Improving Newport Bay Watersheds – Nutrients and Algae

REPORTING WATERSHED IMPROVEMENT (SP 12)
Based on Multiple Evidence of Watershed-wide Improvement (Option 2b)

Executive Summary

Two Newport Bay watersheds show watershed-wide improvement for nutrient impairments to water quality. Nutrient load reductions were achieved using a watershed approach that included both regulatory and non-regulatory mechanisms. These mechanisms were targeted to the three primary sources of nutrients in the watersheds: agriculture, urban runoff and large commercial nursery operations. Water quality data show total nitrogen concentrations have been reduced from highs of 140 mg/L recorded in the 1980s down to less than 2 mg/L today. Biological indicators of watershed health have also shown improvement including reduced algal blooms and increased eel grass populations.

Watershed Identification

a Organization	**Santa Ana Regional Water Quality Control Board - California**
b Point of Contact	Doug Shibberu, Environmental Scientist Santa Ana Regional Water Quality Control Board 3737 Main Street, Suite 500, Riverside, CA 92501 Tel: 951-782-7959; Dshibberu@waterboards.ca.gov Tina Yin, Coordinator US EPA Region 9 75 Hawthorne Street (WTR-3) San Francisco, CA 94105 Tel: 415-972-3579; yin.christina@epa.gov
c Project Title	Reducing nutrient loads and excessive algae blooms in the Newport Bay Watersheds, Orange County, California
d # Watersheds Improved	Two Watersheds for Nutrients: Lower San Diego Creek (180702040103); Big Canyon Reservoir/Frontal Newport Bay (180702040201);

Description of 2002 Baseline Condition

e Watershed(s)	1. Lower San Diego Creek (180702040103); 2. Newport Bay* (180702040201) *also referred to as Big Canyon Reservoir-Frontal Newport Bay
f 2002 Impairments	Peters Canyon Wash (180702040101), not specifically listed, identified as location of significant nutrient sources affecting downstream watersheds
	Lower San Diego Creek (180702040103), Nutrients, excessive algae, metals, pathogens, pesticides, siltation
	Newport Bay (180702040201), Nutrients, excessive algae, metals, pathogens, pesticides, siltation
g Map (optional)	Attached Maps show HUC-12 watersheds, Monitoring and Implementation points. 1. Newport Bay Watersheds Overview Map 2. Peters Canyon Wash Watershed Detailed Map 3. Lower San Diego Creek Watershed Detailed Map 4. Newport Bay Watershed Detailed Map Note: the maps in bitmap format at the end of this document are designed for optimal screen display. Maps are available in PDF for clearer printing on EPA Region 9's Watersheds website or contact Tina Yin, EPA Region 9 yin.christina@epa.gov.

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Evidence of Watershed Approach

h Area of Effort	The Newport Bay watershed is located in the central portion of Orange County, California. The watershed is defined by the foothills of the Santa Ana Mountains to the east (Loma Ridge), and the San Joaquin Hills to the west and southwest. The total area of the Newport Bay watershed is approximately 154 square miles (98,500 acres). The sub-watersheds are: Peters Canyon Wash, Upper San Diego Creek, Lower San Diego Creek, and Newport Bay. The watershed is highly urbanized and also has some agriculture (row crops - strawberries, avocados, lemons and commercial nurseries). Nine cities are located partly or fully within the watershed: Costa Mesa, Irvine, Lake Forest, Laguna Hills, Laguna Woods, Newport Beach, Orange, Santa Ana, and Tustin. The watershed also includes several unincorporated areas of Orange County. The total estimated population within the watershed is 640,000.
i Key Stake-holders Involved and Their Roles	Santa Ana Regional Water Quality Control Board (SARWQCB or Water Board): California regional water quality agency responsible for implementing the federal Clean Water Act as well as state water quality regulations. The SARWQCB adopted a nutrient TMDL for the San Diego Creek and Newport Bay Watershed in 1998. The TMDL has an overall goal of reducing nutrient loads by 50 percent, and eliminating the occurrence of excessive algal blooms in Newport Bay by 2012. The nutrient TMDL established an implementation plan, relying on regulatory, and non regulatory mechanisms requiring stakeholders to reduce nutrient discharges. NPDES Permitted Cities - County of Orange: The County of Orange acts as the lead for the municipalities regulated under the area-wide NPDES stormwater permit for Orange County (Costa Mesa, Irvine, Laguna Hills, Laguna Woods, Lake Forest, Newport Beach, Orange, Santa Ana, and Tustin). The stormwater permittees in the Newport Bay Watershed are responsible for implementing a monitoring plan for the nutrient TMDL. Permittees are also required to implement programs to reduce nutrient runoff from urban areas. University of California Cooperative Extension (UC-Coop): The University of California (UC) operates a 250-acre research and extension station in the watershed. UC-Coop staff and facilities provide training and expertise to improve agricultural runoff water quality and also to improve/reduce runoff from urban landscapes. Large Commercial Nurseries (Hines, Bordiers, El Modeno, and Nakase): Monitoring data (from the TMDL) demonstrated that the large commercial nurseries in the watershed were responsible for a significant portion of the nutrient load discharged into Newport Bay. The nurseries were assigned nutrient loading limits by the Regional Water Board and are required to implement programs to comply with these limits. Irvine Ranch Water District (IRWD): IRWD supplies nearly all water used by municipalities and agricultural operations in the watershed. IRWD also operates the only municipal wastewater treatment facilities in the watershed. IRWD recycles or diverts all wastewater so that no effluent is discharged into Newport Bay. IRWD was recently authorized by state law to provide urban runoff treatment services and is implementing a plan to treat urban runoff using constructed wetlands.

	California Department of Transportation (Caltrans): Caltrans installs and maintains BMPs to treat stormwater runoff from seven highways in the watershed. A recently-built underpass along one of these highways extends below the shallow (nitrate-rich) groundwater table requiring permanent dewatering and discharge of groundwater. Caltrans has built a treatment system to reduce nitrogen loading caused by this discharge.
j Watershed Plans	**Newport Bay/San Diego Creek Watershed Nutrient TMDL and Implementation Plan (1998)** http://www.swrcb.ca.gov/rwqcb8/board_decisions/adopted_orders/orders/1998/98_100_amend98_9.pdf The nutrient TMDL establishes seasonal nutrient load allocations and identifies specific implementation actions with a timetable, to meet water quality objectives. These include NPDES permit limits, agricultural management measures, and water quality monitoring requirements. **Natural Treatment System Master Plan, IRWD (2003)** http://www.naturaltreatmentsystem.org/PDF-NTSMasterPlan-June2005/NTS-MasterPlan-combined.pdf The Irvine Ranch Water District (IRWD), in cooperation with County of Orange and the cities of Irvine, Lake Forest, Newport Beach, Orange, Santa Ana and Tustin, has developed a Natural Treatment System (NTS) plan to address regional water quality treatment needs. The goal of the NTS plan is to improve water quality in San Diego Creek and its tributaries through a network of constructed water quality treatment wetlands, and to complement the nutrient runoff reduction activities by the county and cities for compliance with TMDL targets. Secondary benefits include habitat enhancement, aesthetics, recreation, and education. **Central Orange County Integrated Regional and Coastal Watershed Management Plan (2007)** http://www.irwd.com/AboutIRWD/IRCWMP.php The Central Orange County Integrated Regional and Coastal Watershed Management Plan (IRCWMP) is a comprehensive planning document designed to protect water quality within the Newport Bay/San Diego Creek and Newport Coast Watersheds, including Newport Bay and sensitive coastal regions. The IRCWMP was prepared by local agencies and stakeholders to improve and better coordinate water resource protection efforts. **Orange County Regional Monitoring Plan for the San Diego Creek and Newport Bay Nutrient TMDL** http://www.ocwatershed.com/Watersheds/default.aspx?ID=1000299 The County of Orange conducts the Regional Nutrient Monitoring Program (RMP) for Newport Bay and its watershed pursuant to the requirements established by the TMDL. Routine monitoring includes most of the traditional monitoring that has occurred in the watershed (i.e. samples collected either weekly, bi-weekly, or monthly from drainages throughout the watershed). The data collected is used to assess progress toward attainment of the interim and final TMDL targets for total nitrogen and total phosphorus loadings to the Bay. Routine monitoring results can be found in the quarterly reports on the county's website: www.ocwatersheds.com. Sampling Locations: i. Santa Ana-Delhi Channel at Irvine Boulevard

	ii. San Diego Creek at Campus Drive iii. Bonita Canyon Creek at MacArthur Boulevard iv. Costa Mesa Channel at Westcliff v. El Modena-Irvine Channel at Michelle vi. Lane Channel at Jamboree vii. Agua Chinon Wash at Irvine Center Drive viii. Peters Canyon Wash at Barranca ix. San Diego Creek at Culver A Special Monitoring component of the RMP includes investigations to better understand the nature of nutrient sources and dynamics in the watershed. In addition, algae samples are collected from Upper Newport Bay to analyze the extent, magnitude, and duration of algal blooms.
k Restoration Work/ Implementation Actions	1. In January 1998, the Regional Water Board issued a NPDES permit to Caltrans requiring a 50% nutrient load reduction for surface water discharges from its underpass site. Later that year, the Regional Water Board adopted a nutrient TMDL and implementation plan for San Diego Creek and Newport Bay Watersheds. 2. The TMDL and Implementation Plan required the revision of NPDES permits and nonpoint source Waste Discharge Requirements (WDRs) to include all nutrient discharges to surface waters in Newport Bay including discharges of groundwater from dewatering and clean up projects. These regulatory requirements resulted in several on-the-ground implementation actions: a) Three of the four large commercial nurseries have installed recycling systems to reuse their irrigation runoff. These systems have greatly reduced the dry-weather runoff loads from the nurseries. b) A 40 acre complex of IRWD-owned wetlands is used for treating half the flow of San Diego Creek prior to its discharge into Newport Bay. Through a natural process called denitrification, the wetlands convert soluble nitrogen into inert nitrogen gas that is no longer available to support algae blooms. c) Continuous implementation action is required to address the high nutrient loads from an underpass along a state highway. The underpass extends below the shallow (nitrate-rich) groundwater table, and thus requires permanent dewatering and nitrogen removal treatment. Caltrans built a denitrification filter system to reduce nitrogen concentrations from its permanent groundwater dewatering facility for the underpass. Unfortunately this system, while successful in meeting permit requirements, was later shutdown due to other concerns, thereby requiring a different solution. Caltrans is currently achieving its nitrogen reduction target by diverting all dewatering effluent from the site out of the watershed. 3. The TMDL and Implementation Plan also required the development of an Agricultural Nutrient Management Plan for row crops. Funded with an US EPA grant from Clean Water Act Section 319, the UC Coop. Extension trained growers in the watershed in the use of BMPs, and pilot-tested several BMPs on grower's land. The project demonstrated methods to reduce or eliminate overhead spray irrigation and tailwater runoff. The project contributed to achieving relatively low nutrient runoff

rates calculated for agricultural land uses in the watershed.

4. In 2002 the Orange County stormwater NPDES permits required the regulated community to develop model fertilizer use guidelines and report fertilizer use by municipalities. The UC Cooperative Extension has worked with Orange County and municipalities to develop these guidelines. Annually-reported fertilizer use by the county and cities in the watershed has declined significantly.

Evidence of Watershed-wide Improvement

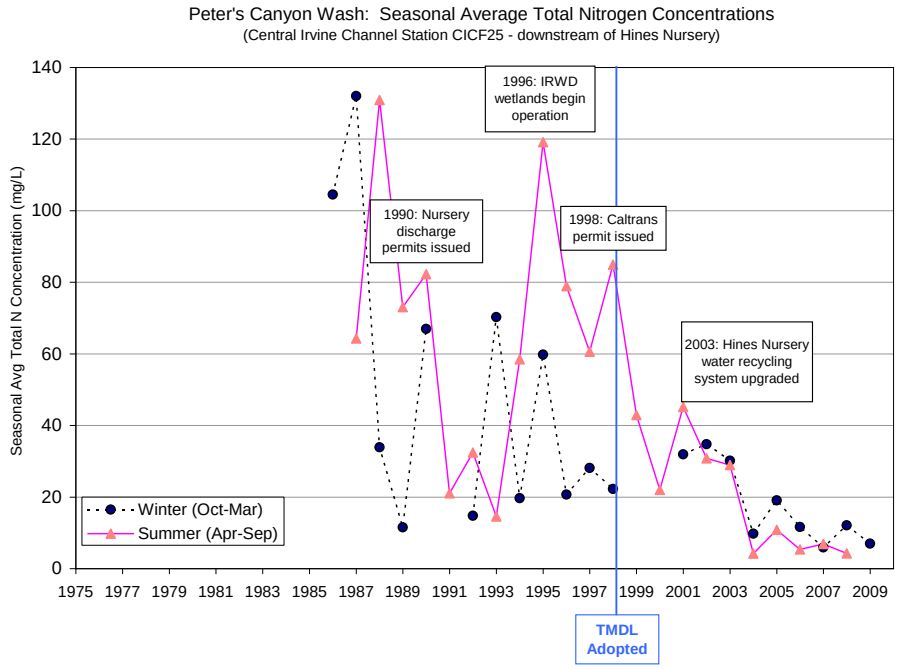
l Impairments Removed (If applicable)

The data show significant improvements in nutrient levels and associated algal blooms, however, it not anticipated that there will be a 303 (d) delisting. The Water Board is currently revising the Nutrient TMDL goals established in the 1998 TMDL. The new goals may require additional nutrient reductions in order to address confined persistence of excessive algal blooms.

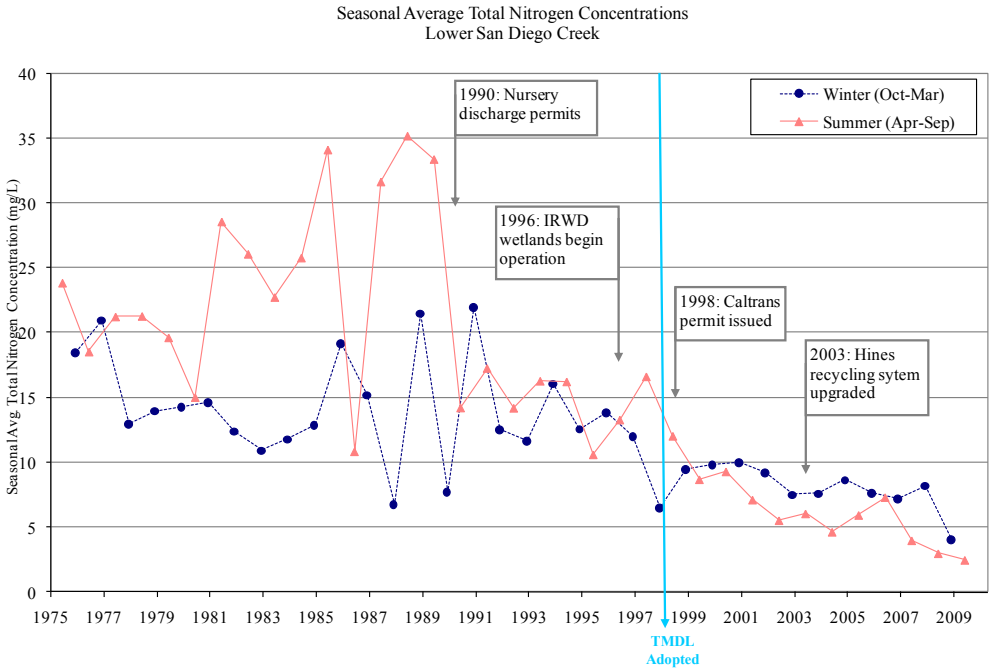
m Improving Trend in Water Quality

Water quality data in the Newport Bay watersheds show improving trends for nutrient levels. Key implementation actions by the Regional Board and other stakeholders in the upper watersheds have contributed to significant decreases in summer season nutrient loads throughout the greater watershed. Further evidence of improved watershed health is provided by biological indicators such as decreased algal blooms and increased eel grass habitat.

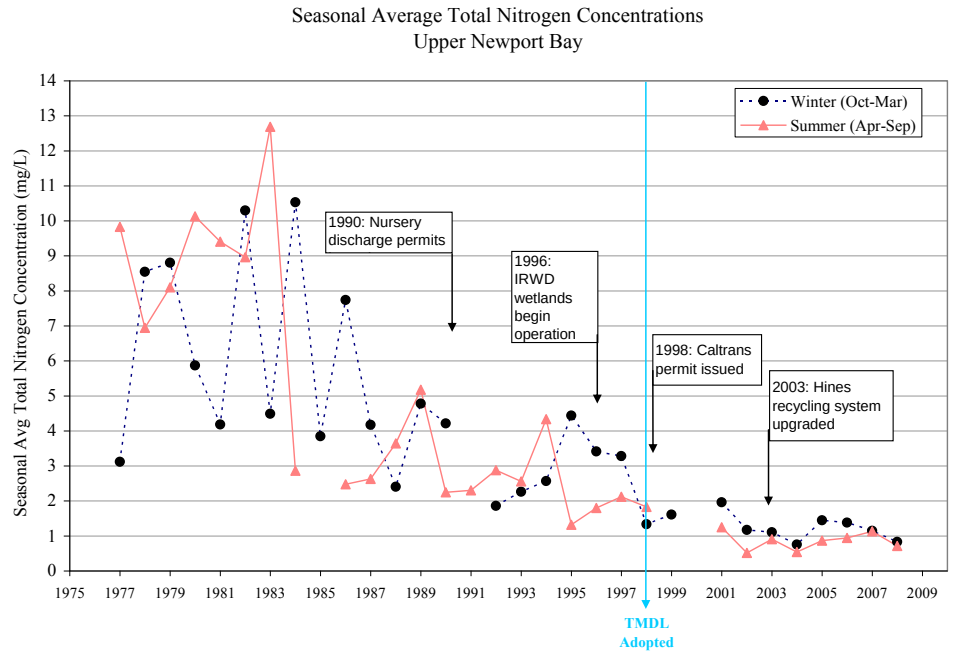
1. Peters Canyon Wash (see figure below): Total nitrogen concentrations have declined significantly since 2000. Levels were observed to rise somewhat due to higher flushing of nitrate from groundwater after the record 2004/05 rainfall season. Despite this increase, concentrations are currently still below levels seen in 2000 and 2001. Levels detected in this watershed have been significantly reduced due to key implementation actions.



2. Lower San Diego Creek Nitrogen concentrations in Lower San Diego Creek have also declined significantly as evidenced by data collected at the Campus Drive monitoring station.



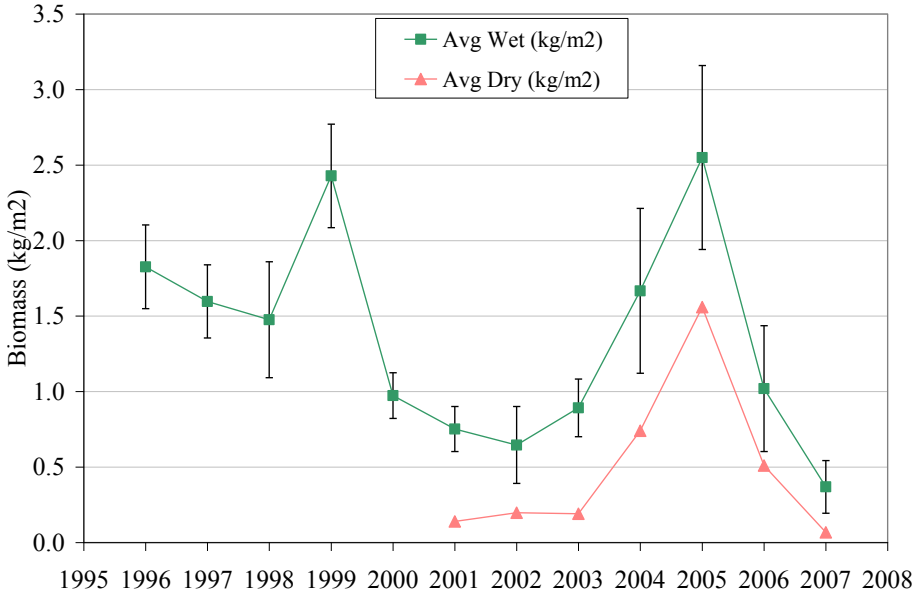
3. Upper Newport Bay (Big Canyon Reservoir-Frontal Newport Bay) (see figure below): Total nitrogen loads have declined significantly since the 1980s, particularly during the summer season. Winter season loads are still driven largely by storm runoff volumes. The trend over the last ten years is obscured by varying, nitrate-rich groundwater baseflows, driven by alternating drought (2002, 2008) and record rainfall (2005) years. (Monitoring Station: UNBSDC – depth averaged)



n Supporting Trends (one or more)

1. Evidence of improving trend in related biological indicator/index

(a) Extent (biomass) of algal blooms in Newport Bay is reduced, although the heavy rainfall year of 2004/05 resulted in a very large bloom in the Upper Bay.



(b) Nitrogen content of algae is lower in the years 2002-2007 than in 1997: The median algae tissue nitrogen concentration in 1997 was 15,000 mg/kg, while the median algae tissue nitrogen level of during 2002-07 was 3,660 mg/kg.

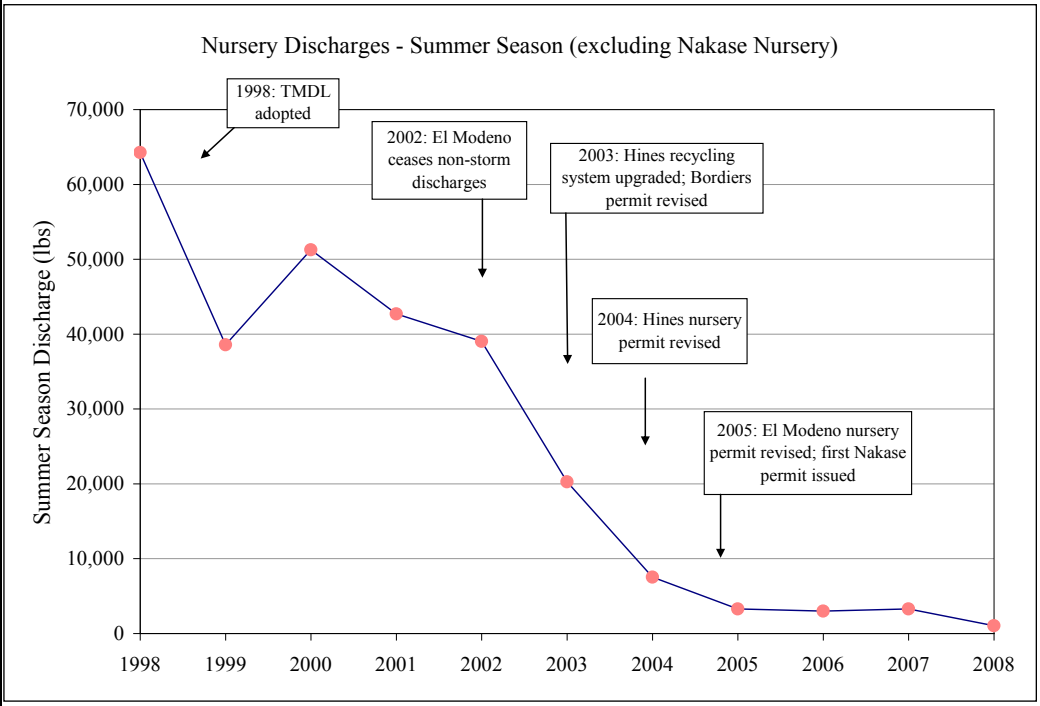
(c) Extent of eelgrass habitat has increased significantly in Lower Newport Bay, although not yet in Upper Newport Bay. Eelgrass surveys by the city of Newport Beach showed that eelgrass habitat in Lower Newport Bay had increased from less than 3 acres in 1993 to over 35 acres in 2004.

Photo: Eelgrass in Newport Bay

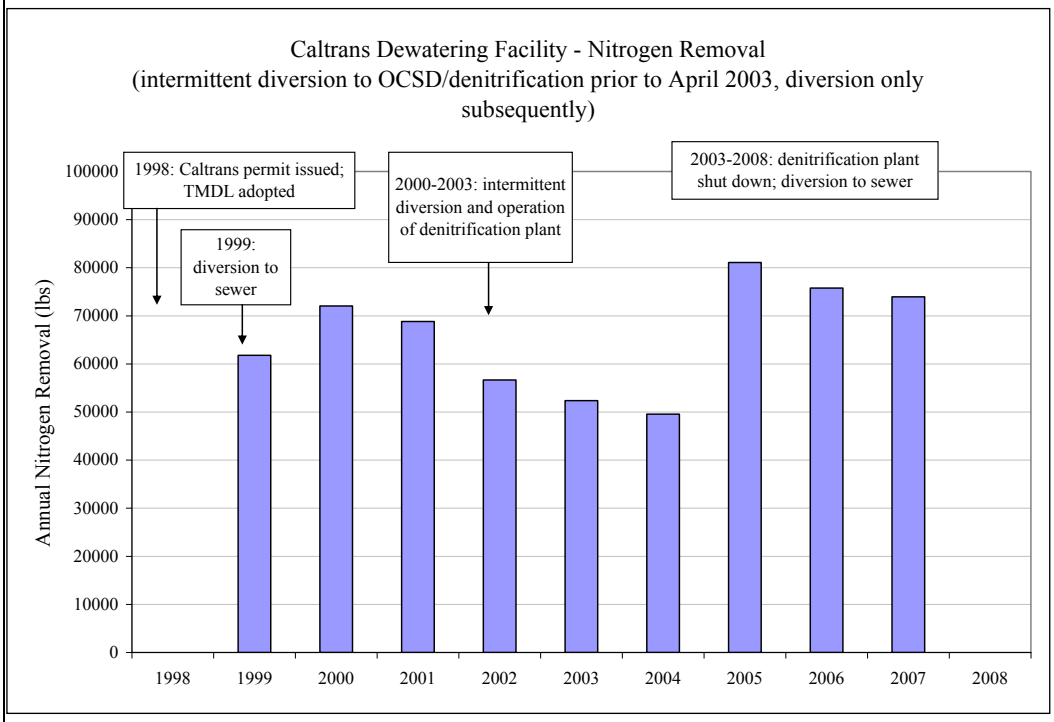
2. Evidence of widespread significant load reductions

The TMDL and implementation plan identified three major sources of nutrients in Newport Bay watersheds: runoff from agriculture, urban areas and commercial nurseries. Key implementation actions taken to address these sources have achieved significant load reductions and can largely be credited with helping to achieve watershed wide improvements in nutrient inputs into the watershed. See figures below.

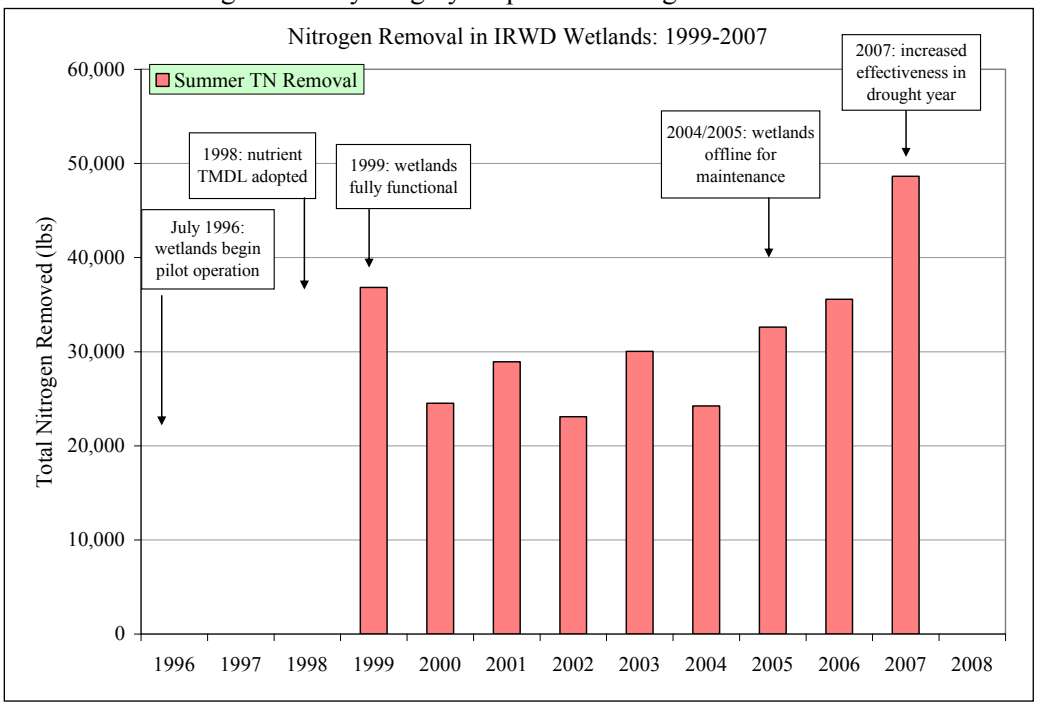
(a) The use of water recycling systems by commercial nurseries has lowered nutrient loads from pre-TMDL levels nearing 65,000 lbs of summer discharge to less than 1000 lbs.



(b) The Caltrans dewatering facility achieves significant load reductions. The load reductions have primarily been achieved by diverting nutrient rich water to sewer rather than surface runoff.



(c) Loads removed in IRWD wetlands are significant, reducing the nitrogen load in San Diego Creek by roughly 30 percent during the summer months.



o Evidence of implementation	The significantly improved nutrient levels and related biological indicators of watershed health (reduced algal blooms and increased eel grass population) are directly attributable to the restoration actions taken by the stakeholders. Restoration activities were targeted to address the most significant nutrient loads in each of the watersheds. Thusly, the stakeholders have been able to demonstrate improving water quality trends throughout the watersheds. Implementation actions throughout the sub-watersheds (12 digit HUCs) together have contributed to overall improvements in the downstream Newport Bay. 1. Regulatory Actions: All relevant discharge permits (NPDES and WDRs) in the watershed now include nutrient discharge requirements. 2. Stakeholder Coordination: The stakeholders in the watersheds have worked together to comply with the requirements of the discharge permits, including coordinated monitoring efforts, outreach and education. A stakeholder group has alsp been formed to address the regional problem of elevated nitrogen and selenium in groundwater (http://www.ocnsmp.com). 3. Outreach, Demonstration and Education: UC Coop Ext. has built a parallel landscape demonstration center where volunteer master gardeners are trained along with county and municipal staff, in lot-level BMPs and landscaping to reduce runoff from urban areas. 4. Business Community Commitment: The Irvine Company, a private real estate company, requires implementation of water quality BMPs as condition of lease to agricultural growers.
p No deteriorating trends	High nutrient loads often cause lethally low levels of dissolved oxygen by producing high algal growth which can deplete oxygen in bottom parts of a stratified water body. According to the Southern California Coastal Water Research Project, Newport Bay is less prone to these problems because it seldom stratifies to a significant extent. Newport Bay's shallow geometry and tidal action generally prevent stratification except during and after storm events, when freshwater runoff overlays the saltier water that usually fills the Bay. Continuous monitoring data collected in 2005 show short episodes of low dissolved oxygen only after storm events. Hypoxic events in Newport Bay appear to be relatively brief and are associated with a combination of stormwater runoff, reduced solar radiation during cloudy weather (leading to increased respiration) and weak tides (which reduce tidal flushing of the Bay). (Nezlin 2006) Source: N. Nezlin, K. Kamer, ED Stein, A. Carr, J. Hyde " Relationship between dissolved oxygen and macroalgal distribution in Upper Newport Bay" Technical Report 494. Southern California Coastal Water Research Project. Westminster, CA. 2006. Web Dec 23, 2009. (ftp://ftp.sccwrp.org/pub/download/DOCUMENTS/TechnicalReports/494_UNB_11.06.pdf) (www.sccwrp.org)
q Photos/Graphics (optional)	Imbedded in this report.

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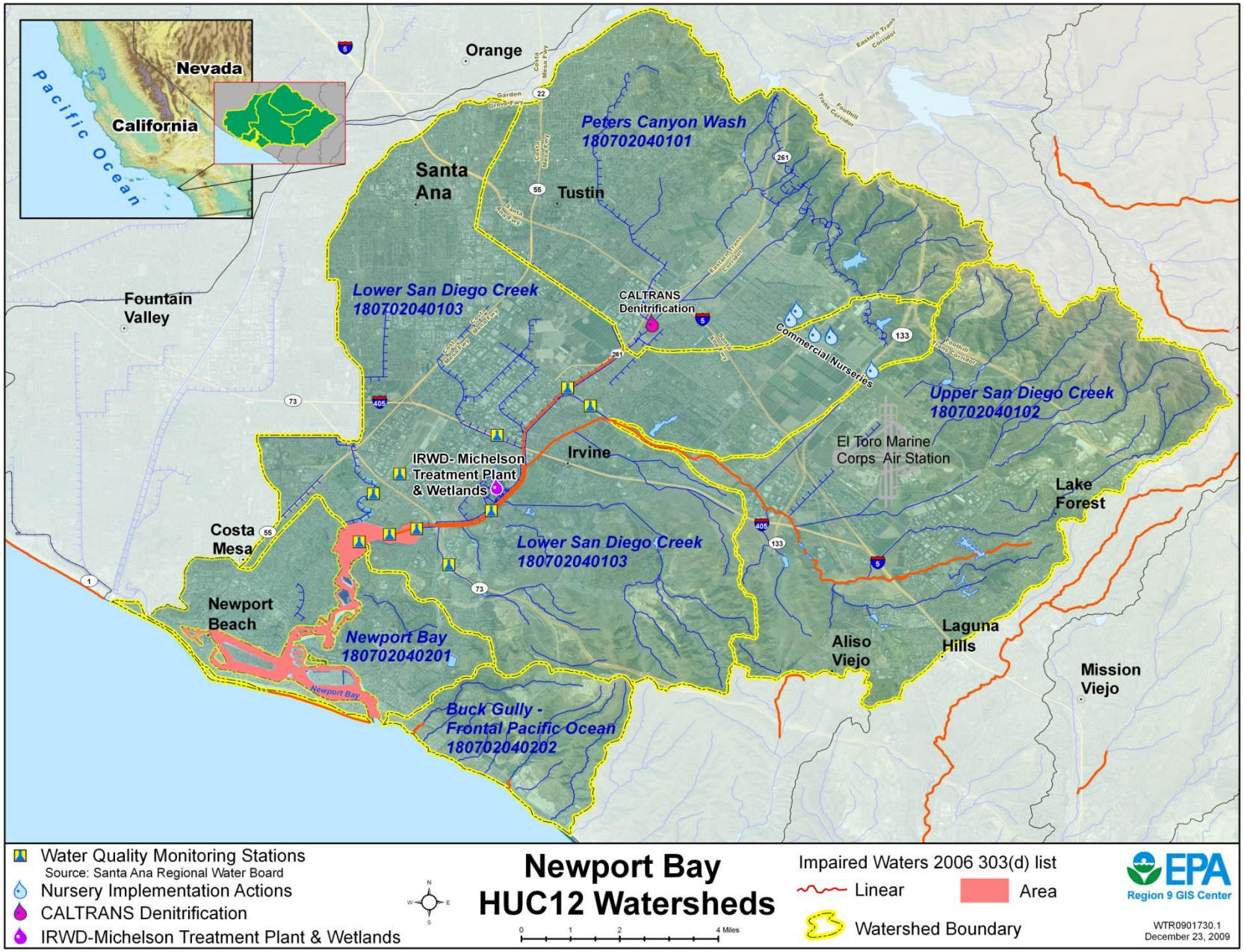

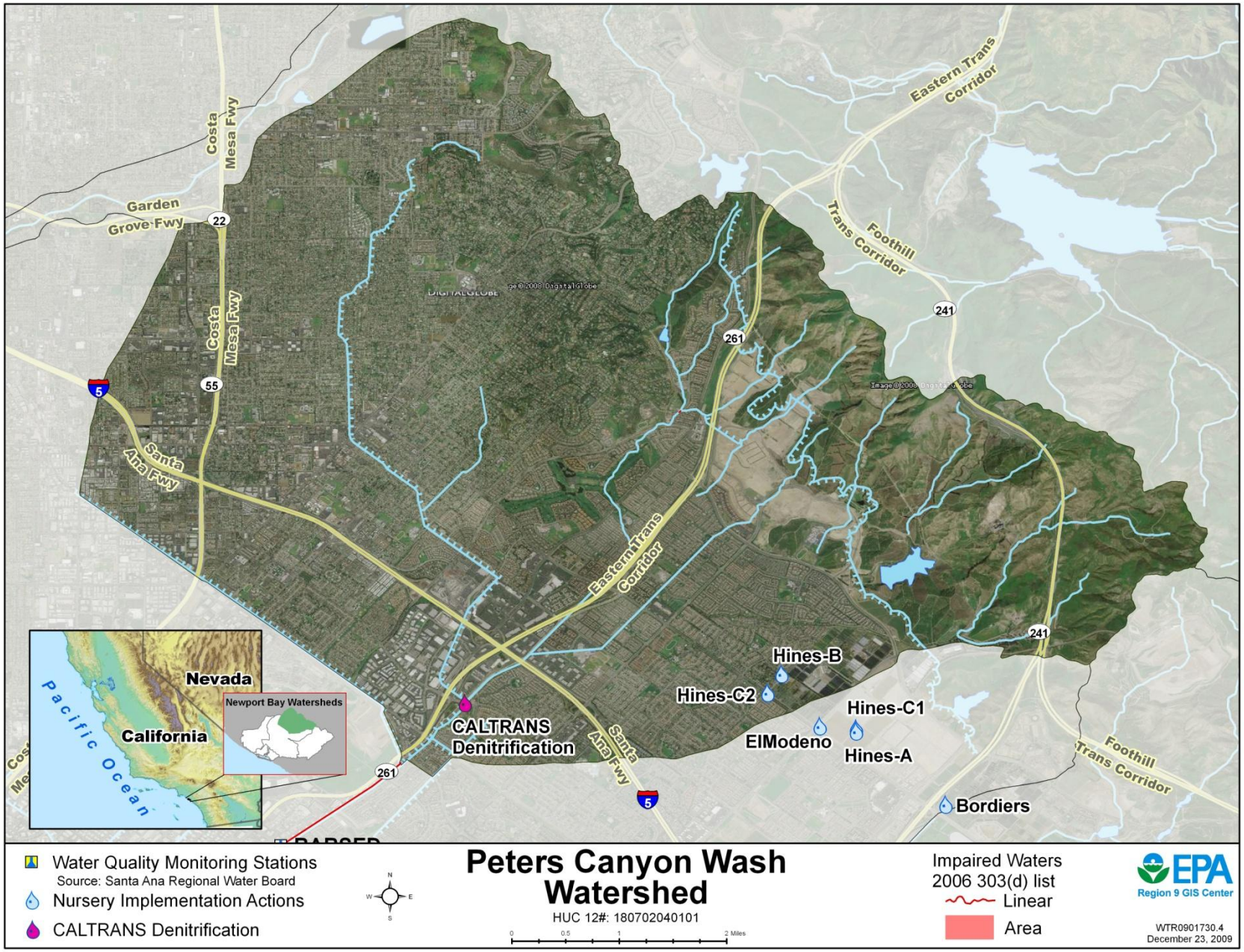

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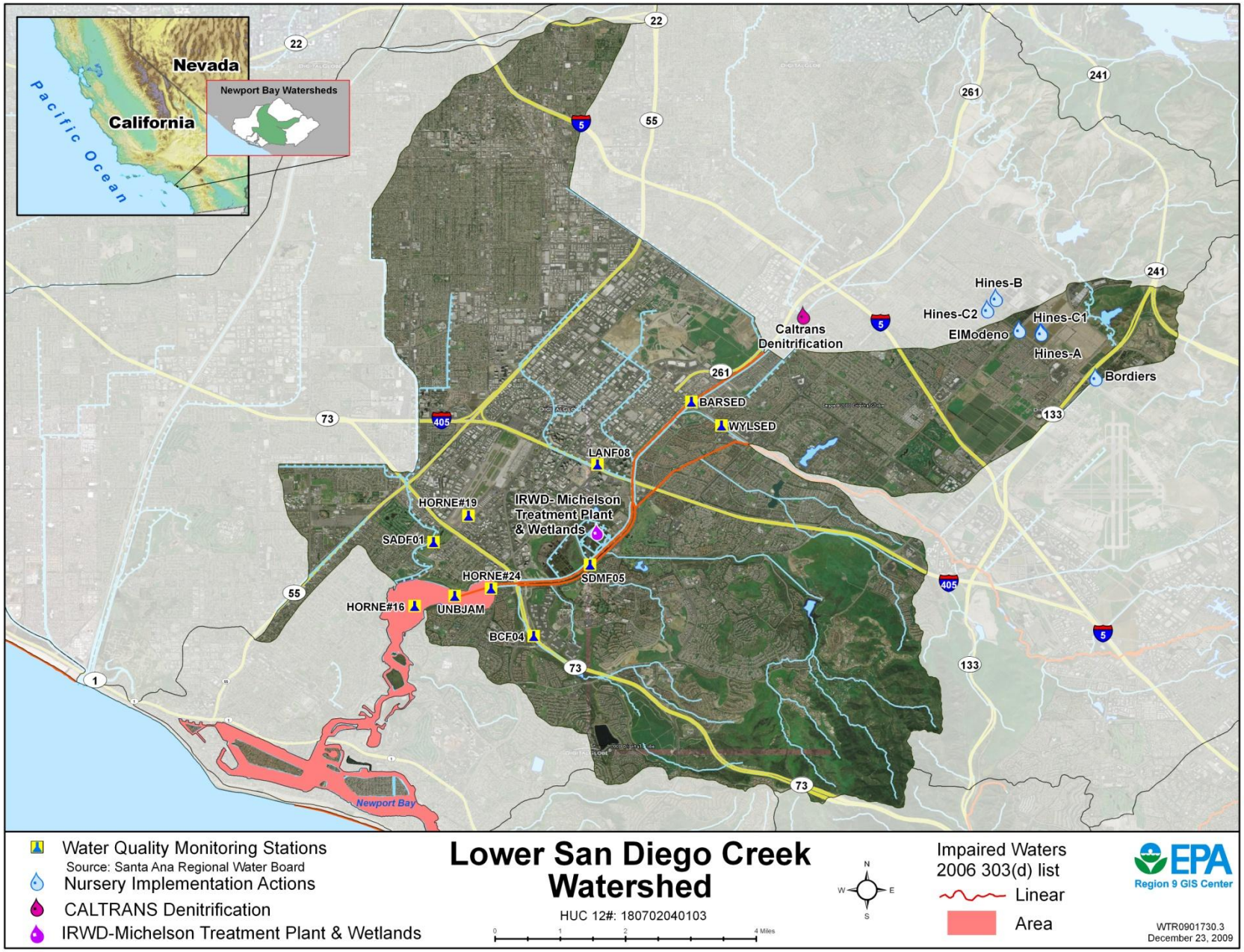

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