the nitrogen is generated from mobile sources and the city has little control over emissions generated by mobile or stationary sources of nitrogen oxide air emissions, the control of nutrients introduced to the watershed through atmospheric deposition is a significant challenge. To address atmospheric deposition, the city plans to implement a

source control campaign targeting significant nutrient sources through existing and improved non-structural BMP programs.

In order to control the discharge of nitrogen associated with atmospheric deposition, the public outreach campaign will focus on:

- Reducing fossil fuel consumption by encouraging carpooling, walking, riding a bike, and using public transportation when possible. The burning of fossil fuel contributes to water pollution when air pollution settles on roads, roofs, sidewalks, and other impervious surfaces and is washed into storm drains when it rains. Less consumption of fossil fuel will result in lower nitrogen emissions to the atmosphere.
- Recommending residents to turn off their vehicles instead of leaving them idle with the engine running. A vehicle idling for 10 minutes a day burns more than 25 gallons of fossil fuel a year. If idling for more than 30 seconds, the US EPA recommends turning off your vehicle to save on gas and protect the environment.
- Encouraging residents to follow their car's manufacturer recommended maintenance guidelines to enhance its performance and reduce emissions.
- Requiring the implementation of Low Impact Development (LID) techniques on new development and significant redevelopment projects, where feasible, to treat and reduce runoff from impervious surfaces such as roads, roofs, patios, and sidewalks which have collected pollutants from atmospheric deposition on the surface.

5.3.1 Phase I

5.3.1.1 Public Education and Outreach Activities

Phase I of the atmospheric deposition outreach program will utilize existing opportunities to disseminate the message. The city will also explore further opportunities to reach the target audience. This phase may include cultivating relationships with auto related businesses to identify target audiences that may not be addressed through the current outreach efforts.

The city will revise its existing stormwater outreach materials to include outreach messages regarding atmospheric deposition. The city will distribute its stormwater outreach material at local community events and take the time to speak with residents to encourage pollution prevention practices relating to atmospheric deposition. The city will also utilize its existing website and social networking accounts (Facebook and Twitter) to incorporate atmospheric deposition education information.

5.3.1.2 Source Reduction Controls

The city is currently implementing the following measures to reduce nutrient pollutant loads associated with atmospheric deposition:

- The city's Municipal Code limits the creation of new impervious surfaces. The Municipal Code requires that no more than 40% of a residential lot may be covered by buildings, structures, and/or paved areas. This controls the amount of impervious surfaces within residential lots and allows for runoff that may wash off nutrients from atmospheric deposition, to evapotranspirate and infiltrate onsite instead of discharging to the MS4.
- City streets are swept weekly using low emissions sweeping vehicles. This practice removes pollutants deposited on streets through atmospheric deposition and serves to reduce new pollutants from being introduced to Machado Lake.
- The city encourages residents to install pervious surfaces when landscaping, and installing or reconstructing driveways.

5.3.2 Phase II

5.3.2.1 Public Education and Outreach Activities

Phase II of the outreach will require more coordination and time to implement. In addition to enhancing the existing program described above, the following activities can be developed to reach target audiences identified during Phase I.

- The city will distribute outreach material at local gatherings, such as farmers markets, encouraging residents to shop, dine, and think locally to reduce fossil fuel consumption.
- The city will form partnerships with auto service facilities. These facilities could directly provide customers with outreach materials.
- The city will implement programs to encourage the incorporation of LID techniques and publicize information regarding simple retrofits such as disconnecting downspouts to reduce runoff of impervious surfaces that have accumulated pollutants as a result of atmospheric deposition.

5.3.2.2 Source Reduction Controls

Additional source reduction control measures that can be developed to further reduce nutrient pollutant loads include:

- Assessing the effectiveness of the city's existing ordinances related to green building and determining areas for enhancement. Possible enhancements may include implementing stronger incentives to encourage the use of LID principles where feasible.
- Stronger incentives for the redirection of downspouts to pervious areas, maximization of porous areas, and utilization of rain collection and reuse systems.

5.3.3 Phase III

5.3.3.1 Public Education and Outreach Activities

Phase III program enhancements will be developed following the review of the first four to five years of monitoring and the Phase I and II program activities. Phase III outreach activities will be developed in conjunction with on-going source reduction controls undertaken by the city.

5.3.3.2 Source Reduction Controls

Based on the results of first four to five years of monitoring, the city will consider if additional source reduction controls are necessary, feasible, and effective in reducing atmospheric deposition impacts. Additional controls may include:

- Phasing out city fossil fuel operated vehicles and considering replacement with high efficiency hybrid vehicles.
- Replacement of street sweeping equipment with high efficiency sweepers and/or increasing the street sweeping frequency.
- Introducing additional bike routes along major roads to encourage alternative modes of transportation.

6. Implementation Schedule

Table 6-1 summarizes the implementation of the different phases of the IP, along with monitoring activities and the Machado Lake Nutrient TMDL compliance milestones.

Table 6-1 Implementation Schedule

Year	2009	2010	Phase I			Phase II			Phase III	
			2011	2012	2013	2014	2015	2016	2017	2018
Monitoring			Develop city of Carson MRP Plan	1st full year of data available	2nd full year of data available	3rd full year of data available	4th full year of data available	5th full year of data available	6th full year of data available	5th full year of data available
TMDL Compliance Milestones	Meet 1st interim WLAs 3/11/2009	Submit MRP for review/ approval	Submit IP for review/ approval		Evaluate effectiveness	Meet 2nd interim WLAs 3/11/2014		TMDL reconsideration 9/11/2016		Meet final WLAs and numeric targets

Appendix A

Machado Lake Nutrient TMDL Source Identification Study

Machado Lake Nutrient TMDL Source Identification Study

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October 20, 2011

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1. Introduction

The City of Carson is named as a responsible jurisdiction under the Machado Lake Nutrient Total Maximum Daily Load (TMDL) and has conducted this Nutrient Source Identification Study to identify potential nutrient sources within the City's drainage area tributary to Machado Lake. The results of this study will help with the development of an implementation and water quality monitoring strategy to comply with water quality standards and waste load allocations.

1.1 Machado Lake and Wilmington Drain

Machado Lake is located in the Ken Malloy Harbor Regional Park, which is a 231 acre Los Angeles City Park serving the Wilmington and Harbor City areas. The park is located west of the Harbor Freeway (110) and east of Vermont Street, between the Tosco Refinery on the south and Pacific Coast Highway on the north. Machado Lake is approximately 103.5 acres in size. The upper portion of the lake, which includes the open water area, is 40 acres and the lower wetland portion is 63.5 acres. The lake and park are important recreational and natural area resources for Harbor and South Bay residents who use the area for picnics, fishing, bird watching, boating, canoeing, and hiking.

Figure 1-1 Machado Lake

The Wilmington Drain is a channelized stream that conveys urban runoff and stormwater flows to Machado Lake and ultimately to the Los Angeles Harbor. Originally a natural stream, most of it is now concrete-lined and managed by the Los Angeles County Flood Control District as a flood control channel. The lake and drain have both been identified as impaired water bodies as a result of pollution in urban and stormwater runoff flowing from its 22.7 square mile subwatershed of the Dominguez Channel Watershed. The Wilmington Drain conveys 88% of the urban and stormwater runoff that flows into Machado Lake, so its water quality is of great importance.

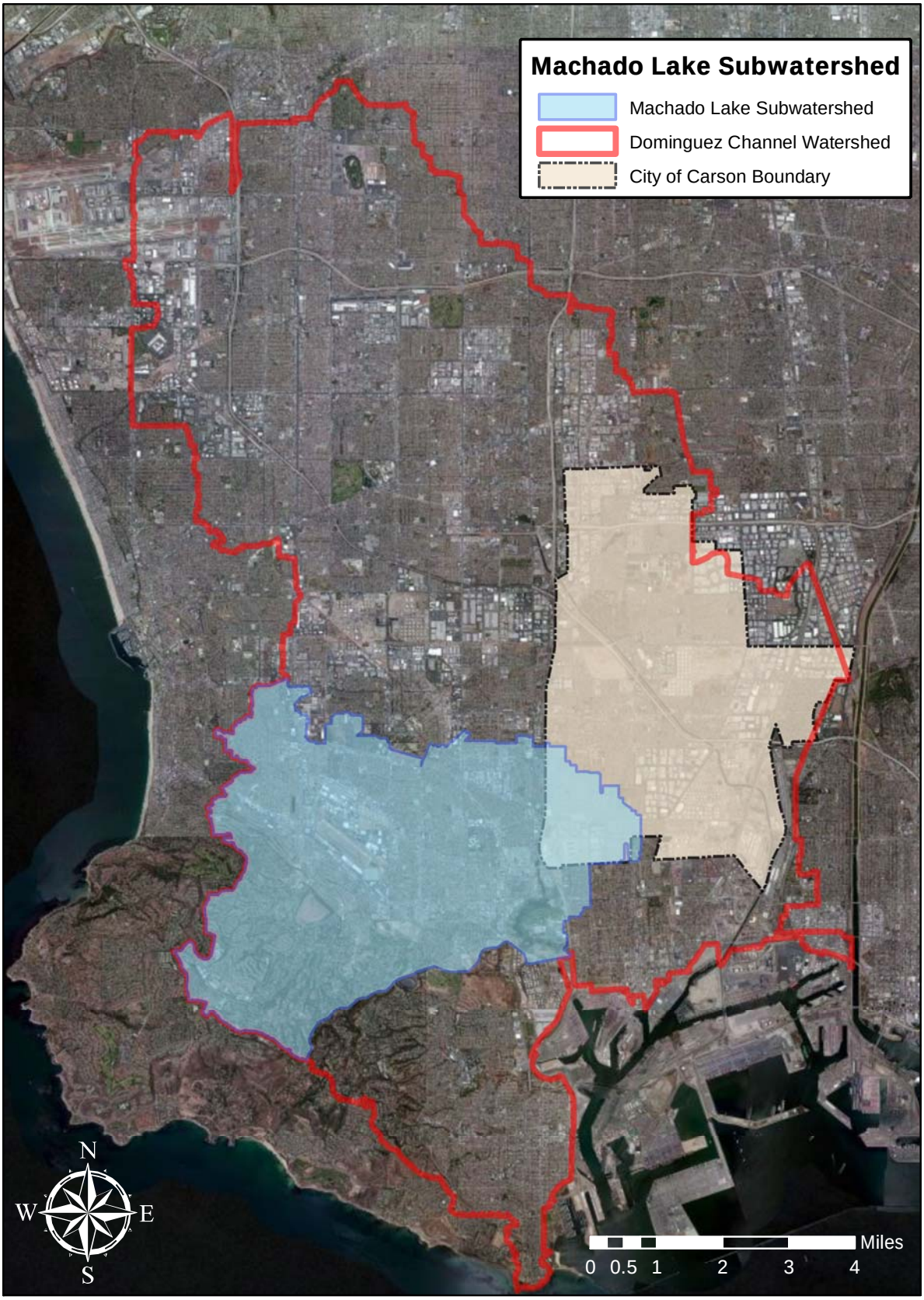

Figure 1-2 Dominguez Watershed Map with Machado Lake Subwatershed

1.2 Machado Lake Nutrient TMDL

Machado Lake was designated as an impaired water body on the 1998, 2002, 2006, and 2010 Federal Clean Water Act (CWA) Section 303(d) lists due to eutrophic conditions, algae, ammonia, and odors. Excessive loadings of nutrients, in particular nitrogen (including ammonia) and phosphorus, cause eutrophic effects, including algae and odors, which impair the beneficial uses of Machado Lake. According to Attachment A of Resolution No. R08-006, the nutrient enrichment results in high algal productivity and algal blooms have been observed in the lake during summer months. In addition, high nutrient concentrations contribute to excessive and nuisance macrophyte growth. Algae respiration and decay depletes oxygen from the water column creating an adverse aquatic environment.

The beneficial uses of Machado Lake that are impaired as a result of nutrients include:

- Recreation (REC 1 and REC 2);
- Aquatic life (WARM, WILD, RARE, and WET); and
- Water supply (MUN).

On May 1, 2008, the Los Angeles Regional Water Quality Control Board (Regional Board) adopted Resolution No. R08-006 amending the *Water Quality Control Plan: Los Angeles Region Basin Plan for the Coastal Watersheds of Los Angeles and Ventura Counties* (Basin Plan) to incorporate a Nutrient TMDL for Machado Lake. The TMDL is designed to protect the beneficial uses of Machado Lake and achieve applicable Water Quality Objectives which include narrative objectives for Biostimulatory Substances and Taste and Odor, and numeric objectives for Dissolved Oxygen and Ammonia. The TMDL was adopted by the U.S. Environmental Protection Agency (US EPA) and became effective on March 11, 2009.

1.3 Machado Lake Numeric Targets

The Machado Lake Nutrient TMDL established numeric targets for water quality indicators for the impaired receiving water body. These numeric targets are summarized in Table 1-1.

Table 1-1 Numeric Targets

Indicator	Numeric Target
Total Phosphorus	0.1 mg/L monthly average
Total Nitrogen (TKN + NO_3-N + NO_2-N)	1.0 mg/L monthly average
Ammonia – N	5.95 mg/L one-hour average
Ammonia – N	2.15 mg/L 30-day average
Dissolved Oxygen	5 mg/L single minimum measured 0.3 meters above the sediments
Chlorophyll a	20 µg/L monthly average

1.4 Waste Load Allocations

The Machado Lake Nutrient TMDL established and assigned dry- and wet-weather interim and final Waste Load Allocations (WLAs) to urban stormwater dischargers subject to a Municipal Separate Storm Sewer System (MS4) discharge permit. The City of Carson is named in the TMDL as an MS4 Permittee that is responsible for discharges to Machado Lake.

The TMDL outlines three options for compliance. Interim and final WLAs are summarized in Table 1-2 and can be demonstrated through one of the following methodologies:

- Concentration-based WLAs with in-lake monitoring.
- Concentration-based WLAs with monitoring at the end of the City of Carson's drainage system (end-of-pipe).
- Mass-based WLAs with end-of-pipe monitoring.

Table 1-2 Interim and Final Waste Load Allocations

Compliance Date	Interim Total Phosphorus WLAs (mg/L)	Interim Total Nitrogen (TKN + NO3-N + NO2-N) WLAs (mg/L)
March 11, 2009	1.25	3.50
March 11, 2014	1.25	2.45
Sept. 11, 2018 (Final WLAs)	0.1	1.00

2. Recognized Nutrient Sources

The effects of nitrogen and phosphorus pollution are diverse and far-reaching and affect human health and the environment. When too much nitrogen and phosphorus enter surface waters they cause the ecosystem to become unbalanced. Nitrogen and phosphorus are often a result of human activities and they speed up the growth of algae in surface waters to an unhealthy level in a process called eutrophication. Algae grow out of control and form what is called an algal bloom. These algal blooms can cause many problems for underwater plants and animals, as well as humans.

One effect that algal blooms have is the reduction or elimination of oxygen in the water. Algal blooms can block sunlight from reaching underwater plants growing at lower depths, which causes a loss of very important habitat. When algal organisms die, they sink to the bottom of the water body where oxygen-consuming bacteria break them down. As a result of this decomposition process, oxygen levels are reduced in the water. In addition, algal blooms can also produce toxins or other negative effects, such as bad smells, ecological problems, loss of property or aesthetic value, clogged drinking water filters, drinking water taste and odor problems, and increased drinking water treatment costs. Harmful algal blooms can cause human health problems through recreational contact or the consumption of contaminated fish and shellfish. The effects of excess nitrogen and phosphorus in surface waters can occur close to and downstream of their sources.

Nitrogen and phosphorus from both point and nonpoint sources contribute to the problem of nitrogen and phosphorus pollution, but the extent to which they contribute to water quality degradation varies by watershed and surrounding land uses. The primary sources of nitrogen and phosphorus are:

- **Agricultural and Livestock Activities.** Agricultural sources such as livestock waste, excess fertilizer, and soil erosion.
- **Landscaping and Pet Waste.** Activities related to the care of areas around a home or neighborhood, such as the use of herbicides, pesticides, and disposal of pet waste. Fertilizers applied to landscaped areas and the leaching of nutrients from landscape debris such as leaves and grass clippings that may accumulate in gutters and catch basins.
- **Atmospheric deposition.** Activities encountered every day such as driving a vehicle and using electrical appliances contribute to atmospheric deposition.
- **Wastewater.** Onsite (septic systems) and municipal wastewater systems; and the use of detergents and soaps, garbage disposals, and vehicle washing.

2.1 Agricultural and Livestock Activities

Agriculture can contribute large amounts of nitrogen and phosphorus to the environment when not well managed. Major sources of nitrogen and phosphorus from agricultural land include the following, with fertilizer and animal manure being the primary sources:

- Commercial fertilizer
- Manure, sludge, and other organic materials
- Crop residues and legumes
- Irrigation water
- Nitrogen and phosphorus already in the soil (reserves)
- Air deposition of nitrogen

Figure 2-1 Nursery

Nitrogen and phosphorus are lost from agricultural lands through a variety of mechanisms, including surface water runoff of soluble nitrogen and phosphorus during major rain events, erosion of sediment containing nitrogen and phosphorus, and groundwater infiltration. Excess nitrogen and phosphorus from agricultural lands can lead to a variety of effects, including eutrophication, algal blooms, and contaminated groundwater.

2.2 Landscaping and Pet Waste

Sources of nitrogen and phosphorus right outside the home include yards, gardens, clippings, leaves, and even pet waste. When too much fertilizer is used, or if it is applied before a major rain event, it can be washed away into the receiving water body. Yard clippings and leaves can also end up in local water bodies if they are left on yards and in the streets. Pet waste that is not properly disposed of is another significant source of nitrogen and phosphorus. As with fertilizer and yard waste, pet waste is washed off

lawns and impervious surfaces either directly into the receiving water body or carried there through storm drain systems.

Lawn and Garden Care

Whether in residential or commercial areas, many people want beautiful lawns, gardens, and landscaping. Caring for these vegetated areas is resource intensive. Without using proper techniques, water quality can be severely impacted by excess application of fertilizers. Nitrogen and phosphorus pollution from over-application of these products is of particular concern because some of the fertilizer can end up in the receiving water body. Suburban areas can have anywhere between 25 and 60 percent impervious surfaces, which prevent water from soaking into the ground. Instead, water flows from the land during storms or from over watering, and carries away fertilizers into the receiving water body. Another source of nitrogen and phosphorus is yard clippings and leaves, which when left in the street after landscaping, can be washed into local streams, increasing nitrogen and phosphorus levels in the water.

The application of fertilizer to residential landscapes as well as ball fields and parks, and commercial landscapes is a potentially significant source of nutrients. While the misapplication of fertilizers can cause pollution in urban and stormwater runoff, proper application informed by soil testing will minimize the excess transport of nitrogen and phosphorus.

A recent nonpoint source loading analysis from a New Jersey study indicated that ten percent of the nitrogen and four percent of the phosphorus applied annually in a 193 square mile area of landscaped residential development ended up in surface waters as a result of over application. Another study (South Jersey Resource Conservation and Development Council, Inc.) found that more than 50 percent of the nitrogen in fertilizer leaches from lawns when improperly applied. This range in potential nutrient loading illustrates the importance of an effective outreach program as a means of source control.

A publication distributed by the University of California Division of Agriculture and Natural Resources recommends 2-4 pounds of nitrogen per 1,000 square feet (0.02 acres) of turf annually applied in multiple divided applications. The publication does not advise rates of phosphorus application, however according to King, Balogh, Hughes, and Harmel, the average ratio of phosphorus to nitrogen applied on golf fairways and tees is 20%, though the phosphorus ratio may be higher for new lawns or golf tees.

A University of Minnesota Extension Study documents that another significant source of phosphorus in runoff is the result of lawn clippings and tree leaves left in streets and gutters. Phosphorus and nitrogen taken up by plants are incorporated into plant tissue as organic compounds. However, plant residues such as lawn clippings and tree leaves, when exposed to wetting by rain or contact with runoff, release phosphorus and nitrogen in soluble form. A study by the University of Minnesota found that “when street gutters were swept weekly and kept free of plant residue, the phosphorus level was 30 to 40 percent less than in areas where no sweeping occurred.” Thus, leaves and other organic debris such as grass clippings which accumulate in gutters and storm drain catch basins between cleaning cycles and are subjected to intermittent wetting and leaching by dry-weather runoff or stormwater runoff have the potential to create a significant source of soluble phosphorus in runoff.

Pet Waste

Pet waste is unsightly and a nuisance when left on the ground. When it is washed into storm drains and local receiving water bodies, it contributes nitrogen, phosphorus, parasites, and bacteria. Although the amount of waste produced by an individual pet might seem small, the cumulative impact of pet wastes on a water body can be significant and lead to conditions unfit for swimming, boating, or fishing.

A study performed by Edith Cowan University in Australia estimated the nutrient load generated in pet waste. For the purposes of this study, the average dog (44 pounds) and small dog/cat (9 pounds) sizes were selected as representative estimates. According to this study, the composition of dog and cat feces is similar. The feces of these animals contain approximately 0.7% nitrogen and 0.25% phosphorus. Urine contains about 1.1% nitrogen and 0.01% phosphorus. For an average dog weighing 44 pounds, 4.59 grams of nitrogen per day and 0.15 grams of phosphorus per day is excreted. The study also used data for small size dogs to estimate the nutrient output of felines. According to the data, a cat weighing 9 pounds would generate 1.23 grams of nitrogen per day and 0.03 grams of phosphorus per day.

2.3 Atmospheric Deposition

Aerial deposition of nitrogen is a significant source of nutrients in urban watersheds. The generation of electricity and burning of fossil fuels to power vehicles emit nitrogen into the air, which later falls to the ground and into receiving water bodies through atmospheric deposition.

Traffic congestion is a source of nitrogen oxides, which are a form of nitrogen, from the burning of gasoline and diesel fuel. The automobile is a necessity of modern day life and an integral part of our culture, but its use has its share of environmental drawbacks.

The combustion of fossil fuels that power cars and trucks produces nitrogen oxide, a combustion byproduct that contains nitrogen and oxygen. Nitrogen oxides exiting vehicle tailpipes are released to the atmosphere and are free to deposit on both land and water. This atmospheric deposition directly contributes nitrogen from nitrogen oxides to our waters. Nitrogen that falls onto the land also threatens our waters, as stormwater runoff can wash the deposited nitrogen into our waterways.

The Machado Lake Nutrient TMDL lists atmospheric deposition as a significant source of nitrogen in the Machado Lake watershed. Similarly, according to the US EPA *Our Nations Air* report, 34% of the annual nitrogen inputs to the Chesapeake Bay and its watershed come from atmospheric deposition. A study conducted by researchers at the University of California, Los Angeles (UCLA), estimated that atmospheric deposition of nitrogen to the Dominguez Channel Watershed (which includes the Machado Lake subwatershed) accounts for approximately 44 grams of nitrogen per hectare per day in the form of HNO_3, NO_2, and NH_3. The South Coast Air Quality Management District (AQMD) estimates that approximately 54% of the emissions of these contaminants come from mobile sources such as cars, trucks, buses, and motorcycles, 34% come from area and off road sources such as gas stations and auto body shops, while the remaining sources can be attributed to point sources such as industrial facilities and power generating plants. The data from the UCLA study indicate that dry deposition accounts for the majority of air pollutant loading to the watershed due to the infrequency of rain events in this region.

2.4 Wastewater

Onsite Wastewater Systems

Approximately 25 percent of homes in the United States are connected to onsite decentralized wastewater treatment (septic) systems that locally treat and dispose of wastewater from a single or small group of homes. Wastewater contains nitrogen and phosphorus from a variety of sources such as soaps, detergents, food, and human waste. When an onsite system is improperly managed, elevated nitrogen and phosphorus levels can be released into receiving water bodies or groundwater.

The proper maintenance and functioning of an onsite system is the responsibility of the property owner. Studies have shown a 10 to 20 percent failure rate of conventional onsite systems. This number is most likely much higher because it does not include unreported system failures. Common causes of onsite

system failure include age, inappropriate design, overloading with too much wastewater in too short a period of time, or poor maintenance.

Municipal Wastewater Treatment Plants

Residences and businesses in urban and suburban areas often send their wastewater to a central location for treatment, called a wastewater treatment plant. Currently, U.S. municipal wastewater treatment facilities process approximately 34 billion gallons of wastewater every day. Once treated, the effluent is typically released into a local water body, where it can become a source of nitrogen and phosphorus. The wastewater treatment plant's effluent is regularly monitored and reported to a State or Federal water quality agency.

Depending on the technology available at the wastewater treatment plant, some facilities are able to remove more nitrogen and phosphorus than others. For example, treatment plants with an enhanced nitrogen and phosphorus removal system can produce effluent with less nitrogen than treatment plants with a biological nutrient removal system. However, upgrading current wastewater treatment plants to be able to remove more nitrogen and phosphorus is expensive.

Recycled Water

Recycled water is known to contain higher levels of nutrients than potable water. Using recycled water to irrigate landscaped medians and parks may result in overspray or non-stormwater discharges from excess irrigation. These higher levels of nutrients such as nitrogen, phosphorus, and oxygen may help with landscape fertilization but can also contribute to the degradation of receiving water bodies as a result of nutrient rich discharges.

2.4.1 Home and Vehicles

The average home contributes nitrogen and phosphorus through a variety of every-day activities, including using soaps and detergents, washing automobiles, using garbage disposals, and wastewater.

Detergent and Soaps

Many soaps, detergents, and cleaning products contain phosphates, which can sometimes end up in receiving water bodies and cause algal blooms. Every day, millions of people use soap and detergents to do laundry, wash dishes, and bathe. Soaps and detergents contained phosphates, a form of phosphorus, to make whites whiter and cut through the grease on dishes. While the wastewater that goes down the drain in homes or businesses is treated, the treatment process does not remove all of the phosphate, resulting in phosphates entering local water bodies. When extra phosphorus is added into a water body, algal growth is amplified, which has negative effects on other aquatic species.

Garbage Disposals

Garbage disposals are a fairly standard kitchen appliance in most homes and a convenient way to dispose of food scraps, vegetable peelings and cuttings, and other food waste. Although disposals keep food scraps out of landfills, they transfer extra nitrogen and phosphorus contained in foods to wastewater treatment systems. Wastewater treatment plants remove some—but not all—of the nitrogen and phosphorus from wastewater and must use electricity and chemicals to do so. Fats and grease that go down the garbage disposal can also solidify within the wastewater pipes, causing sanitary sewer overflows.

Garbage disposals can also increase the rate at which scum and sludge layers build up in the septic tank and increase the frequency for septic tanks to be pumped. If a tank is not pumped frequently enough, elevated nitrogen and phosphorus levels will be released from the system into groundwater or local surface water bodies.

Vehicles Washing

On sunny days, it is common to find people washing their cars at home in the driveway or street. Not only is this rinse water full of soap, but it also carries pollutants such as gasoline and motor oil. After rinse water runs down the driveway and street, it makes its way into a storm drain system. Storm drain systems do not treat the wastewater and instead send it directly to a local water body.

Although washing an individual car now and then is unlikely to cause major impacts, the collective washing of many cars at home can become a big issue for local water bodies.

3. Tributary Drainage Area Review and Analysis

California Watershed Engineering (CWE) conducted field investigations of the City's tributary drainage area on September 28, 2011 and October 3, 2011. Field observations consisted of driving and walking the different residential, commercial, industrial, and open space land uses to identify potential nutrient sources. Analyses also consisted of data review and characterizing homogeneous areas as representative of each of the respective land use types to estimate pollutant loadings likely to be discharged from those drainage areas.

3.1 Machado Lake Tributary Drainage Area

The City of Carson is located in southern Los Angeles County, surrounded by the Cities of Compton, Long Beach, and Los Angeles, and Los Angeles County unincorporated areas and communities. While the City is 18.9 square miles in size, only a small portion of the southwestern quadrant is tributary to the Wilmington Drain and Machado Lake.

The City's tributary drainage area is approximately 1.9 square miles and can be divided into three distinct subwatersheds. Drainage Area No. 1 (DA 1) consists of mixed runoff from the Cities of Carson, Los Angeles, and Torrance, unincorporated County areas, and California Department of Transportation (Caltrans) right-of-way. Discharges from Drainage Area No. 2 (DA 2) are from the Cities of Carson, Lomita, Los Angeles, and Torrance, unincorporated County, and Caltrans. All City of Carson runoff within this area is from the Sanitation Districts of Los Angeles County Joint Water Pollution Control Plant (JWPCP) facility. Runoff from Drainage Area No. 3 (DA 3) is almost exclusively from the City of Carson with the exception of a small area in the upper subwatershed, approximately 34.56 acres, and another small downstream area both from the City of Los Angeles. This drainage area best represents the discharges likely to emanate from the City's different land use types. The reason for this is that DA 3 is predominantly from the City of Carson and the composition of land use types within this drainage area are similar to those of DA 1 and 2 combined. Table 3-1 shows the City's size in relation to the overall size of each drainage area.

Table 3-1 Subwatershed Drainage Area Sizes			
Drainage Area Composition	**DA 1 (Acres)**	**DA 2 (Acres)**	**DA 3 (Acres)**
City of Carson	468	192	547
Others Jurisdictions	644	820	143
Total Area	1,112	1,012	690
Carson as a Percentage of Total Area	**42.1%**	**19.0%**	**79.3%**

Figure 3-1 delineates the City's drainage areas discharging to Machado Lake.

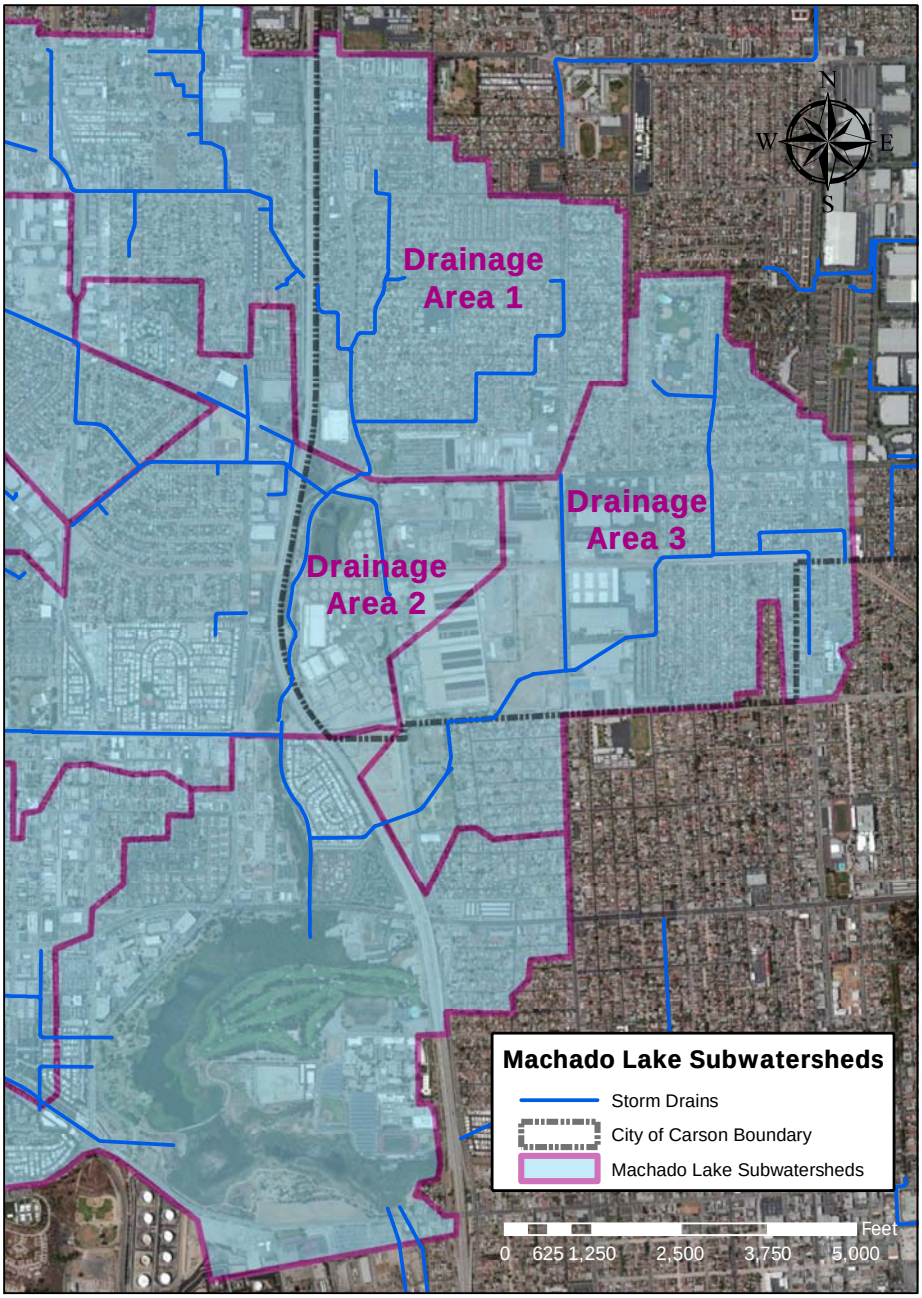

Figure 3-1 Machado Lake Subwatersheds – City of Carson Drainage Areas

3.2 Land Uses

The City of Carson provides a sustainable balance of land uses, including residential, commercial, industrial, educational, recreational, and open space. Table 3-2 provides a breakdown of land use designations within each of the Machado Lake subwatershed drainage areas within the City of Carson.

Table 3-2 Subwatershed Drainage Area Land Use Designations

Land Use Designations	DA 1 (Acres)	DA 2 (Acres)	DA 3 (Acres)	Total Area (Acres)	Percentage of Drainage Area (%)
Commercial Storage	3.58	-	-	3.58	0.30
Developed Local Parks and Recreation	5.87	-	12.79	18.66	1.55
Duplexes, Triplexes, and 2- or 3-Unit Condominiums	-	-	28.48	28.48	2.36
Elementary Schools	18.14	-	6.57	24.71	2.05
Freeways and Major Roads	8.12	6.82	-	14.95	1.24
High-Density Single Family Residential	351.12	-	213.62	564.75	46.78
Liquid Waste Disposal Facilities	1.12	136.05	83.37	220.54	18.27
Low- and Medium-Rise Major Office Use	4.92	-	-	4.92	0.41
Low-Rise Apartments, Condominiums, and Townhomes	16.00	-	21.41	37.41	3.10
Manufacturing, Assembly, and Industrial Services	0.33	7.93	32.28	40.55	3.36
Mixed Residential	-	-	18.64	18.64	1.54
Modern Strip Development	8.35	-	19.26	27.61	2.29
Natural Gas and Petroleum Facilities	-	-	44.46	44.46	3.68
Nurseries	35.54	2.12	0.15	37.82	3.13
Older Strip Development	-	-	0.18	0.18	0.01
Open Storage	-	2.71	0.41	3.12	0.26
Religious Facilities	-	-	3.61	3.61	0.30
Retail Centers	10.97	-	36.55	47.52	3.94
Vacant Undifferentiated	3.57	26.75	1.72	32.04	2.65
Water Storage Facilities	-	9.76	-	9.76	0.81
Wholesaling and Warehousing	-	-	23.93	23.93	1.98
TOTALS	**468**	**192**	**547**	**1,207.24**	**100.00**

The City of Carson drainage area tributary to Machado Lake is dominated by the low, medium, and high density residential land uses. These land use designations encompass approximately 54% of the entire area. The next most dominant land use type is Liquid Waste Disposal Facilities making up 18% of the tributary drainage area. The Liquid Waste Disposal Facilities designation covers most of the Sanitation Districts of Los Angeles County JWPCP facility.

Figure 3-2 illustrates the land use designations within each of the three drainage areas tributary to Machado Lake.

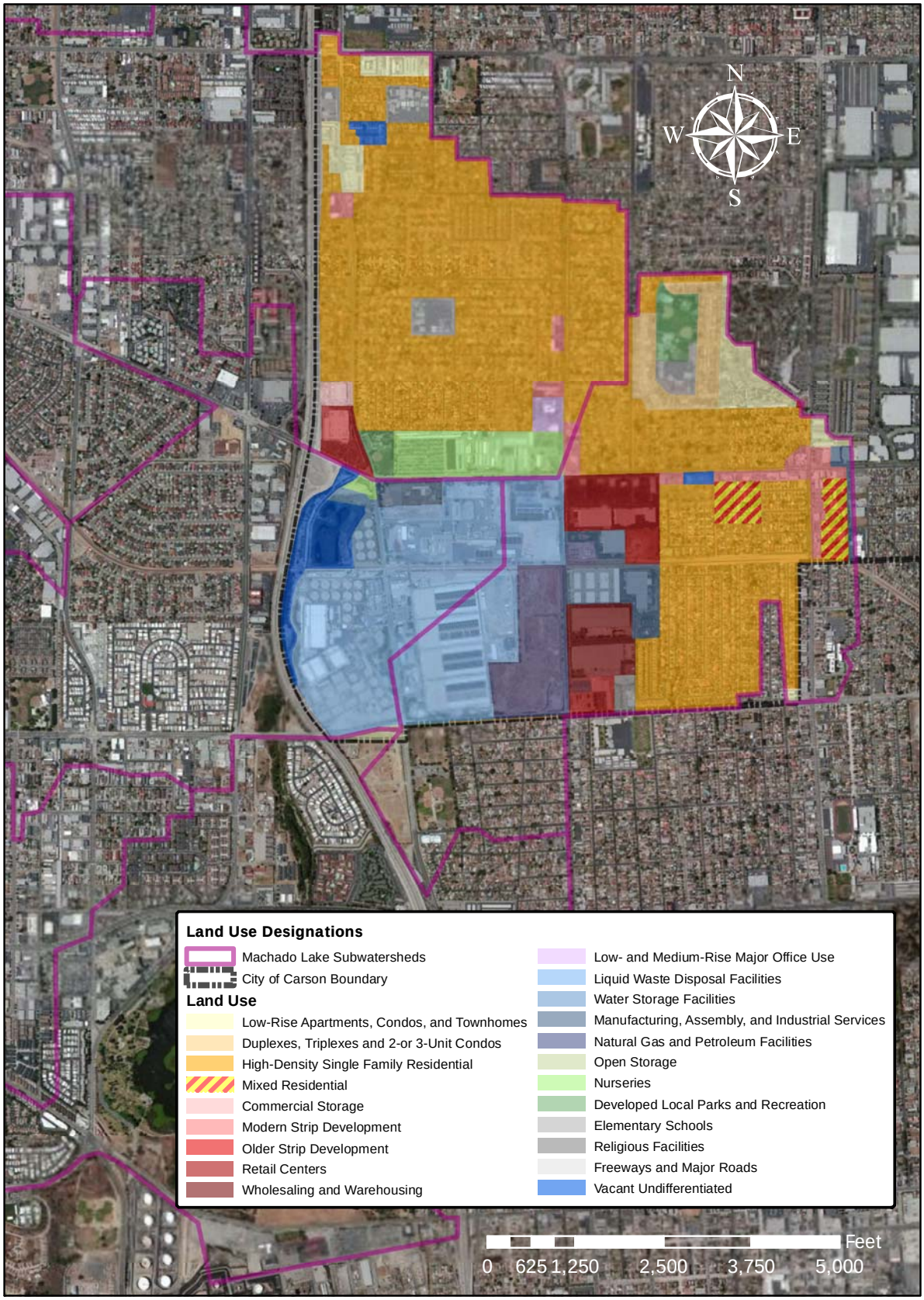

Figure 3-2 Land Use Designations within City of Carson Drainage Areas

3.3 Potential Nutrient Source Locations

The primary sources of nitrogen and phosphorus can be found in any watershed and are not unique to the City of Carson's drainage area tributary to Machado Lake. Potential nutrient source locations identified as a result of this source identification study are summarized in Table 3-3.

Table 3-3 Potential Nutrient Source Locations

Location/Facility	Land Use Designation(s)	Recognized Nutrient Source Category	Area Size (Acres)	Percentage of Drainage Area (%)
Residential Areas	(1) Low-Rise Apartments, Condominiums, and Townhomes; (2) Duplexes, Triplexes, and 2- or 3-Unit Condominiums; (3) Mixed Residential; and (4) High-Density Single Family Residential	Landscaping and Pet Waste	649.28	53.78%
Carriage Crest Park	Developed Local Parks and Recreation	Landscaping and Pet Waste	5.87	0.49%
General Scott Park	Developed Local Parks and Recreation	Landscaping and Pet Waste	12.55	1.04%
Color Spot Nurseries	Nurseries	Agricultural and Livestock Activities	35.64	2.95%
DA 1, 2, and 3	All land use designations	Atmospheric Deposition	1,207.24	100.00%

4. Estimated Pollutant Loads

To establish a basis for focusing and prioritizing implementation strategies, order-of-magnitude estimates have been made of the known anthropogenic sources of nutrients within the City of Carson subwatersheds. These estimates were calculated based on land use information, field investigations, and available literature information. These estimates do not attempt to consider the assimilative capacity of the subwatersheds for nitrogen and phosphorous, rather they are similar to nutrient land application rates and should be considered representative of the relative pollutant potential of a source without considering active controls or natural assimilation which is already acting to mitigate the sources. These estimates are used as a means to prioritize potential sources for attention within the implementation plan.

Once several years of data on dry- and wet-weather runoff quality from the City of Carson subwatersheds have been collected, these order-of-magnitude estimates will be reevaluated in comparison with the water quality data to obtain an understanding of the subwatersheds' capacity for nutrient assimilation at baseline, and to further develop implementation activities, if needed, to more precisely focus on the sources which require additional control.

4.1 Residential Areas

4.1.1 Landscaping Related Pollutant Loads

Table 4-1 estimates the amount of pervious surfaces assumed to be planted with turf and exotic plants within each residential land use designation.

Table 4-1 Residential Pervious Area

Land Use Designations	Pervious Area Percentage (%)	Total Area (Acres)	Pervious Area (Acres)
Low-Rise Apartments, Condominiums, and Townhomes	14%	37.41	5.24
Duplexes, Triplexes, and 2- or 3-Unit Condominiums	45%	28.48	12.82
Mixed Residential	41%	18.64	7.64
High-Density Single Family Residential	58%	564.75	327.56
		TOTAL	**353.26**

Assuming a total of 353.26 acres of residential areas are planted in turf and exotic plants, this would equate to an average annual application of 52,989 pounds per year of nitrogen. Using this typical ratio of 20% phosphorus to nitrogen application, the annual application of phosphorus to turf in the subwatersheds would be 10,598 pounds per year. However, the residential neighborhoods within the Machado Lake subwatersheds are mostly low income housing and the exterior landscaping is not a priority based on visual observations throughout the three drainage areas. Field investigations determined that residents in a significant portion of the drainage areas did not properly maintain their landscaped areas and signs of distress were noted due to a lack of fertilization. Therefore, it is safe to assume that only 50% of the pervious areas are fertilized and the average annual application of nitrogen is 26,495 pounds per year and phosphorus is 5,299 pounds per year.

Figure 4-1 Typical Residential Landscaping

Figure 4-2 Typical Residential Landscaping

4.1.2 Pet Waste Related Pollutant Loads

In order to estimate the nutrient contribution from pets, the average amount of nitrogen and phosphorus in dog and cat excrement was estimated.

The City of Carson has approximately 25,306 housing units within its jurisdiction. The portion which drains to Machado Lake is 1.9 square miles, which is approximately 10% of the total area of the City. Based on this percentage, there are approximately 2,531 homes in the subwatersheds. The Humane Society of the United States estimates that 33% of U.S. households own cats. These pet owners average 2.45 cats per household. Based on these numbers, the portion of the City of Carson draining to Machado Lake has 2,046 cats averaging 0.81 cats per home. A study published in the Journal of the American Veterinary Medical Association estimates that 36% of owned cats defecate outside all the time. Therefore, the average cats per home contributing to nutrient loading would be reduced to 0.3 cats per home. Table 4-2 summarizes the annual nitrogen and phosphorus pollutant loads associated with pet waste from cats.

Table 4-2 Nutrient Pollutant Loads from Cats

No. of Housing Units	No. of Cats/Home	Nitrogen Pollutant Generation (g/day)	Phosphorus Pollutant Generation (g/day)	Nitrogen Pollutant Load (lbs/year)	Phosphorus Pollutant Load (lbs/year)
2,531	0.3	1.23	0.03	729	18

Although it is assumed that pet waste from cats will generate 729 pounds per year of nitrogen and 18 pounds per year of phosphorus, these nutrient pollutant loads do not account for pet owners that clean up after their cats.

The Los Angeles County Department of Animal Care provided numbers of licensed dogs in the City of Carson. In Fiscal Year 2010-11, the total number of licensed dogs amounted to 7,085 and using the same percentage of drainage area to Machado Lake (10%), there would be approximately 709 dogs in the catchment area, averaging 0.28 dogs per house. Table 4-3 shows the annual nitrogen and phosphorus pollutant loads associated with pet waste from dogs.

Table 4-3 Nutrient Pollutant Loads from Dogs

No. of Housing Units	No. of Dogs/Home	Nitrogen Pollutant Generation (g/day)	Phosphorus Pollutant Generation (g/day)	Nitrogen Pollutant Load (lbs/year)	Phosphorus Pollutant Load (lbs/year)
2,531	0.28	4.59	0.15	2,619	86

Again, these nutrient pollutant loads do not account for pet owners that clean up after their dogs.

In total, pet waste generates 3,348 pounds of nitrogen per year and 104 pounds of phosphorus per year in the City of Carson Machado Lake subwatersheds.

4.2 Parks

Two parks are located within the City of Carson's subwatersheds. Carriage Crest Park and General Scott Park have a cumulative size of approximately 18.42 acres. Both parks are maintained by City staff using Simplot BEST Turf Fertilizer and follow the manufacturer's fertilization schedule for twice a year during Spring and Fall. The fertilization schedule is included in Appendix A.

Using the same nitrogen and phosphorus application rates assumed in Section 2.2 for Landscaping and Pet Waste, we estimate an average annual application of 2,763 pounds per year of nitrogen and 553 pounds per year of phosphorus.

Figure 4-3 General Scott Park

Figure 4-4 Carriage Crest Park

4.3 Color Spot Nurseries

Color Spot Nurseries is approximately 35.64 acres in size. Again, assuming similar nitrogen and phosphorus application rates, we estimate an average annual application of 5,346 pounds per year of nitrogen and 1,069 pounds per year of phosphorus. However, based on a site inspection, documented observations, and communication with the facility manager, Mr. Dixon Suzuki, we can safely assume zero discharges during both dry- and wet-weather conditions. All discharge locations throughout the facility had incorporated detention Best Management Practices (BMPs) to detain collected runoff for evapotranspiration and onsite infiltration.

Figure 4-5 BMP at Color Spot Nurseries

Figure 4-6 BMP at Color Spot Nurseries

4.4 Atmospheric Deposition

The City of Carson subwatersheds has a 489 hectare area draining to Machado Lake. Based on this catchment area and the deposition rate obtained from the UCLA study, the aerial deposition is assumed to be 21,516 grams of nitrogen per day. This equates to a deposition rate of 17,314 pounds of nitrogen per year (7,853 kg N/year). The percentage of this load which eventually enters Machado Lake is unknown since quantification of the removal of this pollutant by terrestrial biota is unavailable. However, the TMDL estimates an average point source loading of total nitrogen from the entire Machado Lake watershed of 7,587 kg/year (Technical Memo for Machado Lake Nutrient TMDL, Lai 2008). This value is slightly less than the estimated atmospheric input for the City of Carson's subwatersheds alone. Since the City of Carson subwatersheds makeup less than 9% of the Machado Lake watershed, it can be assumed that a vast majority of nitrogen is being assimilated within the catchment area.

4.5 Estimated Pollutant Load Summary

A comparison of the foregoing estimates of potential major sources of anthropogenic nitrogen and phosphorus within the Machado Lake subwatersheds of the City of Carson is summarized in Table 4-4. Comparison of these estimates indicates that landscaping fertilizer (residential areas, parks, and nurseries collectively) and dry atmospheric deposition represent potential nitrogen sources of the same order of magnitude, while pet waste is lower, though still potentially significant. Significant sources of phosphorus are landscaping fertilizer and leaves and grass clippings accumulated in gutters and catch basins. Dry atmospheric deposition and pet waste do not represent significant sources of phosphorus.

Table 4-4 Estimated Nutrient Pollutant Loads

Nutrient Source	Estimated Nitrogen Source in City of Carson Subwatersheds (lbs/yr)	Estimated Phosphorus Source in City of Carson Subwatersheds (lbs/yr)
Residential Areas		
Landscaping	26,495	5,299
Pet Waste – Cats	729	18
Pet Waste – Dogs	2,619	86
Parks	2,763	553
Color Spot Nurseries	5,346	1,069
Atmospheric Deposition	17,314	-
TOTALS	**55,266**	**7,025**

These estimated nutrient pollutant loads do not consider assimilation, attenuation, sequestration, or removal processes.

There are no known septic systems within the City of Carson's Machado Lake subwatersheds and therefore onsite wastewater systems are not a source of nitrogen and phosphorus.

The JWPCP is one of the largest wastewater treatment plants in the world and is the largest of the Sanitation Districts' wastewater treatment plants. The facility provides both primary and secondary treatment for approximately 300 million gallons of wastewater per day. Prior to discharge, the treated wastewater is disinfected with hypochlorite and sent to the Pacific Ocean through a network of outfalls. These outfalls extend two miles off the Palos Verdes Peninsula to a depth of 200 feet. As a result, the JWPCP facility is not a source of nutrients.

Although recycled water is used for landscaped median irrigation within the City of Carson, it is not used for private or public irrigation within the Machado Lake subwatersheds and for that reason is not a source of nutrients.

5. Source Reduction Strategies and Recommendations

In order to effectively reduce nutrient pollutant loads discharging from the City of Carson drainage areas, a suite of iterative adaptive source control and site design BMPs will need to be developed and implemented targeting the likely sources found throughout the City's Machado Lake subwatersheds.

Residential Areas: Landscaping and Pet Waste

The nutrients of primary concern are nitrogen and phosphorus compounds added through the application of inorganic and organic fertilizers and pet waste. The most effective means to reduce the nutrient pollutant load due to the application of fertilizers by private homeowners and commercial businesses and pet waste are to conduct a focused public education and outreach program.

To yield the highest nutrient pollution reduction, the public education and outreach program executed should be a comprehensive set of outreach activities to target homeowners and local businesses within the three Machado Lake subwatershed drainage areas. This program includes forming new partnerships with garden centers/nurseries, home improvement stores, and pet facilities in order to place outreach materials at the finger tips of consumers. The campaign should focus on "pollutant specific outreach," since the majority of nutrient pollution is created by certain pollutants such as fertilizers, herbicides, pesticides, and pet waste. Educational materials should promote simple pollution prevention behaviors associated with nutrient pollutants. The materials should be placed in the proximity of products containing the potential pollutants. Outreach materials can include tear sheets, tip cards, shelf talkers, and posters. Tear sheets should list the locations of household hazardous waste collection centers, as well as hours of operation, and be placed on counters and checkout stands. Tip cards should provide easy-to-follow pollution prevention tips and be placed on counters in the appropriate section. Shelf talkers, with tear sheets attached, should provide the same information and be placed in the appropriate aisles relating to the nutrient pollutant. This will allow customers to tear off individual sheets and take the information with them. Additionally, the program should utilize posters to encourage the proper disposal of nutrient pollutants and encourage pet owners to pick up after their pets in order to prevent pollution.

In addition, owners, managers, and employees should be educated on stormwater pollution prevention. Once educated, the staff, seen as experts by the customers, can serve as catalysts to spread the stormwater pollution prevention message to "do-it-yourselfers" who may be unintentionally engaged in various polluting activities during their home improvement projects, or pet owners who may not be picking up after their pets. By having staff deliver the stormwater pollution prevention message, the program has the advantage of "the messenger" constantly being at the customers' disposal, thereby being able to effectively reach and educate a large group of potential polluters. As a way of vowing to reach potential polluters, employees should also signed commitment letters demonstrating their support to assist the public education and outreach program.

To address pet waste, the City of Carson currently conducts an annual free dog vaccination program at which time educational materials and free doggie bags are distributed to the individual dog owners. The educational materials inform owners about pet waste and its impact on the environment and provide tips on the proper cleanup and disposal of pet waste.

Additionally, studies suggest that plant matter in catch basins and storm drains may also play an important role in nutrient loading. To reduce the introduction of plant matter, leaves, clippings, and

other vegetative debris, it is recommended that catch basin inlets within in the City of Carson's three Machado Lake subwatersheds install and maintain curb screen BMPs. Catch basin curb screens combined with the City's weekly street sweeping program will formulate an effective approach to prevent vegetative materials from entering catch basins and storm drains which can decompose over time and contribute to nutrient pollutant loads.

Parks

To reduce the likelihood of nutrient discharges from City park facilities, it is recommended that park operations and maintenance personnel receive annual training on the use and application of fertilizers, herbicides, and pesticides.

Parks personnel should adopt similar strategies to those developed by the International Fertilizer Industry Association for using Fertilizer BMPs (FBMPs). The basic principle behind fertilizer BMPs is the "4Rs" – use the right fertilizer product(s) at the right rate, right time and right place. FBMPs are techniques and practices developed through scientific research and verified in the field to achieve economic, social, and environmental goals. FBMP is aimed at managing the flow of nutrients in the course of using fertilizers in a sustainable manner that protects the environment and conserves natural resources. With FBMPs, users implement under specific site and soil conditions, the concepts and elements of balanced fertilization, site-specific nutrient management, and integrated plant nutrient management. Through FBMPs, the benefits that can be derived from fertilizers are maximized while the losses and negative effects of over, under, or misuse of fertilizers are minimized. Implementing such a strategy can help the City of Carson reduce the potential nutrient pollutant load that would be associated with stormwater discharges from parks.

Color Spot Nurseries

Based on practices voluntarily being implemented by Color Spot Nurseries, it is assumed that this nursery will have zero discharges during dry- and wet-weather conditions. All discharge points throughout the facility currently have detention BMPs to detain collected runoff for evapotranspiration and onsite infiltration. The City of Carson has suggested that Color Spot Nurseries investigate the use of rain gardens in lieu of the existing BMP approach and has also offered to assist the property owner with the design of rain garden BMPs for implementation.

It is recommended that City of Carson personnel visually observe and document the performance of existing BMPs during wet-weather events to assess the overall effectiveness of existing BMP measures. Should wet-weather discharges from the Color Spot Nurseries be observed, it is recommended that rain gardens be employed or alternative treatment control BMPs be considered.

Atmospheric Deposition

Atmospheric deposition is a significant source of nitrogen to the City of Carson's Machado Lake subwatersheds. The majority of this source is generated from mobile sources. The City of Carson has little control over emissions generated by mobile or stationary sources of nitrogen oxide air emissions, therefore, the control of nutrients introduced to the subwatersheds through atmospheric deposition is a significant challenge. To address this significant source, the City of Carson should consider implementing a source control public outreach campaign targeting significant nutrient sources through existing and improved non-structural BMP programs.

To control the discharge of nitrogen associated with atmospheric deposition, the public outreach campaign should focus on the following messages:

- The consumption of fossil fuel is a major source of nitrogen emissions to the atmosphere. The burning of fossil fuel contributes to water pollution when air pollution settles on roads, roofs, sidewalks, and other impervious surfaces and is washed into storm drains when it rains.
- Reduce fossil fuel consumption by walking, riding a bike, and using public transportation when possible.
- Carpooling and using hybrid vehicles are great ways to cut down on fossil fuel consumption.
- A vehicle idling for just 10 minutes a day burns more than 25 gallons of fossil fuel a year. If you are going to be idle for more than 30 seconds, EPA recommends turning off your vehicle to save on gas and protect the environment.
- Follow your car's manufacturer recommended maintenance guidelines to enhance its performance and reduce emissions.
- Low impact development, where feasible, can reduce runoff of aerially deposited pollution from impervious surfaces such as residential roofs and patios.

To maximize the effectiveness of the outreach messages, target audiences will need to be identified. Auto related businesses and organizations as well as residential community groups will provide a forum for defining and addressing the target audience.

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Appendix A

BEST Fertilization Schedule

FERTILIZATION SCHEDULE

POST-PLANT – WARM AND COOL SEASON TURFGRASS

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
COOL SEASON: Fescues, Perennial Rye, Annual Rye, Bluegrass												
Program 1- *Minimum (low budget)*	Evergreen 18-5-0 +Iron				Turf Supreme 16-6-8 or Super Turf 25-5-5				Turf Supreme 16-6-8		Evergreen 18-5-0	
Program 2- *Recommended*	Nitra King 19-4-4		Turf Supreme 16-6-8		Super Turf 25-5-5				Turf Supreme 16-6-8		Nitra King 19-4-4	
Program 3- *Mulching/Recycling mowers*	Nitra King 19-4-4 or Evergreen 18-5-0			Super Turf 25-5-5			Super Turf 25-5-5			Super Turf 25-5-5		Nitra King 19-4-4
WARM SEASON: Bermuda, Kikuyu, Zoysia, St. Augustine												
Overseeded	Nitra King 19-4-4 Evergreen 18-5-0		Turf Supreme 16-6-8 or Nitra King 19-4-4		Super Turf 25-5-5		Super Turf 25-5-5		6-24-24XB, Triple Pro 15-15-15, Endure 16-16-16 or Pro Start 16-24-10		Nitra King 19-4-4 Evergreen 18-5-0	
Non-overseeded			Evergreen 18-5-0 +Iron		Super Turf 25-5-5		Super Turf 25-5-5			Turf Supreme 16-6-8		

NOTE: Super Turf 25-5-5 contains two forms of controlled-release nitrogen for long- term turf nutrition. Poly Supreme 23-5-10, Turf Gold 22-5-6, or All Season 19-6-12 can be used effectively in place of Super Turf in the schedule above.

POST-PLANT – TREES, SHRUBS, GROUNDCOVER, FLOWERS, PALMS

PLANT TYPE	PRODUCT	RATE
Trees and Shrubs	Endure 16-16-16	10 lbs. per 1,000 sq. ft. every 4 months
Groundcovers	Turf Supreme 16-6-8, Triple Pro 15-15-15, Endure 16-16-16, Super Iron 9-9-9 (every 6 weeks) Evergreen 18-5-0 +Iron,	6 lbs. per 1,000 sq. ft. every 8 weeks: 10 lbs. per 1,000 sq. ft. every 12 weeks
Annual Flowers	Super Iron 9-9-9, 6-24-24 XB, Endure 16-16-16	10 lbs. per 1,000 sq. ft. every 6 weeks: 10 lbs. per 1,000 sq. ft. every 10 weeks
Palms	Best 13-5-8 Palm Plus	2 – 5 cups per tree

One 50 lb. bag will cover the following:

Nitra King 19-4-4……9,524 sq. ft (up to 6 weeks)
Endure 16-16-16……5,000 to 7,600 sq. ft (up to 10 weeks)
Triple Pro 15-15-15……7,500 sq. ft. (up to 12 weeks)
Poly Supreme 23-5-10……7,700 sq. ft. (up to 12 weeks)
Turf Supreme 16-6-8……..8,000 sq. ft. (up to 8 weeks)
Super Turf 25-5-5……8,300 sq. ft. (up to 12 weeks)
6-24-24 XB……Preplant 2,000-4,000 sq. ft.; Overseed 6,024 sq. ft.
All Season 19-6-12…… 6,300 sq. ft. (up to 12 weeks)
Pro Start 16-24-10……8,000 sq. ft. (up to 8 weeks)
Evergreen 18-5-0+5% Fe 9,000sq.ft.(up to 6 weeks)

PRE-PLANT PROGRAM

TURFGRASS	PRODUCT	APPLICATION RATE
New Sod, seed, or groundcover	6-24-24 XB Homogeneous Pellet	10 to 15 lb. per 1,000 sq. ft.
	Endure 16-16-16 Polyon/X-Cote Slow Release or Triple Pro 15-15-15 (homogeneous) Pro Start 16-24-10	10 lbs per 1,000 sq. ft./305 – 435 lb. per acre 6.6 lb. per 1,000 sq. ft. /287 lb. per acre
Overseeding	6-24-24 XB Homogeneous Pellet	6 to 8 lb. per 1,000 sq. ft.
	Endure 16-16-16, Triple Pro 15-15-15 (homogeneous)	7 to 10 lb. per 1,000 sq. ft. /305 – 435 per acre
TREES & SHRUBS	**PRE-PLANT APPLICATION**	**POST-PLANT APPLICATION**
Best –Paks 20-10-5	One Best-Pak per one-gallon container	2-4 Best-Paks per ½" of tree diameter or
	Two Best-Paks per five-gallon container	2-4 Best-Paks per 1 ½ ft. of height
SPECIALTY PRODUCTS FOR:	**PRODUCT**	**APPLICATION RATES**
Preemergence Weed Control (Crabgrass , Goosegrass, Spurge, Oxalis and More)	Dimension 270 G, 19-4-12, 16-8-8 & Barricade 16-6-8 SEE LABEL FOR SPECIFIC RATES	Timing: Sept – Oct (Poa Annua) Feb – May (Crabgrass) (One 50# bag covers 11,900 – 17,800 sq. ft.)
Postemergence Broadleaf Weed Control (Dandelion, Plantain Clover, plus 188 others)	Turf Supreme w/Trimec 16-6-8 One Shot with Dimension and Trimec	4 lbs. per 1,000 sq. ft.
Dry Spots	Soil Buster 100% Gypsum Equivalent	10 lbs. per 1,000 sq. ft.

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