Technical Memorandum No. 4

ULARA Salt and Nutrient Management Plan

Subject:	**Management Plan**
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Date:	October 27, 2015; Revised December 31, 2015; Revised March 9, 2016, Revised July 13, 2016
Reference:	0597-001.00

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Acronyms and Abbreviations

μg/L	micrograms per liter
AF	acre-feet
AFY	Acre-feet per year
AWS	Automatic Water Softener
AWT	Advanced Water Treatment
BMP	Best Management Practice
BOU	Burbank Operable Unit
BPO	Basin Plan Objective
BSBPO	Basin Specific Basin Plan Objective
BWP	Burbank Water and Power
BWRP	Burbank Water Reclamation Plant
CAO	Cleanup and Abatement Order
CCP	Conservation Credits Program
CCR	California Code of Regulations
CDPH	California Department of Public Health
CECs	Constituents of Emerging Concern
CEQA	California Environmental Quality Act
CH&SC	California Health & Safety Code
Cl	Chloride
CR	Colorado River
CRA	Colorado River Authority
CUWCC	California Urban Water Conservation Council
CVWD	Crescenta Valley Water District
CWA	Clean Water Act
CWC	California Water Code
CWH	Council for Watershed Health
DCE	1,1 Dichloroethene
DCTWRP	Donald C. Tillman Water Reclamation Plant
Delta	Sacramento-San Joaquin Bay Delta
DPR	Direct Potable Reuse
DWR	California Department of Water Resources

EPA	U.S. Environmental Protection Agency
GAC	Granular Activated Carbon
GLAC	Greater Los Angeles County
GOU	Glendale Operable Unit
GSIS	Groundwater System Improvement Study
GW	Groundwater
GWP	Glendale Water and Power
GWR	Groundwater Replenishment
HSG	Hansen Spreading Grounds
IRWM	Integrated Regional Water Management
IW	Imported Water
LACDPW	Los Angeles County Department of Public Works
LADWP	City of Los Angeles Department of Water and Power
LAGWRP	Los Angeles-Glendale Water Reclamation Plant
LAR	Los Angeles River
LARWQCB	Regional Water Quality Control Board – Los Angeles
LASAN	City of Los Angeles Bureau of Sanitation
LF	Lineal Feet
LID	Low Impact Development
LVMWD	Las Virgenes Municipal Water District
MCL	Maximum Contaminant Level
MCY	Million Cubic Yards
mg/L	milligrams per liter
MGD	Million Gallons per Day
µg/L	micrograms per liter
MM	Management Measure
MS4	Municipal Separate Storm Sewer System
MWD	Metropolitan Water District of Southern California
n/a	Not applicable
NdN	Nitrification/Denitrification
NHOU	North Hollywood Operable Unit
NO_3-N, N	Nitrate as nitrogen

NPDES	National Pollutant Discharge Elimination System
NPR	Non-potable Reuse
NWRI	National Water Research Institute
OWTS	Onsite Wastewater Treatment System
Panel	National Water Research Institute's Independent Advisory Panel
PCA	Potentially Contaminating Activity
PCE	Tetrachloroethylene
ppm	Parts per million
PSG	Pacoima Spreading Grounds
PWP	City of Pasadena Department of Water and Power
RW	Recycled Water
RWAG	Recycled Water Advisory Group
RWC	Recycled Water Contribution
RWP	Recycled Water Policy
S/Ns	Salts/Nutrients
SB	Sylmar Basin, Senate Bill
SCAG	Southern California Association of Governments
SCSC	Southern California Salinity Coalition
SFB	San Fernando Groundwater Basin
SNMP	Salt and Nutrient Management Plan
SRWS	Self-Regenerating Water Softener
SW	Stormwater
SWP	State Water Project
SWRCB	State Water Resources Control Board
SWRCB-DDW	State Water Resources Control Board – Division of Drinking Water
TCE	Trichloroethylene
TDS	Total dissolved solids
TM	Technical Memorandum
TMDLs	Total Maximum Daily Loads
TOC	Total Organic Carbon
TSG	Tujunga Spreading Grounds
ULARA	Upper Los Angeles River Area

USBR	United States Department of the Interior – Bureau of Reclamation
USEPA	United States Environmental Protection Agency
UWMP	Urban Water Management Plan
VB	Verdugo Basin
VOCs	Volatile organic compounds
VPWTP	Verdugo Park Water Treatment Plant
WDR/WRR	Waste Discharge Requirements/Water Recycling Requirements
WQOs	Water Quality Objectives
WRF	Water Reclamation Facility
WRP	Water Reclamation Plant
WTP	Water Treatment Plant
WY	Water Year (October 1 of one year to September 30 of the following year)

1 Purpose of TM

This Technical Memorandum (TM) identifies and characterizes the management measures in the Upper Los Angeles River Area (ULARA) salt and nutrient management plan (SNMP) with the focus on potential salt and nutrient impacts over a 2025 planning horizon. The TM constitutes a “Management Plan” consisting of management measures. “Management measures” are defined as projects or other actions (existing, planned, or conceptual) that may in some way change salt and/or nutrient conditions in the ULARA groundwater basins, whether in a positive or negative fashion. Projects or actions that improve salt and nutrient conditions in the ULARA basins are defined as “implementation measures”. Recycled water projects and groundwater remediation efforts are the most significant management measures for this region, but other management options (including land development) are also discussed.

2 Relationship to ULARA SNMP Draft Outline

A Draft Outline of the SNMP for ULARA (Draft Outline) was developed by the ULARA Watermaster and reviewed by the Los Angeles Regional Water Quality Control Board (LARWQCB) in January 2013. Changes were subsequently made in response to comments from the LARWQCB. The revised Draft Outline designated four topics to be covered under “Management Measures”. These four topics are incorporated into the organizational structure of this TM and are cross-referenced as described in Table 2-1.

Table 2-1: Draft Outline SNMP Topics Cross-Referenced in This TM

Draft Outline Topic	Section Number in this TM	Section Title in this TM
Future Recycled Water Use	Section 4.2	Future Projects
Salt/Nutrient Management Options	Section 5.1	Types of Impacts – Loading Versus Concentration
Future Projects	Section 5.2.2	Planned Management Measures
Future Land Development and Use	Section 6	Changing Conditions

3 Assessment of Need for Implementation Measures

The State Water Resources Control Board (SWRCB) Recycled Water Policy (2013) states that within one year of the receipt of a proposed SNMP, the RWQCBs shall consider for adoption revised management plans, consistent with Water Code section 13242, for those groundwater basins within their regions where water quality objectives (WQOs) for salts or nutrients are being, or are threatening to be, exceeded. Accordingly, the need for, or lack of need for implementation measures is determined by comparing existing and projected future groundwater quality to the Basin Plan Objective (BPO) for nitrate and the Basin-Specific Basin Plan Objectives (BSBPOs) for minerals and chloride.

The following considerations help to define the need for implementation measures:

- A comparison of average existing and projected future water quality in the groundwater basins to (1) BPOs for nitrate and (2) BSBPOs for total dissolved solids (TDS) and chloride
- An assessment of the causes of elevated concentrations (if any)
- An assessment of past implementation measures to improve groundwater quality (e.g., basin adjudication to prevent overdraft)

Subsequent steps in the SNMP analysis, primarily modeling, will confirm whether or not additional implementation measures beyond the existing and planned measures in this TM are warranted. In addition, the salt/nutrient (S/N) management process in the ULARA is ongoing and groundwater quality will be monitored and documented to determine if groundwater meets groundwater quality objectives. These actions will also help to determine the need for additional implementation measures for any future SNMP updates.

4 Recycled Water Projects

Recycled water projects are the primary influence on S/N in the ULARA groundwater basins. Based on the quality, deep percolation of recycled water applied to the land surface, via either irrigation and/or artificial recharge operations in spreading basins can increase or decrease salt and/or nutrient concentrations in the local groundwater (i.e., they are all management measures but only some are implementation measures). Projects that use advanced treated recycled water reduce or manage (mitigate) S/N loading on a sustainable[1] basis; however, recycled water projects that use Title 22 tertiary-treated recycled water can increase S/N loading and concentrations, but may reach steady-state in the Basin. Tertiary-treated recycled water is utilized for a variety of non-potable reuse (NPR) applications in the San Fernando Groundwater Basin (SFB), including landscape irrigation and industrial operations. There are also plans for recharge of recycled water in the SFB. Additional details on existing and future recycled water projects are provided in this section and those projects are also further described in Section 5.

4.1 Existing Projects

Recycled water currently used in the ULARA is for non-potable purposes only (non-potable reuse or NPR). NPR is defined as the use of recycled water for a non-potable beneficial purpose, and it requires a source of supply, a dedicated recycled water pipeline to distribute the water, and a customer demand (end use) for the water. All recycled water in the ULARA meets Title 22 standards set forth by the California Code of Regulations for specific end uses. Currently, recycled water is used for landscape irrigation, golf course irrigation, in-plant use at the water reclamation plants that produce the recycled water, power plant cooling, and other industrial uses.

There are four water reclamation plants (WRPs) that have the ability to provide recycled water to the ULARA: the City of Los Angeles Donald C. Tillman WRP (DCTWRP), the Burbank WRP, the Los Angeles-Glendale WRP (LAGWRP), and the Las Virgenes Municipal Water District (LVMWD) Tapia WRF. Of these four, three already provide recycled water to the valley fill areas of the ULARA: the DCTWRP, Burbank WRP, and LAGWRP as shown in Table 4-1. Recycled water projects originating at the Tapia WRF that could impact ULARA are planned projects (i.e., not existing) as of December 2015.

The table includes the typical estimated volumes of recycled water that are delivered within the ULARA each year. Recycled water that reaches the groundwater basins includes recycled water used for irrigation but not for industrial uses. Recycled water for industrial uses is typically sewered and conveyed outside the ULARA.

[1] "Sustainable" in this context is defined as using a resource such that the resource is not depleted or permanently damaged.

Table 4-1: Existing Recycled Water Sources and End Uses

WRP	Treatment Level	Capacity (MGD)	Recycled Water Produced in 2012-2013 (AFY)[1]	End Uses in 2012-2013 (AFY)		Recycled Water to Groundwater Basins in 2012-2013 (AFY)[2]		References
DCT	Tertiary (Title 22) with Nitrification/ Denitrification	80	41,675	NPR: Lakes[3]: Operational Safety Weir[4]: In-Plant:	2,747 26,009 9,951 2,968	SFB:	1,770	2012-2013 ULARA Watermaster Report, Table 2-7
LAG	Tertiary (Title 22) with Nitrification/ Denitrification	20	18,068	NPR (LADWP): NPR (GWP): Operational Safety Weir[4]: In-Plant:	2,306 1,874 12,898 990	SFB (LADWP): SFB (GWP): Verdugo (GWP)[5]:	338 1,571 255	2012-2013 ULARA Watermaster Report, Table 2-7 2001-2012 GWP Data
Burbank	Tertiary (Title 22) with Nitrification/ Denitrification	10	9,030	NPR: Discharge:	1,608 7,422	SFB:	1,608	2012-2013 ULARA Watermaster Report, Table 2-7

Notes:

AFY = acre-feet per year
LAR = Los Angeles River
MGD = millions of gallons per day
WRP = Water Reclamation Plant
GWP = Glendale Water and Power
SFB = San Fernando Basin
DCT = Donald C. Tillman
NPR = non-potable reuse
LADWP = Los Angeles Department of Water and Power
UWMP = Urban Water Management Plan
LAG = Los Angeles-Glendale

1. Calculated as the sum of End Uses in 2012-2013.
2. Includes irrigation uses but not industrial uses (e.g., Valley Generating Station), which are typically sewered.
3. Effluent to the LAR includes tertiary-treated recycled water used for beneficial reuse in Balboa Lake, Wildlife Lake, and the Japanese Gardens.
4. Operational safety weirs convey recycled water to ocean via the Los Angeles River.
5. Based on average of 2001-2012 recycled water deliveries by GWP in the Verdugo Basin.

4.2 Future Projects

In addition to the three WRPs described above, the Tapia WRP is anticipated to supply recycled water to the SFB for NPR before 2025 as the LVMWD tertiary recycled water system is expanded into the West San Fernando Valley. In fact, there are future plans to expand the NPR distribution systems from all four WRPs, as well as to develop a planned groundwater replenishment (GWR) project using recycled water from the DCTWRP. Table 4-2 summarizes the anticipated future recycled water projects in the ULARA.

Table 4-2: Future (2025) Recycled Water Sources and End Uses

WRP	Treatment Level	Influent Capacity (MGD)	Anticipated Recycled Water Produced in 2025 (AFY)	End Uses Annual Average (AFY)		Recycled Water to Groundwater Basins (AFY)		References
DCT	Tertiary to Title 22 Standards with Nitrification/ Denitrification	80	76,289[1]	NPR[2]: Lakes[3]: Op. Safety Weir[4]: In-plant[5]:	3,044 30,245 0 3,000	SFB[6]:	1,948	IRP Go-Policy No. 5. http://lacitysan.org/irp 2010 LADWP UWMP 2014-2015 LADWP Recycled Water Annual Report
	Advanced Water Purification[7]	44	30,000	GWR:	30,000	SFB:	30,000	2014-2015 LADWP Recycled Water Annual Report
	Brine Concentrate[7]	N/A	N/A	Sewer:	10,000	N/A		2012 LADWP Groundwater Recharge Master Planning Report
LAG	Tertiary to Title 22 Standards with Nitrification/ Denitrification	20	19,040[8]	NPR (LADWP): NPR (GWP)[9]: NPR/GWR (PWP)[10]: Op. Safety Weir[4,11]:	6,000 1,662 3,100 8,278	SFB (LADWP)[12]: SFB (GWP)[13]: Verdugo[14]:	1,191 1,396 255	2014-2015 LADWP Recycled Water Annual Report 2010 GWP UWMP 2010 PWP UWMP 2001-2012 GWP Data
BWP	Tertiary to Title 22 with Nitrification/ Denitrification	12.5	10,080	NPR: Discharge:	5,160 4,920	SFB:	5,160	2010 BWP UWMP, Table 5-1
Tapia	Tertiary to Title 22 with Nitrification/ Denitrification	16	12,320	NPR[15]:	8,081	SFB[16]:	1,040	2014 LVMWD RWMP

Notes:

AFY = acre-feet per year
LAR = Los Angeles River
MGD = millions of gallons per day
WRP = Water Reclamation Plant
PWP = Pasadena Water and Power
GWP = Glendale Water and Power
SFB = San Fernando Basin
DCT = Donald C. Tillman
NPR = non-potable reuse
LADWP = Los Angeles Department of Water and Power
UWMP = Urban Water Management Plan
LAG = Los Angeles-Glendale
BWP = Burbank Water and Power

1. Calculated as the sum of End Uses in 2025, including flows to GWR and sewered brine concentrate.
2. Recycled water supplied to the City of Los Angeles by BWP and LVMWD was excluded from the NPR deliveries (LADWP Recycled Water Annual Report FY 2014-15). Value of 3,044 AFY was provided in email communication with LADWP.
3. Approx. 30,245 AFY (27 MGD) are reserved for Lake Balboa, Wildlife Lake, and Japanese Gardens and this full amount is assumed for 2025. These flow-through lakes discharge to the LA River (IRP, LA River Recycled Water Evaluation Study, Phase 1 – Baseline Study Final Report, January 2005).
4. Operational safety weirs convey recycled water to ocean via the Los Angeles River.
5. In-plant flows for 2025 are assumed to be similar to flows for 2012-2013 (rounded to 3,000 AFY).
6. Calculated as 64% of recycled water delivered to NPR End Uses (based on 2012-2013 values in Table 4-1).

7. LADWP is currently exploring other possible treatment trains for GWR other than full advanced water treatment (AWT), which per Title 22 includes reverse osmosis and advanced oxidation treatment. See Section 4.2.1 for additional details. The values shown in Table 4-2 reflect a full AWT project with reverse osmosis for 30,000 AFY of product water.
8. Average flows from LAG are approx. 19,040 AFY (17 MGD) with 50% to Los Angeles and 50% to Glendale (2010 LADWP UWMP). This value for Recycled Water Produced is assumed for 2025.
9. It is estimated that GWP will use 1,662 AFY of their allotted amount in 2025 (2010 GWP UWMP).
10. It is estimated that PWP will use 3,100 AFY of their allotted 6,000 AFY in 2025 (2010 PWP UWMP). It is assumed that all of these flows are delivered to customers in the Raymond Basin.
11. Calculated as the flow remaining after other End Uses (19,040–6,000–1,662–3,100)
12. Value was provided in email communication with LADWP. It should be noted that some recycled water flows from LAG are delivered to end uses that overlie the Central Basin.
13. Calculated as 84% of recycled water delivered to NPR End Uses (based on 2012-2013 values in Table 4-1). It should be noted that some recycled water flows from LAG are delivered to end uses that overlie the Central Basin.
14. Based on average of 2001-2012 recycled water deliveries by GWP in the Verdugo Basin; assumed to stay constant for 2025.
15. Based on LVMWD 2014 RWMP, Table 5-10. Assumes Analysis Scenario 3 with total demands of 8,081 AFY. The remaining flows are assumed to be managed using existing disposal methods.
16. Amount of recycled water discharged to the SFB includes landscape irrigation end uses in LADWP's service area at Hidden Hills, Woodland Hills Golf Course, and Pierce College Extensions. It is assumed that recycled water delivered to all other end uses and disposal methods occurs outside the ULARA basins.

4.2.1 City of Los Angeles (DCTWRP and LAGWRP)

Non-Potable Reuse

The City of Los Angeles Department of Water and Power's (LADWP) 2010 UWMP established a goal of increasing recycled water use to 59,000 AFY by 2035. Of this 59,000 AFY, LADWP expects to deliver as much as 29,000 AFY of recycled water for NPR within the City of Los Angeles (City). Of this total volume, 10,706 AFY of recycled water originating from both the DCTWRP and LAGWRP will be delivered to customers in the SFB by 2025. This includes recycled water for irrigation, industrial cooling, and mixed use and dust control.

In addition to expanded recycled water service from LADWP's distribution pipelines, LADWP finalized an agreement to establish additional connections to the City of Glendale's recycled water pipeline originating from the LAGWRP. This will facilitate conversion of several customer sites in the LAGWRP service area, including Atwater Park, Chevy Chase Park, and Los Feliz Golf Course, all of which are maintained by the Los Angeles Department of Recreation and Parks.

Environmental Reuse

Currently, LADWP provides approximately 26,000 AFY of recycled water for NPR within the City of Los Angeles for beneficial reuse to Lake Balboa (16,500 AFY), the Japanese Garden (4,500 AFY), and Wildlife Lake (5,000 AFY) (LADWP 2015). This recycled water is supplied by DCTWRP and flows to the Los Angeles River and out of the ULARA to the Pacific Ocean. The amount of recycled water flowing through these beneficial reuse features is anticipated to remain steady and will be reviewed in the future by the City.

Proposed Groundwater Replenishment Project

Background

As part of the 2012 RWMP documents, the GWR Master Planning Report defined a project to replenish the SFB with advanced water treatment (AWT) purified recycled water, originating from the DCTWRP. As originally conceived, this project would replenish the SFB via surface application using up to 30,000 AFY by 2024 in existing spreading basins (Hanson and Pacoima) on the northeast side of the SFB.

In 2011, the City of Los Angeles completed a pilot study that evaluated the proposed AWT treatment processes for the proposed GWR project using effluent from the DCTWRP. Processes evaluated included micro-filtration, reverse osmosis, and advanced oxidation, including ultraviolet irradiation/hydrogen peroxide and ozone/hydrogen peroxide. The pilot AWT processes produced exceptional water quality that could safely be used for groundwater replenishment. The quality of recycled water produced by full advanced treatment is typically superior to Title 22 tertiary recycled water quality and ambient groundwater quality in the SFB. Management Measure E34 in Section 5.2.1 describes the regulations in more detail.

In 2015, the City began investigating the possibility of implementing an early phase of the proposed GWR project using recycled water that is not processed using full advanced treatment. Ongoing drought conditions, the overall need for new water supplies, and promulgation of the Title 22 Criteria for groundwater replenishment prompted discussions about implementing a potential "near-term alternative". The objectives of the near-term alternative would be to provide some amount of groundwater replenishment with recycled water to begin sooner than 2024 and explore alternative treatment processes that would meet all regulations and safeguards to protect public health and groundwater quality. The impetus for alternative treatment processes is also linked to the desire to optimize recycled water use. A reverse osmosis system loses 15 to 20% of the water treated as brine concentrate that requires ocean discharge. Other types of treatment exist that do not create this loss of water and are being evaluated by the City.

The concept of a non-AWT phase of the proposed GWR project, along with various alternative treatment trains, has been presented to the Recycled Water Advisory Group (RWAG) and the National Water Research Institute's Independent Advisory Panel (Panel). The RWAG and Panel were convened to provide feedback on the proposed GWR project from planning through implementation. As of the date of this SNMP, the degree to which a non-AWT portion of the GWR project will be implemented has not been determined, though environmental documentation is underway for the proposed full advanced treatment GWR project identified in the 2012 RWMP documents and is expected to be completed in 2016.

<u>Methodology to Develop Hypothetical Range of S/N Loading</u>

Because the level of treatment to be implemented for the proposed GWR project may have a significant impact on S/N loading (and thus on use of assimilative capacity), it was necessary to develop a methodology for the SNMP to capture the hypothetical range of possibilities for the proposed GWR project. To accomplish this, the ULARA Watermaster worked with the LARWQCB to develop two ***hypothetical*** scenarios that are intended to represent the lowest theoretical S/N loading condition and the highest theoretical S/N loading condition. These scenarios were developed as boundary conditions for the SNMP modeling. They represent a range of possibilities for a project being put forth by the City. Actual plans have not been finalized. The two hypothetical scenarios are described below in terms of flow rates and timing:

- ***"Hypothetical Low Loading Scenario"*** – This hypothetical scenario assumes that full advanced treatment (e.g., reverse osmosis and advanced oxidation) would be implemented for a 30,000 AFY surface application GWR project. The scenario is assumed to begin operation in 2024 with 30,000 AFY of advanced treated recycled water; this annual volume would be conveyed for artificial recharge to be split between the Hansen Spreading Grounds (HSG) and Pacoima Spreading Grounds (PSG), and this would continue in perpetuity. The allowable recycled water contribution (RWC) using full advanced treatment is 100% per the Title 22 Criteria; however, this scenario would still account for spreading of stormwater and imported water at the HSG and PSG. A total of 30,000 AFY will be delivered to PSG and HSG. The water quality is assumed to reflect the values for TDS (22 milligrams per liter [mg/L]), nitrate (4.8 mg/L), and chloride (3.6 mg/L) that are shown in Table 5-1. This scenario would produce a brine concentrate that would require management, such as ocean discharge.
- ***"Hypothetical High Loading Scenario"*** – This hypothetical scenario assumes that tertiary recycled water would be used for groundwater replenishment. The scenario is assumed to begin operation in 2017. Using an estimated allowable recycled water contribution (RWC) based on assumed

available diluent water and total organic carbon (TOC) removal, it is calculated that a smaller amount of recycled water would be applied in the first year at the HSG. This amount would be increased in 2020 after TOC removal could be demonstrated. Then, in 2024 when a newly built recycled water pipeline to the PSG is completed, spreading operations with recycled water would begin at the PSG and would increase in 2030 when available diluent flows increase at PSG. The year 2030 represents full utilization of the available 30,000 AFY of recycled water from DCTWRP.[2] It is assumed that both spreading operations (i.e., HSG and PSG) would continue in perpetuity. The water quality is assumed to reflect the values for TDS (555 mg/L), nitrate (5.8 mg/L), and chloride (124 mg/L) that are shown in Table 5-1.

Considerations Regarding the Hypothetical High Loading Scenario

The assumptions used to develop the high loading scenario were the result of numerous discussions between the City, the ULARA Watermaster, and LARWQCB. It was acknowledged that use of hypothetical low and high boundary conditions for the purposes of the SNMP modeling would be beneficial to provide a meaningful framework for assessing the impacts of the proposed GWR project as it is further defined. In general, the amount of tertiary recycled water assumed to be spread at the HSG and PSG is determined by the projected amount of diluent flow available and the allowable RWC pursuant to the Title 22 Criteria (see Management Measure E34 in Section 5.2.1 for additional detail) as follows:

- The assumed soil aquifer treatment performance for reduction of TOC will be similar to the performance observed at the existing Montebello Forebay GWR project that has been operating in the Central Groundwater Basin for over 50 years. This assumption about TOC removal is needed to establish a potential allowable RWC under the Title 22 Criteria.
- Per the Title 22 Criteria, the RWC at HSG would be 20% for the first year of operation (2017) and up to 45% every year thereafter, based on the allowable RWC in the Montebello Forebay Water Recycling Requirements. It is assumed that the RWC at the PSG would be set at 45% starting in 2024, the first year of operation, and every year thereafter.
- The scenario is predicated on the use of all stormwater spread at the HSG, PSG, and Tujunga Spreading Grounds (TSG), plus imported water spread at the PSG, and assumes that these flows can be converted via modeling to underflow credited as diluent water. The credited diluent water would then allow the volumetric RWC requirements to be met before diluent water and recycled water reaches potable wells. This approach was presented in the 2012 RWMP documents. It is assumed that this method of crediting underflow would have to be approved under the Alternatives Section in the Title 22 Criteria. It also takes into consideration planned improvements to the HSG, PSG, and TSG to increase the amount of stormwater capture at those facilities over time. The gradual increase in stormwater capture accounts for the increased amounts of recycled water that are assumed for 2017, 2020, 2024, and 2030 (LADWP, 2015). These assumptions allow the tertiary spreading to be the highest loading hypothetical scenario for the Basin.

4.2.2 City of Burbank (Burbank WRP)

LADWP has entered into agreements with Burbank Water and Power (BWP) to provide groundwater storage credits in exchange for recycled water delivery from the Burbank WRP. These agreements include expanding Burbank's recycled water distribution system to the city boundary where LADWP would receive the recycled water for distribution to potential recycled water customers. Per the agreements, BWP can

[2] Special consideration is given to this scenario such that flow projections are extended beyond the 2025 planning horizon.

potentially deliver up to 3,300 AFY of recycled water to LADWP, once all proposed infrastructure improvements are completed. This is based on the maximum flow limit that BWP has agreed to provide.

4.2.3 Las Virgenes Municipal Water District (Tapia WRF)

Based on the 2014 LVMWD Recycled Water Master Plan, LVMWD identified multiple NPR pipeline extensions to expand their current recycled water distribution system. Three of the NPR extensions identified, would serve recycled water within the SFB. One of the NPR extensions, the Woodland Hills Golf Course Extension, would serve Woodland Hills Golf Course, Hidden Hills, and the Pierce College Extension within the City of Los Angeles. For this extension, a 30-inch diameter pipeline would deliver approximately 1,040 AFY of recycled water for irrigation uses within the City of Los Angeles portion of the SFB. The preliminary design for this project is currently being conducted, and therefore, the pipeline lengths and diameters are further being refined.

5 Management Measures

This section provides a more detailed discussion of the types and characteristics of various management measures (see definition in Section 1). The section also provides detailed information on the specific existing, planned, and conceptual management measures for the ULARA.

5.1 Types of Impacts –Loading Versus Concentration

Implementation measures are projects or programs that control, reduce, or manage (mitigate) S/N loading on a sustainable basis. They are a subset of management measures, as described in Section 1. Management measures generally impact S/N in two ways: 1) they can increase or decrease the S/N loading to groundwater, and/or 2) they can increase or decrease the concentration of S/N in groundwater. The distinction is important in understanding the different types of benefits provided by management measures in the context of S/N management. The impacts are differentiated by the quality of the source water and by whether one source water replaces another (of different water quality).

Table 5-1 summarizes the range in average TDS, chloride, and nitrate-N concentrations in different types of waters recharged to the ULARA groundwater basins. The different water sources are listed from top to bottom, from lowest to highest relative TDS concentrations. The current average groundwater concentrations in the ULARA groundwater basins are also included in the table (highlighted in light blue) to provide context. For reference, the applicable Basin Plan Objectives (BPOs) are also shown.

Table 5-1: Average TDS, Chloride and Nitrate Source Water Concentrations (including BPOs)

Type of Water	TDS (mg/L) [BPO]	Chloride (mg/L) [BPO]	NO_3–N (mg/L) [BPO]
DCTWRP Advanced Water Treated RW[1]	22	3.6	4.8
Stormwater[2]	182	7	(__)[12]
Treated Imported Water[3]	291	49	1.4
Sylmar Basin Groundwater[3]	353 [600]	25 [100]	26 [45]
Verdugo Basin Groundwater[3]	548 [600]	86 [100]	44 [45]
DCTWRP Tertiary RW	555[4]	124[4]	5.8[5]
Burbank WRP Tertiary RW	615[6]	123	5.5
San Fernando Basin Groundwater[3]	618	45	27
West of I-405	768 [800]	32 [100]	32 [45]
Sunland-Tujunga	n/a [400]	n/a [50]	n/a [45]
Foothill	n/a [400]	n/a [50]	n/a [45]
Major Wellfield	521 [600]	32 [100]	23 [45]
Narrows	564 [900]	70 [150]	27 [45]
LAGWRP Tertiary RW	658[4]	146[4]	5.8[7]
Los Angeles River[8]	670	120	4.5
Las Virgenes WRP Tertiary RW[9]	768	144	10
Eagle Rock Basin Groundwater[10]	838 [800]	106 [100]	23 [45]
DCTWRP Advanced Brine Concentrate	2,300[11]		

Notes:
TDS – total dissolved solids mg/L – milligrams per liter NO_3-N – nitrate as nitrogen BPO – Basin Plan Objective

1. LADWP Groundwater Replenishment Master Planning Report, March 2012. Appendix J Groundwater Replenishment Evaluation TM.
2. LADWP and LASAN Final Revised Salt Management Plan for San Fernando Basin Water Year 2011-12.
3. ULARA Watermaster review of available data (2002-2012) – median values (averaged for SFB subbasins)(ULARA, 2014). Includes SWP, Colorado River Authority, (CRA), and Los Angeles Aqueduct water.
4. LADWP and LASAN Final Revised Salt Management Plan for San Fernando Basin, Water Year 2011-12. Tertiary treated recycled water from DCTWRP (2006-2011) and LAGWRP (2006-2011).
5. City of Los Angeles Recycled Water Master Plan Groundwater Replenishment Master Planning Report. Appendix D – DCT Data Summary Technical Memorandum.
6. BWP's 2013 Recycled Water Sampling Results (http://www.burbankwaterandpower.com/water/recycled-water/water-quality).
7. City of Los Angeles Recycled Water Master Planning Long-Term Concepts Report, Volume 2 of 2: Appendices A-K. Appendix D – LAG Effluent Water Quality.
8. Monitoring point RSW650 (R4) is located in the LA River 214 feet upstream from LAGWRP discharge. LADWP 2012 LAG Effluent Data.
9. California Regional Water Quality Control Board Los Angeles Region. Waste Discharge Requirements for the Las Virgenes Municipal Water District, Tapia Water Reclamation Facility. Discharge to Malibu Creek and Los Angeles River. NPDES No. CA0056014. Average Daily Discharge from Monitoring Data (From November 2005 – June 2009).
10. Data provided from Sparkletts wells from 2010-2013.
11. City of Los Angeles Recycled Water Master Plan Groundwater Replenishment Master Planning Report. Table 5-32.
12. Not currently available.

The following is an introductory discussion of S/N loading and concentration impacts. The average water quality values in Table 5-1 may be used to generally illustrate the loading and concentration impacts on a groundwater basin from the different source waters. Depending on the concentration of a particular constituent in a source water, and whether or not this source water is replacing another source water, a project can increase or decrease the S/N loading into a basin while also increasing or decreasing the S/N concentration in groundwater.

Figure 5-1 shows a schematic diagram representing how several types of management measures conceptually impact the basins in terms of both TDS loading and average TDS concentrations in groundwater. The figure visually represents TDS concentrations as though they were "visible", with higher concentrations (i.e., lower quality) represented by darker blues and lower concentrations (i.e., higher quality) represented by lighter blues.

The arrows in grouping "A" represent a situation where recharge of a lower-quality water is replaced with a higher-quality water (e.g., recharge of imported water being replaced by recharge of AWT water). The dotted line surrounding the first arrow in grouping "A" indicates that this water is no longer used and is replaced by the solid outline arrow. In this case, both the TDS loading and average TDS concentration in groundwater decrease because this situation adds a higher quality water and takes away a lower quality water.

Arrow "B" in Figure 5-1 represents a situation where recharge of a high quality water is introduced, but without taking away recharge of a lower quality water. Thus, the TDS loading would increase while the basin concentration of TDS would decrease (e.g., new stormwater capture that does not offset another type of recharge).

Grouping "C" represents a situation where recharge of a higher-quality water is replaced with a lower-quality water (e.g., recharge of imported water being replaced by recharge of tertiary-treated recycled water). In this case, both the TDS loading and average TDS concentration in groundwater increase.

Arrow "D" represents a situation where recharge of a lower-quality water is introduced, but without taking away recharge of a higher quality water. This would cause the TDS loading and average TDS concentration in the groundwater to both increase (e.g., new landscape irrigation with tertiary-treated recycled water).

Finally, Arrow "E" represents a situation where groundwater is removed from a basin. Nothing is added, only removed (e.g., typical groundwater pumping). This situation would decrease the TDS loading while the basin concentration of TDS would remain at a steady state. It should be noted that TDS-related impacts to the groundwater basin after the water is pumped depend on the ultimate use of the water and the location where it is used.

Figure 5-1: Conceptual Examples of Management Measures with Loading and Concentration Impacts on TDS

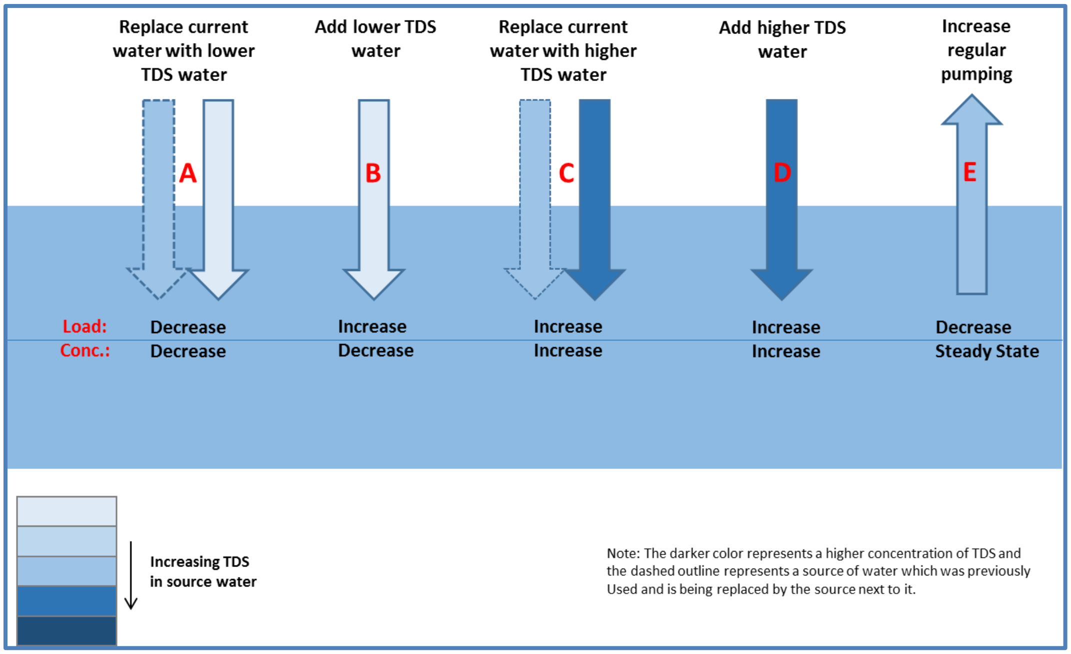

Figure 5-2 shows a schematic diagram representing how several types of management measures conceptually impact the basins in terms of nitrate loading and average nitrate concentrations in groundwater. The figure visually represents nitrate concentrations as though they were "visible", with higher concentrations (i.e., lower quality) represented by darker blues and lower concentrations (i.e., higher quality) represented by lighter blues.

The arrows in grouping "A" represent a situation where recharge of a lower-quality water is replaced with a higher-quality water (e.g., recharge of imported water being replaced by recharge of AWT water). As with TDS, both the nitrate loading and average nitrate concentration in groundwater decrease because this situation adds a higher quality water and takes away a lower quality water.

Arrow "B" in Figure 5-2 represents a situation where recharge of a high quality water is introduced, but without taking away recharge of a lower quality water. Thus, the nitrate loading would increase while the basin concentration of nitrate would decrease (e.g., new stormwater capture that does not offset another type of recharge).

Grouping "C" represents a situation where recharge of a higher-quality water is replaced with a lower-quality water (e.g., recharge of imported water being replaced by recharge of tertiary-treated recycled water). In this case, both the nitrate loading and average nitrate concentration in groundwater could increase.

Arrow "D" represents a situation where recharge of a lower-quality water is introduced, but without taking away recharge of a higher quality water. This would cause the nitrate loading and average nitrate concentration in the groundwater to both increase (e.g., new landscape irrigation with tertiary-treated recycled water).

Arrow "E" represents a situation where groundwater is removed from an area of a basin that has high nitrate concentrations (e.g., a nitrate treatment/remediation project). Nothing is added, but nitrate is removed with the pumped water and treated. This situation would decrease the nitrate loading and decrease average basin concentrations of nitrate.

Finally, Arrow "F" represents a situation where groundwater is removed from a basin. Nothing is added, only removed (e.g., typical groundwater pumping). This situation would decrease the nitrate loading while the basin concentration of nitrate would remain at a steady state. It should be noted that nitrate-related impacts to the groundwater basin after the water is pumped depend on the ultimate use of the water and the location where it is used.

Figure 5-2: Conceptual Examples of Management Measures with Loading and Concentration Impacts on Nitrate

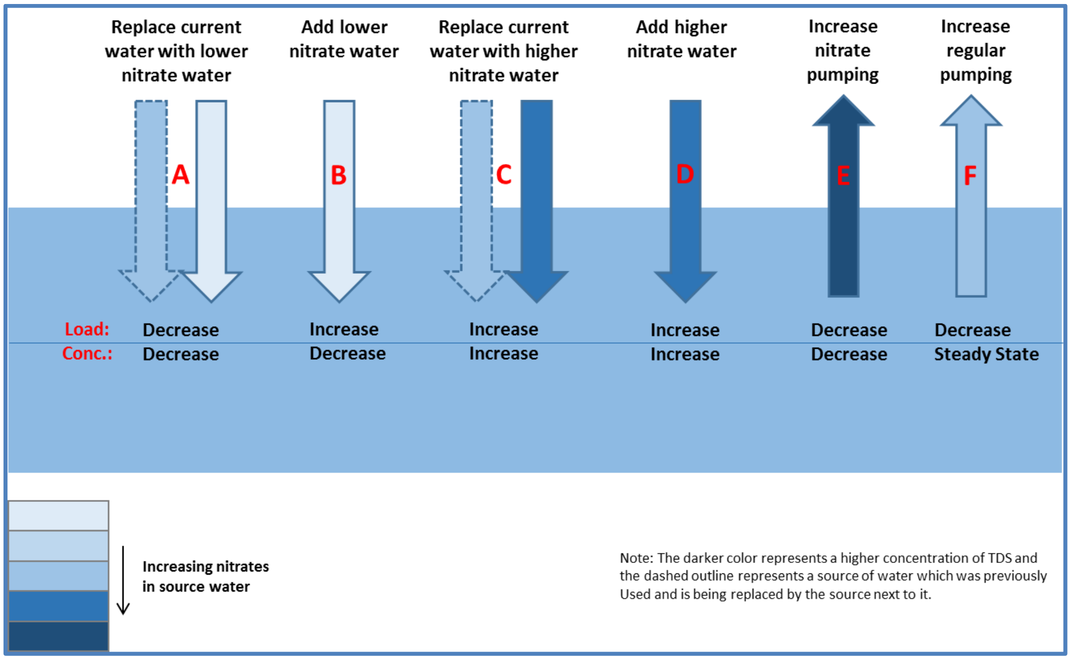

Table 5-2: Examples of Different Types of Management Measures and S/N Impacts

Description	Impact to S/N Loading	Impact to S/N Concentrations	Example Project
Replace current water with lower nitrate/TDS/chloride water	Decrease	Decrease	Replace imported water with AWT recycled water at PSG
Add lower nitrate/TDS/chloride water	Increase	Decrease	Groundwater Replenishment Project (HSG and PSG)
Replace current water with higher nitrate/TDS/chloride water	Increase	Increase	Existing irrigation that replaces imported water with tertiary-treated recycled water
Add higher nitrate/TDS/chloride water	Increase	Increase	New irrigation with tertiary treated recycled water
Increase nitrate plume pumping	Decrease	Decrease	EPA Operable units
Increase well pumping	Decrease	Steady State	Typical groundwater production

5.2 Existing, Planned, and Conceptual Management Measures

Management measures are projects or programs that impact salts and nutrients in the Basins, either positively or negatively. The SNMP planning horizon is 2025 for most of the management measures summarized in this section, though SNMP modeling may be used to project impacts beyond 2025.

Generally, projects that alter stormwater, wastewater, and recycled water quality have impacts on the groundwater quality in the basins. Improvements in basin water quality typically result from projects that increase stormwater recharge, increase recharge of purified recycled water, or in some other way reduce sources of S/N loading by lowering constituent concentrations. Basin water quality may be lowered by projects that increase constituent concentrations. All projects that affect TDS, nitrate, and chloride concentrations are included in this TM as management measures.

The management measures were classified into three categories: existing, planned, and conceptual. Figure 5-3 lists the existing, planned and conceptual management measures, as well their impacts to groundwater in terms of S/N loading and concentration. “Existing” management measures are projects/programs that are currently in place as of October 2015. For existing management measures, the impacts to S/N loading and concentration are determined in relation to conditions before they were implemented. Management measures are classified as “planned” if they are scheduled to be in operation between October 2015 and 2025, notwithstanding exigencies that are outside the control of the project sponsors. Available cost information, as well as flows and water quality information, are shown for planned management measures. The “conceptual” management measures are projects that have been hypothetically identified but may not have costs, flows, water quality, or other details determined at this time; so they may or may not be implemented before or after 2025.

Individual projects are described in the sections that follow Table 5-3, organized by the existing, planned, and conceptual categories. Project numbers correspond to the numbers shown in the third column from the left in Table 5-3. Generally speaking, measures that decrease concentrations of TDS, nitrate, and chlorides, as indicated in the last column of Table 5-3, are considered to be “implementation measures”.

Table 5-3: ULARA Existing, Planned and Conceptual Management Measures

Timeframe	Category	Project No.	Existing S/N Management Measures	Basin	Year and Flow (AFY) (assumed constant if shown with no year)	Water Source	Water Quality Reference or Values	Impact to S/N Loading (TDS, NO_3-N, Cl)	Impact to S/N Concentration (TDS, NO_3-N, Cl)
Existing	Groundwater Recharge	E1	Pacoima Spreading Grounds (GWR w/recycled water is described under "Planned Management Measures")	SFB	2015: 6,564 2019: 6,924 2024: 7,284 2029: 8,004 2034+: 9,264	SW	Table 5-1	Increase	Decrease – All
					7,425 (from MM E7)	IW	Table 5-1	Increase	Decrease - TDS, N Increase - Cl
		E2	Tujunga Spreading Grounds	SFB	2015: 0 2017: 5,100 2019: 6,000 2024: 6,900 2029: 8,700 2034+: 11,850	SW	Table 5-1	Increase	Decrease – All
		E3	Tujunga Wash Greenway and Stream Restoration	SFB	362	SW	Table 5-1	Increase	Decrease – All
		E4	Branford Spreading Grounds	SFB	540	SW	Table 5-1	Increase	Decrease - All
		E5	Hansen Spreading Grounds (GWR w/recycled water is described under "Planned Management Measures")	SFB	2015: 13,900 2019: 14,640 2024: 15,380 2029: 16,860 2034+: 19,450	SW	Table 5-1	Increase	Decrease – All
		E6	Lopez Spreading Grounds	SFB	540	SW	Table 5-1	Increase	Decrease - All
		E7	Pacoima B-6, MWD Foothill Feeder Replenishment Project (supplies water to MM E1)	SFB	(see MM E1)	GW	Table 5-1	(see MM E1)	(see MM E1)
	Groundwater Remediation	E8	Burbank Operable Unit	SFB	10,000	GW	n/a	Varied	Varied
		E9	Glendale Operable Unit	SFB	7,800	GW	n/a	Varied	Varied
		E10	Glenwood Nitrate Removal Plant	VB	450	GW	Reduces nitrate from 44 to 20 mg/L	Varied Decrease - N	Varied Decrease - N
		E11	North Hollywood Operable Unit	SFB	1,250	GW	n/a	Varied	Varied
		E12	Groundwater System Improvement Study	SFB	N/A	GW	n/a	n/a	n/a
		E13	Pollock Wells Treatment Plant	SFB	3,000	GW	n/a	Varied	Varied
		E14	Temporary Tujunga Wellfield Treatment Study Project	SFB	10,000	GW	n/a	Varied	Varied
		E15	Verdugo Park Water Treatment Plant	VB	300	GW	n/a	Varied	Varied
		E16	Los Angeles-Burbank Groundwater System Interconnection	SFB	1,700	GW	Table 5-1	Varied	Varied
	Stormwater capture/runoff management	E17	Branford Spreading Basin Cleanout and Pump	SFB	550	SW	Table 5-1	Increase	Decrease – All
		E18	Big Tujunga Dam Seismic Retrofit Project	SFB	3,750	SW	Table 5-1	Increase	Decrease - All
		E19	Bull Creek Los Angeles Reservoir Water Quality Improvement	SFB	500	SW	Table 5-1	Increase	Decrease - All

Timeframe	Category	Project No.	Existing S/N Management Measures	Basin	Year and Flow (AFY) (assumed constant if shown with no year)	Water Source	Water Quality Reference or Values	Impact to S/N Loading (TDS, NO_3-N, Cl)	Impact to S/N Concentration (TDS, NO_3-N, Cl)
Existing		E20	Johnny Carson Park Stream Restoration and Park Revitalization	SFB	RW-10, SW-2 RW for NPR - 30	RW/SW	Table 5-1	Increase	Decrease – TDS, N Increase - Cl
		E21	LARWQCB MS4 NPDES Permits	ULARA	--	SW	Table 5-1	Increase	Decrease - All
		E22	LID and stormwater BMPs to reduce salinity/nutrient loading	ULARA	--	SW	Table 5-1	Increase	Decrease - All
		E23	Marsh Park, Phase II	SFB	2.14	SW	Table 5-1	Increase	Decrease - All
		E24	Rogers Park Watershed Runoff Treatment Reuse and Infiltration	SFB	4,200	SW	Table 5-1	Increase	Decrease – All
		E25	Pacoima Wash Natural Park	SFB	8	SW	Table 5-1	Increase	Decrease – All
		E26	Woodman Avenue Stormwater Capture Project	SFB	55	SW	Table 5-1	Increase	Decrease - All
		E27	Glenoaks-Sunland Stormwater Capture	SFB	28	SW	Table 5-1	Increase	Decrease - All
		E28	North Hollywood Street Enhancement	SFB	Not Available	SW	Table 5-1	Increase	Decrease - All
		E29	Stormwater Capture Master Plan	SFB	N/A	SW	Table 5-1	n/a	n/a
	Conservation	E30	Senate Bill x7-7 (20% by 2020) and Other Activities	ULARA	--	IW, GW	n/a	Potential Decrease	Potential Increase
	Institutional	E31	Basin adjudication	ULARA	--	GW, SW	n/a	Increase	Decrease – All
		E32	Groundwater management (ULARA Watermaster)	ULARA	--	GW, SW	n/a	Increase	Decrease - All
	Land use regulation	E33	Model Water Efficient Landscape Ordinance	ULARA	--	All	n/a	Potential Decrease	Potential Increase
	Public education	E34	Council for Watershed Health – website and outreach	ULARA	--	All	n/a	Not assessed	Not assessed
		E35	Southern California Salinity Coalition Outreach Efforts	ULARA	--	All	n/a	Not assessed	Not assessed
		E36	ULARA SNMP	ULARA	--	All	n/a	Not assessed	Not assessed
		E37	ULARA Watermaster – website and outreach	ULARA	--	All	n/a	Not assessed	Not assessed
		E38	WateReuse Association and Foundation	ULARA	--	All	n/a	Not assessed	Not assessed
	Regulatory/Non-regulatory	E39	Recycled Water Non-Potable Reuse Regulations, Guidelines, Permits	ULARA	--	All	n/a	Not assessed	Not assessed
		E40	State Regulations for GWR using Recycled Water and LARWQCB Permits for GWR Projects	ULARA	--	All	n/a	Not assessed	Not assessed
		E41	Wastewater, Recycled Water, Surface Water/Stormwater, Imported Water and Groundwater Monitoring	ULARA	--	All	n/a	Not assessed	Not assessed
	Source water salinity control	E42	LACDPW stormwater "First Flush" policy	ULARA	--	SW	Not available	Decrease	Decrease – All
		E43	MWD Salinity Source Water Control Program	ULARA	--	IW	Table 5-1	Decrease	Decrease - All
	Wastewater nutrient source control	E44	Industrial wastewater source control programs	ULARA	--	RW	Not available	Decrease	Decrease - All
		E45	Wastewater and recycled water nitrogen treatment	ULARA	--	RW	Table 5-1	Decrease - N	Decrease - N
	Non-potable Reuse	E46	Burbank WP Projects from Burbank WRP	SFB	1,608	RW	Table 5-1	Increase	Increase – N, CL Decrease - TDS
		E47	Glendale WP Projects from LAGWRP	SFB VB	1,571 255	RW	Table 5-1	Increase	Increase – All

Timeframe	Category	Project No.	Existing S/N Management Measures	Basin	Year and Flow (AFY) (assumed constant if shown with no year)	Water Source	Water Quality Reference or Values	Impact to S/N Loading (TDS, NO_3-N, Cl)	Impact to S/N Concentration (TDS, NO_3-N, Cl)
		E48	LADWP Projects from DCTWRP	SFB	1,770	RW	Table 5-1	Increase	Increase – N, CL Decrease - TDS
		E49	LADWP Projects from LAGWRP	SFB	338	RW	Table 5-1	Increase	Increase – All

Table 5-4: ULARA Existing, Planned and Conceptual Management Measures (continued)

Timeframe	Category	Project No.	Planned S/N Management Measures	Basin	Flow (AFY)	Cost	Expected Implementation Date	Water Quality Reference or Values	Impact to Loading (TDS, NO_3-N, Cl)	Impact to Concentration (TDS, NO_3-N, Cl)
Planned	Groundwater Recharge	P1	Big Tujunga Reservoir Sediment Removal	SFB	2,100	$24M	9/2018	Table 5-1	Increase	Decrease - All
		P2	Tujunga Spreading Grounds Reconstruction Project	SFB	4,200	$27M	2018	Table 5-1	Increase	Decrease - All
		P3	City of Los Angeles GWR Project – "Hypothetical Low Loading Scenario"	SFB	30,000	$415M	2024	Table 5-1	Increase	Decrease - All
			City of Los Angeles GWR Project – "Hypothetical High Loading Scenario"		5,000 19,000 28,000 30,000	Not available	2017 2020 2024 2030	Table 5-1	Increase	Decrease – TDS Increase – N, Cl
		P4	Hansen Dam Water Conservation	SFB	3,400	$6M	12/2016	Table 5-1	Increase	Decrease – All
		P5	Pacoima Reservoir Sediment Removal	SFB	3,200	$85M	10/2020	Table 5-1	Increase	Decrease - All
		P6	Anheuser-Busch Brewery	SFB	840	$22M	2016	TDS = 150 mg/L NO_3 = MCL Cl = MCL	Increase	Decrease - All
	Groundwater Remediation	P7	Groundwater Remediation Facilities	SFB	123,000	$700M	2021	n/a	Varied	Varied
		P8	Mission Wells Improvement	SB	3,570 additional GW access	$26M	7/2017	n/a	Varied	Varied
		P9	Rockhaven Well	VB	484	$1.87M	1/2016	Reduces nitrate from 44 to 20 mg/L	Decrease - N	Decrease - N
		P10	CVWD Nitrate Removal Treatment Facility at Well 2	VB	240	Not Available	6/2017	Reduces nitrate from 44 to 20 mg/L	Decrease - N	Decrease - N
	Stormwater capture/runoff management	P11	Additional LID Projects, Stormwater BMPs, and LARWQCB MS4 Permits	ULARA	Assumed very small	Not available	Ongoing	Table 5-1	Increase	Decrease – All
		P12	Big Tujunga Dam Spillway Dam	SFB	705	$2M	Not Available	Table 5-1	Increase	Decrease - All
		P13	Boulevard Pit Stormwater Capture Project	SFB	9,760	$110M	12/2023	Table 5-1	Increase	Decrease – All
		P14	Browns Canyon Wash at Route 118 and Rinaldi	SFB	Not Available	Not Available	Not Available	Table 5-1	Increase	Decrease – All
		P15	Chase Street Stormwater Greenway	SFB	7	$2.2M	12/2018	Table 5-1	Increase	Decrease - All
		P16	Los Angeles River Natural Park	SFB	Not Available	$64M	3/2018	Table 5-1	Increase	Decrease – All
		P17	North Hollywood Transmission Corridor Easement Stormwater Capture Study	SFB	750	$15M	12/2021	Table 5-1	Increase	Decrease – All
		P18	Pacoima Neighborhood Retrofit	SFB	1,000	$30M	2017	Table 5-1	Increase	Decrease – All

Timeframe	Category	Project No.	Planned S/N Management Measures	Basin	Flow (AFY)	Cost	Expected Implementation Date	Water Quality Reference or Values	Impact to Loading (TDS, NO_3-N, Cl)	Impact to Concentration (TDS, NO_3-N, Cl)
Planned		P19	Sheldon Pit	SFB	4,500	$75M	12/2024	Table 5-1	Increase	Decrease – All
		P20	Sun Valley EDA Public Improvements Stormwater Capture Project	SFB	93	$2.44M	4/2016	Table 5-1	Increase	Decrease – All
		P21	Sun Valley Watershed Rory M. Shaw Wetlands Park Project (a.k.a. Strathern Wetlands Park)	SFB	560	$132.8M	12/2019	Table 5-1	Increase	Decrease – All
		P22	Valley Generating Station Stormwater Recharge Project	SFB	118	$1.62M	8/2017	Table 5-1	Increase	Decrease – All
		P23	Verdugo Hills Stormwater Project	VB	47	$34.2M	4/2017	Table 5-1	Increase	Decrease – All
		P24	Whitnall HWY Powerline Easement Stormwater Capture Project	SFB	110	$10.3M	12/2018	Table 5-1	Increase	Decrease - All
		P25	Crescenta Valley County Park Stormwater Recharge Facility	VB	340	Not Available	12/2018	Table 5-1	Increase	Decrease - All
	Conservation	P26	Be A Water Saver Water Conservation Program	SFB	500	$1.5M	9/2016	n/a	Potential Decrease	Potential Increase – All
		P27	Senate Bill x7-7 (20% by 2020)	ULARA	--	n/a	2020	n/a	Potential Decrease	Potential Increase - All
	Regulatory/Non-regulatory	P28	State Regulations for Groundwater Replenishment using Recycled Water and LARWQCB Permits for groundwater recharge projects	ULARA	--	-	Ongoing	n/a	Not assessed	Not assessed
		P29	SNMP Monitoring Program	ULARA	--	-	Ongoing	n/a	Not assessed	Not assessed
	TMDLs	P30	TMDLs	ULARA	--	-	Ongoing	n/a	Decrease	Decrease - All
	Wastewater nutrient source control	P31	Septic-To-Sewer Drinking Waterwell Protection Project	SFB	23	$1.7M	4/1/2016	n/a	Decrease	Decrease - All
	Non-potable Reuse	P32	Burbank WP Projects from Burbank WRP	SFB	5,160 (cumulative)	-	Ongoing	Table 5-1	Increase	Increase – N, Cl Decrease - TDS
		P33	Glendale WP Projects from LAGWRP	SFB VB	1,396 (cumulative) 255	-	Ongoing	Table 5-1	Increase	Increase - All
		P34	LADWP Projects from DCTWRP	SFB	1,948 (cumulative)	-	Ongoing	Table 5-1	Increase	Increase – N, Cl Decrease - TDS
		P35	LADWP Projects from LAGWRP	SFB	1,191 (cumulative)	-	Ongoing	Table 5-1	Increase	Increase - All
		P36	Pasadena WP Projects from LAGWRP	Raymond	3,100	-	Ongoing	Table 5-1	No impact	No impact
		P37	Las Virgenes MWD Projects from Tapia WRP	SFB	1,040	-	Ongoing	Table 5-1	Increase	Increase - All
		P38	Two-Strike Park Recycled Water Project	VB	Not Available	Not Available	4/2018	Not Available	TBD	TBD

Table 5-5: ULARA Existing, Planned and Conceptual Management Measures (continued)

Timeframe	Category	Project No.	Conceptual S/N Management Measures	Basin	Cost	Expected Implementation Date	Impact to Loading	Impact to Concentration
Conceptual	**Groundwater Remediation**	C1	Glendale Water and Power Disinfection Operation	SFB	--	n/a	None	None
	Stormwater capture/runoff management	C2	Additional LID projects and stormwater BMPs	ULARA	--	n/a	Potential Increase	Potential Decrease - All
		C3	Mission Hills Green Belt	SB	--	n/a	Increase	Decrease - All
		C4	Sepulveda Basin Sports Complex Multi-Purpose Open Space	SFB	--	n/a	Increase	Decrease - All
		C5	Sepulveda Basin Sports Complex Riparian Buffer	SFB	--	n/a	Increase	Decrease – All
		C6	Taylor Yard River Park Parcel G2	SFB	--	n/a	Increase	Decrease – All
		C7	Water Quality Improvement Project	ULARA	--	n/a	Decrease	Decrease – All
	Conservation	C8	Senate Bill x7-7 (20% by 2020)	ULARA	--	n/a	Potential Decrease	Potential Increase – All
		C9	Xeriscape policy	ULARA	--	n/a	Potential Decrease	Potential Decrease - All
	Source water salinity control	C10	Bay Delta Conservation Plan	ULARA	--	n/a	Decrease	Decrease - All
	Wastewater salinity/nutrient source control	C11	Residential automatic water softener control (bans and/or rebates)	ULARA	--	n/a	Decrease	Decrease – TDS, Cl
	Recycled Water	C12	Direct Potable Reuse	SFB	--	n/a	Decrease	Decrease – All

5.2.1 Existing Management Measures

Groundwater Recharge

MM E1 and MM E2. Pacoima and Tujunga Spreading Grounds – The Pacoima and Tujunga spreading grounds use a mixture of stormwater and imported water for GWR. The replenishment water results in an increase to TDS, nitrate, and chloride loadings and a decrease in concentrations in groundwater (except for chloride in imported water, see below). The average amount of GWR at each spreading grounds is discussed below (LADWP, 2015).

- PSG – Over a 10-year period, the spreading grounds received an average of about 7,420 AFY of stormwater and 4,197 AFY of imported water, for a total average of 11,617 AFY. Projecting forward, stormwater capture is anticipated to average 6,564 AFY from 2015 to 2019, then increase by 360 AFY in 2019 due to improvements at the spreading facilities. Additional improvements are expected to increase capture by another 360 AFY in 2024, by 720 AFY in 2029, and by 1,260 AFY in 2034. Also, imported water recharged to PSG is anticipated to average 7,425 over the next 34 years (see MM E11). See Table 5-3 for a tabulated version of this description. The imported water contains a slightly higher concentration of chloride than the ambient concentrations in SFB (Table 5-1), so the impact would be to increase average chloride concentrations.
- TSG – Over a 10-year period, the spreading grounds received an average of approximately 9,700 AFY of stormwater and 752 AFY of imported water, for a total average of 10,452 AFY. Projecting forward, stormwater capture is anticipated to average 5,100 AFY from 2017 to 2019 (no capture from 2015 to 2017), then increase by 900 AFY in 2019 due to improvements at the spreading facilities. Additional improvements are expected to increase capture by another 900 AFY in 2024, by 1,800 AFY in 2029, and by 3,150 AFY in 2034. See Table 5-3 for a tabulated version of this description.

MM E3. Tujunga Wash Greenway and Stream Restoration – Diversion from the lined channel of Tujunga Wash to the unlined (natural) portion allows 362 AFY of water to be percolated in the SFB, thereby increasing TDS, nitrate, and chloride loadings but reducing concentrations in the groundwater.

MM E4, MM E5, and MM E6. Branford, Hansen, and Lopez Spreading Grounds – These spreading grounds are primarily used for the artificial recharge of stormwater runoff. Precipitation has a direct influence on the GWR and on the amount of groundwater in storage in the SFB. The recharge water results in an increase to TDS, nitrate, and chloride loadings and a decrease in concentrations in groundwater. The average amount of GWR at each spreading ground is discussed below (LADWP, 2015).

- Branford Spreading Grounds – The Branford spreading grounds received an average of approximately 540 AFY of stormwater for GWR (per LADWP's email on March 16, 2015). Over the next 34 years, it is anticipated that this amount of stormwater capture will not change.
- HSG – The Hansen spreading grounds historically received approximately 14,000 AFY of stormwater for recharge on average (per LADWP's email on March 16, 2015). Projecting forward, stormwater capture is anticipated to average 13,900 AFY from 2015 to 2019, then increase by 740 AFY in 2019 due to improvements at the spreading facilities. Additional improvements are expected to increase capture by another 740 AFY in 2024, by 1,480 AFY in 2029, and by 2,590 AFY in 2034. See Table 5-3 for a tabulated version of this description.
- Lopez spreading grounds – The Lopez spreading grounds received an average of approximately 590 AFY of stormwater for GWR (per LADWP's email on March 16, 2015). Beginning in 2015 and projecting forward, Lopez spreading grounds are projected to receive 540 AFY.

MM E7. Pacoima B-6, MWD Foothill Feeder Replenishment Project – The MWD Foothill Feeder connection enables the City of Burbank to import surplus water from the State Water Project into the SFB for artificial recharge at the PSG. This new source of water offers Burbank the flexibility to purchase MWD water for spreading as opposed to purchasing replenishment water. During the 2011-2012 WY, a total volume of 1,371 AF of MWD water was spread by Burbank in the Pacoima Spreading Grounds. It is assumed that this project will replenish approximately 7,425 AFY moving forward and this volume of imported water is captured under MM E1.

Groundwater Remediation

The impacts of groundwater remediation projects on TDS, nitrate, and chlorides depend on how the groundwater is ultimately used and the overall basin water balance. Some groundwater will be used for irrigation and return to the basin, some may go to the local wastewater treatment plant and be reused or discharged to surface water and flow out of the basin. Some may leave the basin as subsurface outflow. In this section and in Table 5-3, the impacts to TDS, nitrate, and chloride are assumed to be "varied" unless there is specific removal of one of the constituents as the result of that MM.

MM E8. Burbank Operable Unit (BOU) – Pumping by active water wells in the BOU removes volatile organic compounds (VOCs) from the local groundwater. The contaminated water is treated through an air stripping process and liquid granular activated carbon (GAC) to remove the organic solvents. The treated water is blended to lower nitrate levels and the water is delivered to the City of Burbank's Water and Power Department for distribution to the public water supply system (EPA, 1986). During the 2011-2012 Water Year (WY), a total of 9,993 AF of groundwater was pumped and treated at the BOU. Burbank also uses this facility to reduce the concentrations of nitrate in its pumped groundwater with a blending facility that uses imported supplies from the Metropolitan Water District of Southern California (MWD) before delivery to customers.

MM E9. Glendale Operable Unit (GOU) – Treatment of contaminated groundwater pumped by the active water wells in the GOU was designed to remove VOCs in the local groundwater and has the capacity to treat up to a total of 8,065 AFY from its two existing wellfields, the Glendale North Wellfield and the Glendale South Wellfield. The pumped groundwater is treated and then blended with imported MWD supplies to reduce the concentrations of nitrate and hexavalent chromium. The GOU treated 7,830 AF of pumped groundwater during the 2011-2012 WY. It is assumed that the project will treat approximately 7,800 AFY moving forward.

MM E10. Glenwood Nitrate Removal Plant – The Glenwood Nitrate Removal Plant uses ion exchange to remove nitrate from locally pumped groundwater. The facility treated approximately 447 AF of groundwater during the 2011-2012 WY. The treatment plant was taken out of service in 2011 to replace the ion exchange resin. The use of a nitrate specific resin allows for longer volume batch runs to remove nitrate. This ultimately results in a lower volume of wastewater to be discharged to the Los Angeles sewer system. From a localized groundwater perspective, this project decreases nitrate loading and concentration by pumping groundwater that contains nitrate and then removing nitrate. Nitrate is removed by ion exchange from an untreated concentration of 44 mg/L to a treated concentration of 20 mg/L. It is assumed that the project will treat approximately 450 AFY moving forward.

MM E11. North Hollywood Operable Unit (NHOU) – Since the early 1980s discovery of VOCs in the groundwater in the SFB, LADWP has worked with state and federal agencies to help contain and remediate the high-concentration plumes of VOCs in the North Hollywood portion of the SFB. The NHOU was designed and implemented to contain and remove the VOC contamination at a total groundwater pumping volume of 3,226 AFY. Water is pumped to an aeration tower where the contaminants are removed from the water by an air stripper. These contaminants are then captured by a vapor phase GAC system to limit air emissions of the compounds. The treated water is transferred to a holding reservoir before entering LADWP's distribution system. Unfortunately, this NHOU remedy has failed to fully contain the plumes, resulting in contaminants escaping the containment areas and forcing the closure of other nearby LADWP water supply wells. Newly emerging constituents have been detected in the NHOU extraction wells, including hexavalent chromium and 1,4-dioxane; but the NHOU was not designed to remove these contaminants. Concentrations of hexavalent chromium in excess of 400 micrograms per liter (µg/L) have forced LADWP to halt active pumping from extraction well NHE-2. To address the increasing levels of hexavalent chromium, the Los Angeles Regional Water Quality Control Board (LARWQCB) issued a Cleanup and Abatement Order (CAO) to the responsible parties. Although the NHE-2 is being operated under the CAO by the responsible parties, LADWP continues to operate and maintain the facility under the direction of the United States Environmental Protection Agency (EPA) pursuant to a Cooperative Agreement between the two parties. Current operations include use of five of the seven extraction wells. A total of 1,248 AF of groundwater were treated through the NHOU during the 2011-2012 WY. It is assumed that the project will treat approximately 1,250 AFY moving forward.

MM E12. Groundwater System Improvement Study – The Groundwater System Improvement Study (GSIS) is an independent study being performed to identify, characterize, and evaluate water quality in the SFB. As a part of the GSIS, the LADWP has constructed approximately 26 new groundwater monitoring wells and performed short-term monitoring of existing and new wells, in order to obtain supplemental water quality data. Ultimately, remediation will depend on the upcoming basin characterization, remediation requirements (Federal and State laws, rules and regulations), CDPH Policy 97-005 permit guidelines, and necessary reasonable costs for remediation. This study was completed in February 2015. The information collected from this study will be used to plan the Groundwater Remediation Facilities Project in the SFB.

MM E13. Pollock Wells Treatment Plant – The Pollock Wells Treatment Plant treats groundwater pumped from two wells with four liquid-phase GAC vessels that have a total design flow of 4,839 AFY. The treatment plant was designed to absorb the VOCs trichloroethylene (TCE) and tetrachloroethylene (PCE). During the 2011-2012 WY, the Pollock wellfield successfully extracted a total of 2,957 AF of groundwater for treatment at this facility. It is assumed that the project will treat approximately 3,000 AFY moving forward.

MM E14. Temporary Tujunga Wellfield Treatment Study Project – The Temporary Tujunga Wellfield Treatment Study Project would restore the use of two of the 12 production wells in this wellfield and 12,000 AFY of pumping capacity that have been unavailable due to water quality constraints. The project utilizes liquid-phase GAC vessels on Well Nos. 6 and 7 to process extracted groundwater and remove certain VOCs like TCE, PCE, carbon tetrachloride, and 1,1 dichloroethene (DCE). During the 2011-2012 WY, nearly 4,680 AF of groundwater were pumped and treated for VOC removal. It is assumed that the project will treat approximately 10,000 AFY moving forward.

MM E15. Verdugo Park Water Treatment Plant – The City of Glendale Verdugo Park Water Treatment Plant (VPWTP) treats groundwater pumped from the Verdugo Basin for turbidity and bacteria, but has been operating significantly below its expected capacity of 1,129 AFY. In the 2011-2012 WY, a total of 316 AF of groundwater was treated. It is assumed that the project will treat approximately 300 AFY moving forward.

MM E16. Los Angeles-Burbank Groundwater System Interconnection – The Los Angeles and Burbank distribution systems will be connected to effectively increase the capacity to serve customer demands from the Burbank Operable Unit (BOU), which is currently being operated at less than full capacity. Once the BOU demands are increased with the implementation of the project in September 2015, approximately 1,700 AFY of additional groundwater will be provided.

Stormwater Capture/Runoff Management

MM E17. Branford Spreading Basin Cleanout and Pump – This project installed a pump from Branford Spreading Grounds to direct water into the TSG, providing more GWR. In addition, the project removed the clogging layer at the bottom of the basin, which improved percolation rates. This allows approximately 550 AFY of GWR. Recharge of stormwater increases TDS, nitrate, and chloride loadings but decreases concentrations in groundwater.

MM E18. Big Tujunga Dam Seismic Retrofit Project – The existing dam was seismically retrofitted and the spillway capacity was increased to prevent flood damage and impacts to public safety associated with dam failure. The dam improvements increase the average stormwater capture by 3,750 AFY. The increased stormwater capture increases TDS, nitrate, and chloride loadings but reduces concentrations in groundwater due to the relatively low S/N concentrations in surface water/stormwater compared with ambient groundwater.

MM E19. Bull Creek Los Angeles Reservoir Water Quality Improvement Project – The Bull Creek Los Angeles Reservoir Water Quality Improvement Project will design and construct stormwater conveyance facilities for compliance with the Enhanced Surface Water Treatment Rule. The improvements will include: widening a portion of the Bull Creek Extension Channel; realigning a section downstream of the widening; constructing a new diversion structure and overflow structure; and improving the inlet structures. This project provides approximately 500 AFY of additional stormwater capture; therefore this project increases TDS, nitrate, and chloride loadings and reduces concentrations in groundwater.

MM E20. Johnny Carson Park Stream Restoration and Park Revitalization – The City of Burbank renovated the Johnny Carson Park and restored the channel at Old Tujunga Wash to integrate a more natural treatment of urban stormwater runoff by removing the concrete, improving, and restoring a natural flow of stormwater in order to allow more water to be absorbed into the water table. The revitalization of the streambed improves groundwater percolation, reduces stormwater runoff, reduces localized flooding, and improves water quality. This project recharges approximately 10 AFY of recycled water, recharges 2 AFY of stormwater, and provides 30 AFY of recycled water for non-potable uses from the Burbank WRP. This project increases TDS, nitrate, and chloride loadings and decreases TDS and nitrate concentrations in groundwater because these concentrations are lower than ambient groundwater concentrations. Chloride concentrations will increase because the concentrations are higher than ambient groundwater.

MM E21. Los Angeles Regional Water Quality Control Board (LARWQCB) Municipal Separate Storm Sewer System (MS4) Permit for Los Angeles County – In 2001, the LARWQCB issued the National Pollutant Discharge Elimination System (NPDES) permit (2001 MS4 Permit; Order No. 01-182, NPDES No. CAS004001) for MS4 discharges for 84 cities and a majority portion of the unincorporated areas of Los Angeles County. The 2001 MS4 Permit regulated the discharge of runoff from MS4s or storm drains, prohibited non-stormwater discharges into the storm drain system, and limited any discharges to receiving waters that would cause or contribute to a violation of water quality standards. The 2001 MS4 Permit required implementation of a Stormwater Quality Management Plan that included the use of BMPs to reduce the amount of pollutants in stormwater and dry-weather runoff.

In December 2012, the LARWQCB adopted a new MS4 Permit (Order No. R4-2012-0175; http://www.waterboards.ca.gov/rwqcb4/water_issues/programs/stormwater/municipal/index.shtml) that replaced the 2001 MS4 Permit. The 2012 MS4 Permit differs significantly from the 2001 MS4 Permit in several respects, including new requirements for hydromodification[3] and also for LIDs that apply to existing development or redevelopment[4] projects that have been constructed or for which grading or land disturbance permits have been submitted and are deemed complete prior to the adoption date of the 2012 MS4 Permit. Significantly, permittees are encouraged to infiltrate stormwater as a fundamental aspect of permit implementation. Additional details regarding the MS4 permits in Los Angeles County can be found in the *SNMP Monitoring Plan*, which has been submitted to LARWQCB under a separate cover. Generally, MS4 permit requirements in ULARA capture additional stormwater and therefore increase TDS, nitrate, and chloride loadings and decrease concentrations in groundwater.

MM E22. Low Impact Development (LID) and stormwater best management practices (BMPs) – LID includes design techniques that may infiltrate, filter, store, evaporate, and/or detain surface water runoff close to its source of collection. BMPs address the increased volume and rate of runoff from impervious surfaces and the concentration of pollutants in the runoff. BMPs can include structural systems such as infiltration devices, ponds, filters and constructed wetlands. BMPs can also include non-structural BMPs such as LID practices to preserve/recreate natural landscape features or minimize effective imperviousness and management measures such as maintenance practices, street sweeping, public education, and outreach programs. The main goals of LID and stormwater BMPs are to increase GWR and improve stormwater quality. There are multiple existing and planned LID and stormwater BMPs in the ULARA. These projects/practices generally capture more stormwater and therefore increase TDS, nitrate, and chloride loadings and decrease concentrations in groundwater.

MM E23. Marsh Park Phase II – The Marsh Park Phase II Project included the removal of two smaller buildings and conversion of 3 acres of impervious industrial land into a natural, landscaped open space park featuring native habitat restoration. The on-site and off-site runoff is detained and bio-filtered through the park's system of arroyos before being slowly released into the Los Angeles River allowing approximately 2.14 AFY of stormwater to be captured. This project generally captures more stormwater and therefore increases TDS, nitrate, and chloride loadings and decreases concentrations in groundwater.

MM E24. Rogers Park Watershed Runoff Treatment Reuse and Infiltration – This project increased the capacity of the Tujunga Wash Intake from approximately 180,990 AFY to 361,980 AFY, and it increased the storage capacity of the rubber dam from 100 AF to 944 AF. This project created a diversion of Pacoima Wash flows to allow recharge of approximately 4,200 AFY of additional stormwater. This project captures more stormwater and therefore increases TDS, nitrate, and chloride loadings and decreases concentrations in groundwater.

MM E25. Pacoima Wash Natural Park –The Pacoima Wash Natural Park is located along the Pacoima Wash and cleans water from over 33 acres before it flows to the Los Angeles River and southern California beaches. The park's green technology improves water quality and also provides recreation and habitat. This project allows recharge of approximately 8 AFY and therefore increases TDS, nitrate, and chloride loadings and decreases concentrations in groundwater.

MM E26. Woodman Avenue Stormwater Capture Project - The Woodman Avenue Stormwater Capture Project captures surface runoff from approximately 111 acres that currently flows along street gutters to

[3] "Hydromodification" can be any activity that increases the velocity and volume (flow rate), and often the timing, of runoff. Such activities include: construction and maintenance of channels, levees, dams, and other water conveyance structures and/or impoundments for purposes of flood control, water storage, water conveyance, and navigation; dredging and/or filling or other alterations to natural land contours for the purposes of new development (including transportation and other infrastructure) or navigation; development of impervious surfaces (asphalt, concrete, most buildings, etc.); and deforestation or removal of vegetation.

[4] The definition of "redevelopment" used in the text refers to the definition used in the 2012 MS4 permit.

storm drains, through the Tujunga Wash and the Los Angeles River, and into the ocean. The project will direct the flows through pre-treatment devices and into a vegetated swale and an underground retention system for infiltration into the San Fernando Groundwater Basin, capturing an estimated 55 AFY. The infiltration swale and underground retention system replaced an existing 16-foot wide, 3,500-foot long concrete median along Woodman Avenue between Lanark Street and Saticoy Street. The project was completed in February of 2014. This project captures more stormwater and therefore increases TDS, nitrate, and chloride loadings and decreases concentrations in groundwater.

MM E27. Glenoaks-Sunland Stormwater Capture – The Glenoaks-Sunland Stormwater Capture project was completed in January 2014. This project consisted of construction of four dry wells that would capture approximately 28 AFY of stormwater for infiltration.

MM E28. North Hollywood Street Enhancement – The North Hollywood Street Enhancement Project will introduce aesthetically attractive multiuse median landscapes along the arterial streets to provide stormwater runoff capture and infiltration. LID strategies will be introduced and will include designing multi-purpose pathways using permeable pavements and enhancing sidewalk rights-of-way with integrated vegetated swales and curb inlet planters to capture street and adjacent property runoff for infiltration. This project will provide approximately 0.25 AFY of stormwater capture and the implementation date was January 2015. Costs for this project were not available.

MM E29. Stormwater Capture Master Plan – The LADWP explored and identified opportunities to increase stormwater capture in Los Angeles as part of its effort to increase the local water supply and reduce the dependence on imported water. The Stormwater Capture Master Plan evaluated existing stormwater capture facilities and projects, quantified the maximum stormwater capture potential, provided potential strategies to increase stormwater capture, and recommended stormwater capture projects, programs, policies, and incentives. This plan is an outline for policymakers that will explain the LADWP's strategies for the next 20 years to implement stormwater and watershed management programs. LADWP began its initial research for the Stormwater Capture Master Plan in the fall of 2013 and produced a final plan in August 2015.

Conservation

MM E30. Senate Bill x7-7 and Other Activities – As recognized in the California Department of Water Resources (DWR) Public Review Draft of the Water Plan Update 2013 (DWR, 2013), conservation is a fundamental component of the South Coast region's water management planning. The South Coast Region includes all of Orange County and portions of Ventura, Los Angeles (including ULARA), San Bernardino, Riverside, and San Diego counties. Water agencies in the South Coast have been aggressively implementing water conservation since the 1990s. Many local water agencies are signatories to the California Urban Water Conservation Council (CUWCC) memorandum of agreement for urban water conservation and also have adopted UWMPs to ensure water supply reliability during normal, dry, and multiple dry years. These agencies implement BMPs and demand management measures contained in those documents. The backbone of MWD's conservation program is the Conservation Credits Program (CCP), initiated in 1988, that contributes $195 per AF of water conserved to assist member agencies in pursuing urban BMPs and other demand management opportunities. All of the region's water suppliers have water conservation programs for their customers which feature residential and commercial water saving tips, rebates for water efficient purchases (e.g., low - flow toilets, high - efficiency clothes washers, weather - based irrigation controllers), and tools for implementing landscape/garden improvements.

Local agencies are also developing water conservation master plans and conservation rate structures as well as working closely through integrated regional water management (IRWM) planning efforts to develop coordinated water efficiency programs. To these ends, the Greater Los Angeles County (GLAC)

IRWMP (GLAC IRWMP Leadership Committee, 2013) has been developed to define a clear vision and direction for the sustainable management of water resources in the GLAC Region for the next 20 years, to present the basic information regarding possible solutions and the costs and benefits of those solutions, and to inspire the region and potential funding partners outside this region.

The Water Conservation Act of 2009 (Senate Bill [SB] x7-7) requires each urban retail agency to establish in its UWMP a reduction goal to help California achieve a 20% statewide reduction in daily per capita water use by 2020. SB x7-7 requires urban water suppliers to calculate baseline water use and set an interim 2015 (half the 2020 target) and 2020 water use targets. One hundred fifty seven South Coast urban water suppliers have submitted 2010 UWMPs to DWR. SB x7-7 provides options to meet these targets including shifting to more recycled water use. The UWMPs indicate the South Coast Hydrologic Region had a population-weighted baseline average water use of 188 gallons per capita per day with an average population-weighted 2020 target of 159 gallons per capita per day.

Most recently, with emergency drought conditions persisting throughout California, the Governor issued an Executive Order on April 1, 2015. For the first time in the state's history, this Executive Order required mandatory conservation for all residents, and directed several state agencies to take immediate action to safeguard the state's remaining potable urban water supplies in preparation for a possible fifth year of drought. This emergency regulation requires an immediate 25% reduction in overall potable urban water use statewide, on average.

Water conservation can have mixed impacts on S/N loading. It has the potential to increase the TDS, chloride, and nitrate concentrations in wastewater discharged to the sewer due to reduced in-home water use. This is because the same amount of constituents are added through use, but the total volume of water used is less. On the other hand, to the extent that conservation reduces irrigation and associated irrigation return flows, it could decrease S/N loading. Overall, SB x7-7 has the potential to reduce TDS, nitrate, and chloride loadings and increase concentrations in groundwater, and is accordingly included as a management measure.

Institutional

MM E31 and MM E32. Basin Adjudication and Groundwater Management (ULARA Watermaster)

The following are existing institutional management measures currently in place:

- Basin adjudication and
- Establishment of groundwater management (ULARA Watermaster).

The ULARA basins were adjudicated in January 1979, a process that included the identification of four distinct groundwater basins: the San Fernando, Sylmar, Verdugo, and Eagle Rock basins. The ULARA Watermaster was also appointed in 1979 for the purpose of protecting and preserving groundwater in the ULARA basins.

The adjudication includes provisions and stipulations regarding: water rights; the calculation of imported return water credit; storage of water; stored water credit; and arrangements for a physical solution of water for the principal parties. The principal parties are: City of Burbank, City of Glendale, City of Los Angeles, City of San Fernando and Crescenta Valley Water District.

In late-2007, the cities of Burbank, Glendale, and Los Angeles entered into a 10-year agreement to help reverse the long-term decline in stored groundwater and the concurrent accumulation of a large quantity of unsupported stored water credits in the SFB. The agreement contains several important provisions, including: restrictions on pumping of stored water credits; the joint efforts of the City of Los Angeles and the County of Los Angeles Department of Public Works to rehabilitate existing facilities and/or construct new facilities to help increase recharge of stormwater runoff; and efforts to reduce future losses from the basin due to rising groundwater and underflow out of ULARA. Efforts to increase stormwater capture have the effect of potentially increasing TDS, nitrate, and chloride loadings while decreasing concentrations in groundwater; and efforts to reduce underflow losses (more groundwater retained in ULARA) have the effect of potentially increasing TDS, nitrate, and chloride loadings. Restrictions on pumping reduce removal of TDS, nitrate, and chloride from the basin.

Per the adjudication, and/or as modified by subsequent safe yield evaluations by the Watermaster, the current total amount of allowable extraction from each basin is shown in Table 5-6.

Table 5-6: Extraction Rights by Basin and Agency (AFY)

Basin	City of Burbank	City of Glendale	City of Los Angeles	City of San Fernando	Crescenta Valley Water District	Total
San Fernando Basin	4,117	4,898	84,641	--	--	93,656
Sylmar Basin	--	--	3,570	3,570	--	7,140
Verdugo Basin	--	3,856	--		3,294	7,150
Eagle Rock Basin	--	--	--	--	--	0

Land Use Regulation

MM E33. Model Water Efficient Landscape Ordinance – The Water Conservation in Landscaping Act of 2006 required cities, counties, charter cities, and charter counties, to adopt landscape water conservation ordinances by January 1, 2010. Pursuant to this legislation, the DWR has prepared a Model Water Efficient Landscape Ordinance (Model Ordinance) for use by local agencies. The Model Ordinance became effective on September 10, 2009.

All local agencies must adopt a water efficient landscape ordinance by January 1, 2010. The local agencies may adopt the State Model Ordinance, or craft an ordinance to fit local conditions. In addition, several local agencies may collaborate and craft a region-wide ordinance. In any case, the adopted ordinance must be as effective as the Model Ordinance in regard to water conservation.

The objectives of the existing DWR's Model Water Efficient Landscape Ordinance are to:

- Promote the values and benefits of landscapes while recognizing the need to invest water and other resources as efficiently as possible;
- Establish a structure for planning, designing, installing, maintaining, and managing water efficient landscapes in new and rehabilitated projects;
- Establish provisions for water management practices and water waste prevention for established landscapes; and
- Use water efficiently without waste by setting a Maximum Applied Water Allowance as an upper limit for water use and reduce water use to the lowest practical amount.

Reducing irrigation reduces TDS, nitrate, and chloride loadings from the various irrigation water sources, including recycled water.

Public Education

MM E34. Council for Watershed Health (Website and Outreach) – The Council for Watershed Health (CWH) is an organization established in 1996 to facilitate a stakeholder-driven consensus process to enhance the economic, social, and ecological health of the region's watersheds through education, research, and planning. One of the goals of the CWH is to achieve regional sustainability through integrated natural resources management, including water resources management. CWH conducts active technical and outreach programs directed at professionals, the media, agencies, elected officials, and the public. The impacts of this organization and its outreach efforts on S/N loadings and concentrations in groundwater are not assessed.

MM E35. Southern California Salinity Coalition (SCSC) Outreach Efforts – SCSC was formed in 2002 to address the critical need to remove salt from water supplies and to preserve water resources in California. SCSC is administrated by the National Water Research Institute (NWRI) and is a coalition of water and wastewater agencies in Southern California dedicated to managing salinity in the water supply. SCSC has partnered with MWD and United States Department of the Interior – Bureau of Reclamation (USBR) to update the 1999 Salinity Management Study. As part of the effort, SCSC will be producing outreach and education materials on understanding Southern California salinity conditions and practices and identifying opportunities to promote effective regional salinity management. SCSC is working to update the regional salt balance by considering local and imported salinity sources and identifying trends (e.g., groundwater basin accumulation considering salt imports and exports); develop a tool to determine annual salinity indicators to assess the status of regional salinity management; identify regulatory approaches that affect salinity management and water resource development (e.g., State/Regional Board criteria for brine discharges, implementation of SNMPs, water quality objectives for TDS, etc.); and assess the regional salinity impacts of compliance with SB X7-7 (refer to MM E30), including impacts to wastewater and receiving groundwater. This organization and its outreach efforts have the potential to decrease salt (TDS and chloride) loadings and concentrations in groundwater.

SCSC maintains websites for outreach on salinity information (www.socalsalinity.org) and assessing impacts of salinity from irrigation (www.salinitymanagement.org). The SCSC website (www.socalsalinity.org) describes upcoming and past events hosted by SCSC and provides salinity-related publications such as fact sheets, research project reports, workshop summaries, and SCSC-funded projects. The impacts of this organization and its outreach efforts on S/N loading and concentrations in groundwater are not assessed.

MM E36. ULARA SNMP – To promote the development of the ULARA SNMP, an informational website section was created on the ULARA website by the Watermaster (http://www.ularawatermaster.com/SNMP). The website section disseminates information regarding the SNMP including contact information, meeting minutes, and web links to other reference materials. The impacts of this planning document and outreach efforts on S/N loadings and concentrations in groundwater are not assessed.

MM E37. ULARA Watermaster (Website and Outreach) – The ULARA Watermaster website (http://www.ularawatermaster.com) provides information on the adjudication history and individual ULARA basins, annual Watermaster reports; annual groundwater pumping and spreading plans; legal documents; and other reference sources. The website also provides information on the ULARA SNMP (see MM E36). The impacts of this website and outreach efforts on S/N loadings and concentrations in groundwater are not assessed.

MM E38. WateReuse Association and WateReuse Research Foundation – The WateReuse Association is a nonprofit organization whose mission is to advance the beneficial and efficient uses of high-quality, locally produced, sustainable water sources for the betterment of society and the environment through advocacy, education and outreach, research, and membership. The WateReuse Research Foundation is an educational, nonprofit corporation that was established to conduct applied research on behalf of the water and wastewater community for the purpose of advancing the science of water reuse, recycling, reclamation, and desalination. The Foundation's research covers a broad spectrum of issues, including chemical contaminants, microbiological agents, treatment technologies, salinity management, public perception, economics, and marketing. The Foundation's research supports communities across the United States and abroad in their efforts to create new sources of high quality water while protecting public health and the environment. The impacts of this organization's efforts on S/N loadings and concentrations in ULARA groundwater are not assessed.

Regulatory/Non-Regulatory

MM E39. Recycled Water Non-Potable Reuse Regulations, Guidelines, and Permits – In January 1977 the SWRCB approved Resolution No. 77-1 which stated, "the California legislature has declared that the State shall undertake all possible steps to encourage the development of water reclamation facilities so that reclaimed water may be made available to help meet the growing water requirements of the State". The resolution also recognized the need to protect public health from the environmental problems associated with reclamation projects. To this end, the SWRCB included in its July 1997 strategic plan a goal to meet this objective.

Recycled water has been used in California since the late 1800s. Public health restrictions have been in effect since the early twentieth century. The regulations covering recycled water irrigation in California are found in the California Health and Safety Code (CH&SC) Division 104, Part 12; California Water Code (CWC), Division 7; California Code of Regulations (CCR), Title 22, Division 4; and CCR, Title 17, Division 1, Chapter 5, Group 4. These documents can be found on the LARWQCB website (http://www.swrcb.ca.gov/losangeles/laws_regulations/).

Recycled water is an important resource for the State of California, and its use for non-potable applications is, in many cases, mandated by State law. Manuals have been developed to ensure protection of public health and compliance with regulations. One manual, the 2005 Los Angeles County Recycled Water User's Manual, was prepared for local recycled water irrigation users. This manual was compiled by the local chapter of Watereuse and includes the water and regulatory agencies involved with recycled water. The manual provides the recycled water "User" and "Site Supervisor" a resource for the day-to-day operation and control of that system. The manual outlines the process of converting to recycled water use in order to protect the health and welfare of the personnel involved with its use and the general public and to protect the quality of local water resources.

Overall, recycled water non-potable reuse regulations, guidelines, and permits have the potential to both increase and decrease S/N loadings and concentrations in groundwater in the ULARA groundwater basins. These impacts are not assessed in this SNMP.

MM E40. State Regulations for Groundwater Replenishment using Recycled Water and LARWQCB Permits for Groundwater Recharge Projects – Final regulations for surface and subsurface application of recycled water for groundwater replenishment were promulgated in 2014 (see Title 22 Criteria, Articles 5.1 and 5.2). These regulations include a number of measures to ensure protection of groundwater quality, including:

- An industrial pretreatment and pollutant source control program for the wastewater,
- Pathogenic microorganism control,
- Nitrogen compounds control,

- Regulated contaminants and physical characteristics control,
- Diluent water requirements,
- CEC monitoring,
- Demonstration that recycled water is retained underground for a period of time necessary to allow a response time sufficient to identify failure and implement actions necessary for the protection of human health,
- Calculation of the running monthly average RWC based on the total volume of recycled water and credited diluent water that is recharged during the preceding 120 months,
- Chemical monitoring requirements for the recycled water and groundwater,
- Preparation of an Operation Optimization Plan that identifies and describes the operations, maintenance, analytical methods, and monitoring necessary to meet all GWR Regulations,
- Groundwater monitoring well requirements, and
- Reporting to the SWRCB Division of Drinking Water (formerly CDPH) and LARWQCB.

Due to the potential for confusion and duplication of effort between CDPH and the RWQCBs, CDPH and the SWRCB signed a Memorandum of Agreement (MOA) in 1996. The MOA delineates responsibilities of each agency in review and approval of recycled water projects. As of July 1, 2014, under the direction of California Governor Jerry Brown, the administration of the Drinking Water Program was transferred from CDPH to the SWRCB to consolidate all major water quality programs within a single department, which will allow the State to better manage and protect water resources and ensure safe drinking water for all Californians. Thus, the State's drinking water and recycled water programs are now regulated under the SWRCB Division of Drinking Water. While the SWRCB Division of Drinking Water regulates public water systems and sets standards for wastewater reuse to protect public health (Water Recycling Criteria in Title 22 of the California Code of Regulations), the RWQCB has the permitting and ongoing oversight authority of GWR projects. SWRCB Division of Drinking Water requirements for permit approval are to be incorporated in the final permit that will be issued by the RWQCB.

Overall, the Title 22 Criteria and resulting Waste Discharge Requirements/Water Recycling Requirements (permits) for GWR projects have the potential to both increase and decrease S/N loadings and concentrations in groundwater in the ULARA groundwater basins. These impacts are not assessed in this SNMP.

MM E41. Wastewater, Recycled Water, Surface Water/Stormwater, Imported Water and Groundwater Monitoring – There are multiple recycled water, wastewater, imported water, surface water/stormwater, and groundwater monitoring programs within ULARA. Details regarding these monitoring programs are provided in the SNMP Monitoring Plan, which will be submitted to LARWQCB under a separate cover. These monitoring programs provide a comprehensive and continuing assessment on all the types of water within ULARA.

Under the various existing monitoring programs, for several years groundwater has been and continues to be monitored near Superfund sites, in production wells used for water supply, in wells that supply water to treatment facilities, and in multiple depth-discrete monitoring wells. Groundwater from more than 100 wells is sampled on a daily to annual basis. Hundreds of chemicals/analytical parameters are tested each year. The impacts of monitoring efforts on S/N loadings and concentrations in ULARA groundwater are not assessed.

Source Water Salinity Control

MM E42. LACDPW Stormwater "First Flush" Policy – LACDPW has operational guidelines that dictate a "first flush" policy. The policy states that if stormwater turbidity reaches approximately 500 parts per million after the first several hours of storm flow (i.e., "first flush"), then the intake pumps to spreading grounds will be shut off. Typically, the operators use visual cues (e.g., grab samples) to determine the cloudiness of the water. Influent to spreading grounds is not typically tested for pollutants; however, the intakes will be shut off if an oil sheen is present. Trash racks are cleaned out as needed. This first flush is believed to contain higher concentrations of pollutants, and thus conducting first flush diversions potentially lowers S/N loadings and concentrations in groundwater by sending these constituents (including TDS, nitrate, and chloride) to the stormwater collection system and ultimately out of ULARA to the ocean.

MM E43. MWD Salinity Source Water Control Program – The MWD imports supplemental water supplies to the Southern California region, which includes the ULARA. These supplies are imported from the Colorado River (CR) via the Colorado River Aqueduct and the Sacramento-San Joaquin Bay Delta (Delta) via the State Water Project (SWP). The salinity of these imported supplies is managed through source control measures, collaborative actions with other agencies, distribution system salinity management, and participation with local agencies to protect groundwater and recycled water supplies. Source control measures are critical for reducing salinity in imported water supplies and protecting supplies from additional salinity[5]. Salinity control programs and studies are described below.

- Colorado River Basin Salinity Control Program – The program provides Federal appropriations for salinity reduction projects. These projects include irrigation improvement practices, rangeland management, and deep well brine injection which aid in meeting the program's salinity numerical objectives for the Colorado River Basin.
- California Department of Water Resources Municipal Water Quality Investigations Program – The program, funded through the SWP Contractors, provides routine and real-time monitoring and forecasting of salinity levels in the Delta and SWP.
- Future SWP Activities – The proposed Bay Delta Conservation Plan could significantly reduce TDS levels of exported SWP supplies. If the plan is implemented, the Sacramento River would bypass the Sacramento -San Joaquin Delta and feed directly into the SWP, reducing TDS levels in the SWP supply.
- 2013 Update of the 1999 Salinity Management Study – The 1999 Study is being updated through a partnership between MWD, the USBR, and the SCSC. The update will seek to effectively quantify and set goals for managing the effects of salinity on water resources in Southern California.

Collaborative actions with other agencies allow MWD to exchange water supplies, thereby providing its service area with lower salinity water as described below.

- MWD exchanges CR supplies for lower salinity SWP supplies with the Desert Water Agency and the Coachella Valley Water District. These water agencies contract for SWP supplies, but are unable to take direct delivery of these supplies.
- As opportunities arise, MWD also exchanges some of its SWP supplies for higher quality runoff from the Sierra Nevada mountain range as part of its storage and recovery operations with San Joaquin Valley irrigation districts.

[5] Information provided by Kathy Kunysz, Metropolitan Water District, July 31, 2012

MWD delivers a blend of CR water and SWP supplies to ULARA and this imported water is treated by three of MWD's drinking water treatment plants: two blended water plants (Weymouth and Diemer WTPs) and one SWP plant (Jensen WTP).

- 1999 Salinity Management Policy – MWD continues to support long-term salinity control by considering the 500 mg/L annual TDS goal in its operations by blending water from the SWP and CR. The update of the 1999 Salinity Management Study will assess MWD's future operational capability to deliver low salinity water supplies through 2020.

MWD works with local agencies to manage salinity to protect the quality of groundwater resources and enhance the quality of recycled water.

- Multiple-Agency Collaboration – The Southern California Salinity Coalition, formed in 2002, focuses on coordinating salinity management strategies and programs, including research projects, with water and wastewater agencies throughout Southern California. Refer to MM E29 for a further description of the Southern California Salinity Coalition.
- In addition, the Multi-State Salinity Coalition was formed in 2001 to advance the development of local and regional projects and programs associated with desalination and salinity management technologies, practices, funding, and implementation.
- Local Salinity Management Projects – Various Southern California agencies are undertaking salinity management studies and projects related to brine concentrate disposal, water softener management, and desalination projects.
- Agricultural Salinity Management Practices – Agricultural organizations, such as San Diego County Farm Bureau, support salinity management practices involving the use of low-salinity irrigation water, monitoring soil salt levels, soil leaching, and proper irrigation practices.

In general, actions taken by MWD to reduce the S/N content of imported water decrease both S/N loadings and concentrations in the ULARA basins.

Wastewater Salinity/Nutrient Source Control

MM E44. Industrial Wastewater Source Control Programs – Within the ULARA, the City of Los Angeles Bureau of Sanitation (LASAN), BWP, and GWP implement pretreatment programs that regulate industrial and commercial discharges into the wastewater management system. These activities are conducted in accordance with ordinances adopted by these agencies, Federal pretreatment regulations pursuant to 40 Code of Federal Regulations Part 403, and the Clean Water Act (CWA). The source control programs permit, inspect, monitor, develop source control and pollution prevention requirements, and take enforcement actions for permit and ordinance violations. The overall objectives of the programs are to:

- Protect water treatment plants (WTPs) and WRPs from interference with process operations and pass through of harmful pollutants to the environment;
- Protect the life, health, and safety of operating and maintenance personnel;
- Ensure the health, safety, and welfare of the public;
- Provide the opportunity for beneficial reuse of biosolids; and
- Provide the opportunity for water reclamation.

LASAN's ordinance allows for the development of industrial and commercial discharge requirements to protect the quality of recycled water and meet Waste Discharge Requirements/Water Recycling Requirements (WDR/WRR) and NPDES limits, including S/Ns. This could be accomplished by establishing industry-specific or industrial category-specific discharge limits, requiring industries to bypass discharges around WRPs, prohibiting the use of industrial or commercial self-regenerating water softeners (SRWS), requiring implementation of pollution prevention BMPs, and conducting public outreach. Thus, in general these programs help to reduce S/N loadings and concentrations in groundwater by minimizing the concentrations of TDS, chloride and nitrate entering the water cycle.

MM E45. Wastewater and Recycled Water Nitrogen Treatment – Within the Los Angeles Region, wastewater treatment plants that discharge to inland surface waters have implemented nitrification-denitrification (NdN) as part of their secondary biological treatment processes to reduce nitrogen concentrations. The biological conversion of ammonia in sewage to nitrate-nitrogen is called nitrification. The biological reduction of nitrate to nitrogen gas by facultative heterotrophic bacteria is called denitrification. The DCTWRP, LAGWRP, BWRP, and Tapia WRF include NdN to meet NPDES discharge limits for ammonia, nitrate, and nitrite. These measures decrease nitrate loadings and concentrations in ULARA. There is no impact on TDS or chloride.

Non-Potable Reuse

As mentioned in Section 4, recycled water is utilized for a variety of NPR applications in the SFB, including irrigation and industrial operations. For the purposes of the SNMP, irrigation is the primary consideration since it can contribute to S/N loadings in the groundwater basins.

MM E46. Burbank Water and Power (BWP) Projects from Burbank WRP – This project provides up to 1,608 AFY of recycled water for non-potable reuse through various projects. All of the NPR end uses overlie the SFB. The BWP Recycled Water System Expansion, Phase 3 project is one of these projects and provides up to 61 AFY of recycled water. These projects increase TDS, nitrate, and chloride loadings to the basin. Concentrations of TDS are decreased because the concentrations in tertiary recycled water from BWRP are slightly lower than ambient groundwater in the SFB (Table 5-1). The concentration of chlorides is increased because the concentration from BWRP is higher than ambient groundwater. The concentrations of nitrate are presumed to increase because irrigation water that percolates is concentrated with respect to nitrogen through evapotranspiration and the addition of fertilizer and amendments.

MM E47. Glendale WP Projects from LAGWRP – This management measure provides up to 1,571 AFY of recycled water from the LAGWRP to the SFB and 255 AFY to the Verdugo Basin through various projects. These projects increase TDS, nitrate, and chloride loadings to the basin. The concentrations of TDS and chlorides are increased because the concentrations from LAGWRP are higher than ambient groundwater. The concentrations of nitrate are presumed to increase as well because irrigation water that percolates is concentrated with respect to nitrogen through evapotranspiration and the addition of fertilizer and amendments.

MM E48. LADWP Projects from DCTWRP – This management measure provides approximately 1,770 AFY of recycled water from the DCTWRP through various projects in the SFB. These include projects that serve recycled water for irrigation of golf courses and parks located adjacent to DCTWRP in the Sepulveda Basin Recreation Area. Concentrations of TDS are decreased because the concentrations in tertiary recycled water from DCTWRP are lower than ambient groundwater in the SFB (Table 5-1). The concentration of chlorides is increased because the concentration from DCTWRP is higher than ambient groundwater. The concentrations of nitrate are presumed to increase because irrigation water that percolates is concentrated with respect to nitrogen through evapotranspiration and the addition of fertilizer and amendments.

MM E49. LADWP Projects from LAGWRP – These projects provide up to 338 AFY of recycled water for non-potable reuse overlying the SFB. One of the existing projects is the Bette Davis Water Recycling Project (75 AFY). These projects increase TDS, nitrate, and chloride loadings to the basin. The concentrations of TDS and chlorides are increased because the concentrations from LAGWRP are higher than ambient groundwater. The concentrations of nitrate are presumed to increase as well because irrigation water that percolates is concentrated with respect to nitrogen through evapotranspiration and the addition of fertilizer and amendments.

5.2.2 Planned Management Measures

The planned management measures are numbered MM P1 through MM P38 in Table 5-3 and are described in detail below. These projects/programs are expected to be implemented by the 2025 planning horizon of the ULARA SNMP.

Groundwater Recharge

MM P1. Big Tujunga Reservoir Sediment Removal – The Big Tujunga Reservoir Sediment Removal Project will permanently remove approximately 4.4 million cubic yards (MCY) of sediment from the Big Tujunga Reservoir. This project will provide capacity for 1,425 AFY to 2,727 AFY of additional stormwater recharge to the groundwater basin. The expected implementation date is September 2018. This project will increase TDS, nitrate, and chloride loadings and reduce concentrations in groundwater. It is assumed that the project will provide approximately 2,100 AFY of additional stormwater capture moving forward.

MM P2. Tujunga Spreading Grounds Reconstruction Project – The Tujunga Spreading Grounds Reconstruction Project will provide approximately 4,200 AFY of additional recharge capacity through improvements with an expected implementation date is in 2018. Currently, potential exists for recharged water to displace the methane gas being produced within the nearby Sheldon-Arleta Landfill during stormwater spreading operations. The methane gas collection system was replaced to enhance the containment of the methane gas within the landfill and restore the historic spreading flow capacity. This project will increase TDS, nitrate, and chloride loadings and reduce concentrations in groundwater.

MM P3. City of Los Angeles Groundwater Replenishment Project – This locally-controlled proposed GWR project would move the City of Los Angeles toward its goal of reducing dependence on imported water supplies and help secure a more reliable and sustainable water supply. The proposed project would replenish the SFB with up to 30,000 AFY of recycled water from DCTWRP in the SFB by 2024. The type of treatment and timing for the project is under discussion. For purposes of the SNMP, two hypothetical S/N loading scenarios were used to develop a framework for evaluating a future GWR project. Details on the treatment, flows, and timing for two different scenarios used for the SNMP (i.e., “hypothetical high loading” and “hypothetical low loading” scenarios) are provided in Section 4.2.1. The groundwater quality impacts will depend on the treatment level of the recycled water delivered. Typically, recharge of tertiary-treated recycled water will increase TDS, nitrate, and chloride loadings while also increasing nitrate and chloride concentrations (due to evapotranspiration and fertilizer addition). TDS concentrations would likely be reduced (see Table 5-1). Recharge of AWT recycled water will increase TDS, nitrate, and chloride loadings while decreasing the concentrations of these constituents.

MM P4. Hansen Dam Water Conservation Project – The Hansen Dam Water Conservation Project will utilize the existing debris and flood control pools for water conservation purposes by raising their respective maximum elevations to allow for additional water supply storage. The extra supply storage can then be utilized for dam releases to the downstream spreading grounds. This project will provide approximately 3,400 AFY of GWR and implementation is expected to commence December 2016. Additional stormwater recharged will increase TDS, nitrate, and chloride loadings and decrease concentrations in the basin.

MM P5. Pacoima Reservoir Sediment Removal – The Pacoima Reservoir Sediment Removal Project will remove sediment caused by fires near the Pacoima Dam. The project will include construction of an access road to establish vehicular access to Pacoima Reservoir, sediment removal activities, and sediment placement in an existing pit or new sediment placement site. This project will allow approximately 3,200 AFY of additional GWR through the removal of 2.4-5.2 MCY of sediment. The expected implementation date of this project is October 2020. Additional stormwater recharged will increase TDS, nitrate, and chloride loadings and decrease concentrations in the basin.

MM P6. Anheuser-Busch Brewery – The project will reduce sewer discharges by injecting treated water on-site. The water will be treated to Title 22 standards prior to injection. It is estimated that a potential of up to 840 AFY of recycled water will be injected. The estimated water quality is 100 – 200 parts per million (ppm) for TDS, with nitrate and chloride concentrations below their respective primary and secondary Maximum Contaminant Levels (MCLs). It is expected that this project will be implemented within the first quarter of 2016. It is assumed that the TDS will be approximately 150 mg/L and that nitrate and chloride will be at the primary and secondary MCLs for modeling purposes. Given the assumed concentrations of these constituents, this project will likely increase TDS, nitrate, and chloride loadings and decrease concentrations in the basin.

Groundwater Remediation

The impacts of remedial pumping and treatment on TDS, nitrate, and chloride concentrations and loading are the same as any groundwater pumping in the basin. The impact depends on how the groundwater is used and the overall basin water balance. Some groundwater will be used for irrigation and return to the basin, some may go to the local wastewater treatment plant and be reused or discharged to surface water and flow out of the basin. Some may leave the basin as subsurface outflow. In this section and in Table 5-4, the impacts to TDS, nitrate, and chloride are assumed to be "varied" unless there is specific removal of one of the constituents as the result of that MM.

MM P7. Groundwater Remediation Facilities – The eastern portion of the SFB has been contaminated primarily due to improper handling and disposal of solvents beginning in the 1940s. This contamination has severely impaired the SFB and reduced LADWP's ability to pump its adjudicated right of 87,000 AFY of water. As of 2012, 57 out of 115 groundwater production wells have been removed from service due to contamination. Therefore, the remediation of SFB is necessary to provide public benefit.

Based on the GSIS, recommendations and assistance will be provided to develop short and long term projects including the design and construction of the Groundwater Remediation Facilities. Ongoing sampling and monitoring of the 26 new groundwater monitoring wells will provide supplemental water quality data that will be necessary to fully map and monitor the extent of the contamination. This project will provide environmental benefits, meet safe drinking water regulations, and prevent further loss of this important groundwater resource. This project will construct groundwater treatment facilities in North Hollywood, Rinaldi-Toluca, and Tujunga Wellfields in the SFB to allow treatment of up to 123,000 AFY of groundwater from the SFB. The LADWP is planning to have these facilities in-place and operational by 2021. It is assumed that the project will treat 123,000 AFY when operational.

MM P8. Mission Wells Improvement – The Mission Wells Improvement project will construct monitoring wells to restore the overall capacity to produce groundwater, to fully utilize LADWP's water rights of 3,570 AF from the SB, and to reestablish pumping in order to avoid losing any of the current stored water credits of approximately 12,000 AF from this basin. This project provides approximately 4,170 AFY of groundwater remediation for the first 15 years after implementation and will then provide 3,570 AFY for the duration of the project life. The project will be implemented in two phases: the first phase will construct up to five monitoring wells in addition to replacing existing deteriorated production wells in the Sylmar Basin and the second phase will construct an ammonia station and onsite hypochlorite generating station to meet the Stage 2 Disinfection Byproducts Rule. The estimated implementation date is July 2017.

MM P9. Rockhaven Well – The Rockhaven Well Project is a joint project between the Crescenta Valley Water District (CVWD) and GWP to activate a new water supply groundwater well which was constructed by GWP. This well was previously considered unusable due to nitrate contamination. This project will connect the existing GWP well to CVWD's Glenwood Nitrate Water Treatment Plant. It will include an installation of a 450 gallon per minute (gpm) pump, onsite piping, an electrical and telemetry system, drain line for waste, on-site improvements, and 1,200 LF of 8-inch diameter water main. By partnering to construct this connection, both CVWD and GWP will share in an additional 484 AFY of local groundwater supply that can now be pumped from the Verdugo Groundwater Basin to meet potable demands. This project will be brought online in January 2016.

However, because nitrate is removed by ion exchange from an untreated concentration of 44 mg/L to a treated concentration of 20 mg/L., the project is expected to reduce nitrate loading and concentrations. It is assumed that the project will treat 484 AFY moving forward.

MM P10. Crescenta Valley Water District Nitrate Removal Treatment Facility at Well 2 - CVWD desires to reactivate its Well 2 and install a nitrate removal treatment facility at CVWD's Ordunio Reservoir site. The project will utilize a local water resource, increase CVWD's ability to adjudicated rights within the Verdugo Basin, reduce CVWD's dependence on imported water from MWD and reduce nitrates levels within the Verdugo Basin. Well No. 2 was drilled in 1927 and was taken out of service in 1977 due to nitrate levels above the MCL and lack of a nitrate removal treatment facility. The Well 2 capacity is 150 gpm, which is 240 AFY and the nitrate levels are between 45 – 50 mg/l. The project will include a new 150 gpm pump and motor, onsite piping, small building, electrical and telemetry system, storm drain line to pump to waste, and on-site improvements. The project will also include the installation of a nitrate removal treatment facility which will treat the groundwater below the MCL and remove nitrates from the Verdugo Basin. The anticipated start date of this project is June 2017.

Stormwater Capture/Runoff Management

Increased recharge of stormwater increases TDS, nitrate, and chloride loadings because stormwater contains low concentrations of these constituents; stormwater decreases concentrations in groundwater because it has lower concentrations compared with ambient groundwater.

MM P11. Additional LID Projects, Stormwater BMPs, and LARWQCB MS4 Permits – As described for Management Measure No. E20 in Section 5.2.1, there are multiple existing and planned LID projects and stormwater BMPs. Recent MS4 permits issued by the LARWQCB include new requirements for hydromodification and LID that apply to existing development or redevelopment projects that have been constructed or for which grading or land disturbance permits have been submitted and are deemed complete prior to the adoption date of the MS4 permit. It is anticipated that the MS4 permits and permit-related LID/BMP projects overall would decrease S/N loading and concentrations in groundwater (WRD, 2015). It is not possible to estimate quantitatively how implementation of new MS4 permits will impact S/N loading because permit-related LID/BMP projects are considered conceptual and most will likely be implemented beyond the SNMP 2025 planning horizon. Projects that are implemented prior to 2025 will be low volume and thus, are not expected to substantively impact S/N loadings.

In the 2012 MS4 permit that was issued by LARWQCB for the 84 cities and a majority portion of the unincorporated areas of Los Angeles County, Enhanced Watershed Management Programs (EWMP) and Watershed Management Programs were required for development to increase stormwater and non-stormwater surface water capture, as well as improve surface water quality. Recharge of higher quality surface water will result in improved groundwater quality once these programs are implemented.

MM P12. Big Tujunga Dam Spillway Dam – The Big Tujunga Dam Spillway Dam is a planned project that will construct a dam within the spillway at Big Tujunga Dam to increase the maximum storage capacity of the reservoir by approximately 705 AFY. The start date for this project is not currently available.

MM P13. Boulevard Pit Stormwater Capture Project – The Boulevard Pit Stormwater Capture Project is a planned project that will acquire and develop the Boulevard Pit into a multi-use retention and recharge facility to enhance stormwater conservation. This project will capture approximately 9,760 AFY of stormwater and will be implemented by December 2023.

MM P14. Browns Canyon Wash at Route 118 and Rinaldi – The Browns Canyon Wash and Route 118 and Rinaldi Project will include construction of detention areas and swales to improve water quality from stormwater runoff. The channel volume will be increased by 4.5 AF of swales and the overall detention capacity will be increased by 13.1 AF. The start date for this project is not currently available.

MM P15. Chase Street Stormwater Greenway – The Chase Street Stormwater Project is a planned project that will install a stormwater greenway along Chase Street. The vegetated planters in the parkways will capture and infiltrate approximately 7 AFY of street runoff, provide stormwater filtration, and tree shading. Native landscape will be provided as habitat and a recreational rest stop along the channel near Bull Creek. A channel diversion from Bull Creek, with a pre-filter and lift station will transfer runoff through a pipeline to a local sod farm where it will be used to irrigate up to 30 commercial areas. This project is expected to be implemented by December 2018.

MM P16. Los Angeles River Natural Park – The Los Angeles River Natural Park project is a planned project to develop a system for natural stormwater treatment along the northern bank of the Los Angeles River. The Los Angeles River Natural Park will be able to divert and treat 11.4 AF of runoff from over 200 acres of its surrounding tributary area. The storage area will provide approximately 8 AF of reuse for irrigation. In addition, during the dry season, the project would draw up to 5.6 AFY of water from the Los Angeles River to sustain constructed wetlands, which provide settlement, filtration, and cleaning before discharging the treated water back into the Los Angeles River. This project is expected to begin operation by March 2018.

MM P17. North Hollywood Transmission Corridor Easement Stormwater Capture Study – This project will conduct a planning study to expand the Whitnall Highway corridor park project proposed by the LADWP by evaluating the capacity and capability of the entire transmission corridor from Tujunga Spreading Grounds to the Burbank city limits. In order to accomplish the goals of the project, stormwater runoff will be captured at several locations along the easement and directed into a network of swales, culverts, hydrodynamic separators, and infiltration basins for pre-treatment and infiltration. This project will increase stormwater capture by approximately 750 AFY. The estimated implementation date is December 2021

MM P18. Pacoima Neighborhood Retrofit – The Pacoima Neighborhood Retrofit is a planned project that will develop neighborhood street edge alternatives to include addition of adjacent surplus property, create a swale network and promote stormwater capture, increase pervious surfaces, plant native species to decrease irrigation needs, and capture and infiltrate stormwater and remediation of polluted surface water runoff. The project is being piloted first in Panorama City, where 24 homes were retrofitted for onsite stormwater capture and management, potable supply conservation, and greywater reuse. It will be extended to 8 other neighborhoods in the San Fernando Valley to provide approximately 1,000 AFY of stormwater capture. This project is expected to be implemented by 2017.

MM P19. Sheldon Pit – The Sheldon Pit Project site was an active aggregate mine and is currently operated for fine sediment placement. The site is approximately 138 acres and has been mined to a depth of approximately 250 feet below ground surface. The planned project will enhance the area with stormwater capture facilities along with multi-use attributes to provide approximately 6,000 AF of storage capacity. This project entails a massive water conservation effort by diverting 4,500 AFY of water from Tujunga Wash into Sheldon Pit for GWR while open space attributes would provide benefits such as habitat enhancement and both active and passive recreational opportunities. The project will be implemented by December 2024.

MM P20. Sun Valley Economic Development Administration Public Improvements Stormwater Capture Project

The Sun Valley EDA Public Improvements Stormwater Capture Project will install 46 dry wells within the sidewalks along Branford Street between Haddon Avenue and Arleta Avenue. The dry wells will capture, treat, and recharge stormwater from a 146 acre tributary area into the SFB. The project anticipates recharging an average of approximately 93 AFY of stormwater. The project is currently under construction and is expected to be complete by April 2016.

MM P21. Sun Valley Watershed Rory M. Shaw Wetlands Park Project – The Sun Valley Watershed Rory M. Shaw Wetlands Park Project will convert a 46-acre debris landfill into a multi-purpose wetlands park facility. The project will include a storm drain system that will capture approximately 560 AFY of stormwater runoff from a 929-acre tributary area and convey it to the wetlands park. The wetlands park will feature a detention pond with a storage capacity of 400 AF that will store runoff and reduce flooding in the surrounding areas. The wetlands park will also feature a 10-acre wetland that will provide a sustainable habitat for various plant and animal species, and a natural treatment system for removing pollutants from the collected stormwater runoff. The treated stormwater will then be pumped to existing underground infiltration basins at Sun Valley Park for GWR. The wetlands park will also include 15 acres of open and recreational space, and opportunities for educational and interpretive signage. The expected implementation date of the project is December 2019.

MM P22. Valley Generating Station Stormwater Recharge Project – The Valley Generating Station Stormwater Recharge Project is a stormwater capture project designed to help alleviate localized flooding, recharge the groundwater basin, and improve downstream quality. In order to accomplish the goals of this project, stormwater runoff will be captured and directed through a series of recharge basins, swales and overflow culverts to strategic points on-site. Another project consideration is the construction of a large infiltration swale on Little San Fernando Road to provide off-site stormwater capture. This project will increase GWR by 118 AFY and will be implemented by August 2017.

MM P23. Verdugo Hills Stormwater Project – The Verdugo Hills Stormwater Project intercepts runoff from a total of 845 acres and provides filtration, storage, and reuse. The project expands environmental stewardship and provides for multiple benefits to habitat, recreation, and open space. It implements a recreational "wet" driving range feature a the Verdugo Hills Golf Course called an "Aqua-Range" that has been successfully implemented elsewhere for revenue that in this case would be directed to facility operations and maintenance. This Aqua-Range maximizes the storage area during the wet season by using both above and below ground storage, and then routes surface treated volumes to subsurface storage (for reuse) in the dry season. The existing 16-acre golf course remains, minus approximately 5 acres of turf for replacement with California native plants which reduces the overall irrigation demand of the 16-acre course by nearly 31% and balances the evaporative losses from open water/UV treatment areas. Landscaped step pools provide for sediment removal and water access for wildlife. This project provides a total of approximately 47 AFY of stormwater capture for recharge and has an expected implementation date of April 2017.

MM P24. Whitnall HWY Powerline Easement Stormwater Capture Project – The Whitnall HWY Powerline Easement Stormwater Capture Project is a planned project that entails the capture, treatment, and infiltration of stormwater runoff from streets in the San Fernando Valley. This project will help alleviate local flooding, provide water quality enhancements, and recharge the groundwater basin by approximately 110 AFY. Local stormwater runoff will be diverted using swales, culverts, and pipes through pretreatment devices into infiltration basins. The pretreatment devices will remove debris such as trash, suspended sediments, and pollutants associated with solids such as heavy metals. After pretreatment, water will then enter into 4- and 10-foot deep infiltration basins, where the treated stormwater runoff will recharge the SFB. This project will be implemented by December 30, 2018.

MM P25. Crescenta Valley County Park Stormwater Recharge Facility - CVWD wants to install a stormwater recharge facility at Crescenta Valley County Park to capture and infiltrate stormwater and dry-weather flow within the Verdugo Wash to recharge the Verdugo Basin. Project goals for the stormwater recharge facility will be to increase groundwater supplies, improve local water supply reliability particularly during times of drought, improve groundwater quality, and reduce surface water runoff within the Park. The project is estimated to increase the local water supply by an annual average of 340 AFY. The project includes installation of a rubber dam system in the Verdugo Wash to divert stormwater into infiltration galleries located under the existing ball field area, re-design existing parking lot with infiltration galleries to collect on-site storm water, and construct an educational native plant landscaping garden. The anticipated start date is December 2018.

Conservation

Water conservation can have mixed impacts on S/N loading. It has the potential to increase the TDS, chloride, and nitrate concentrations in wastewater discharged to the sewer due to reduced in-home water use. This is because the same amount of constituents are added through use, but the total volume of water used is less. On the other hand, to the extent that conservation reduces irrigation and associated irrigation return flows, it could decrease S/N loading.

MM P26. Be a Water Saver Conservation Program – The Be a Water Saver Conservation Program is a planned project that increases water conservation efforts that will conservatively save approximately 500 AFY of water through the use of various conservation programs. This project is expected to be fully implemented by September 2016.

MM P27. Senate Bill x7-7 – Conservation is a fundamental component of water management planning. Many local water agencies are signatories to the CUWCC memorandum of agreement for urban water conservation and also have UWMPs to ensure water supply reliability during normal, dry, and multiple dry years. The backbone of MWD's conservation program is the CCP, initiated in 1988, that contributes $195 per AF of water conserved to assist member agencies in pursuing urban BMPs and other demand management opportunities. All of the region's water suppliers have water conservation programs for their customers.

Local agencies are also developing water conservation master plans and conservation rate structures as well as working closely through IRWM planning efforts to develop coordinated water efficiency programs. To these ends, the GLAC IRWMP (GLAC IRWMP Leadership Committee, 2013) has been developed for the greater Los Angeles County area.

In 2009, Senate Bill x7-7 was enacted to amend the California Water Code to establish a statewide target to reduce urban per capita water use by 20% by 2020. The law requires urban retail water suppliers, individually or on a regional basis, to develop an urban water use target by December 31, 2010, to meet their target by 2020, and to meet an interim target (half of their 2020 target) by 2015. One hundred fifty - seven South Coast urban water suppliers have submitted 2010 UWMPs to DWR. The law provides options to meet these targets including shifting to more recycled water usage.

The GLAC IRWMP provides estimates of water conservation target volumes (water use efficiency excluding water recycling) for the ULARA in 2035. Accordingly, existing water conservation efforts are planned to continue through the SNMP future planning period and beyond. Overall, SB x7-7 has the potential to reduce S/N loading and concentrations in groundwater.

Regulatory/Non-Regulatory

MM P28. State Regulations for Groundwater Replenishment using Recycled Water and LARWQCB Permits for Groundwater Recharge Projects – Final regulations for surface and subsurface application of recycled water for groundwater replenishment were promulgated in 2014 (see Title 22 Criteria, Articles 5.1 and 5.2).

Overall, the Title 22 Criteria for and resulting Waste Discharge Requirements/Water Recycling Requirements (permits) for GWR projects have the potential to both increase and decrease S/N loading and concentrations in groundwater in the ULARA groundwater basins. These impacts are not assessed in this SNMP. Additional detail on these regulations is provided under MM E40.

MM P29. SNMP Monitoring Plan – The Recycled Water Policy requires development of a SNMP Monitoring Plan for each groundwater basin in California. The *Monitoring Plan for SNMP*, provided under separate cover, includes a detailed description of the SNMP Monitoring Plan. The intent of the SNMP Monitoring Plan is to evaluate concentrations of S/Ns in groundwater with respect to applicable WQOs. The SNMP Monitoring Program will assist in the overall efforts to decrease S/N loading and concentrations in the groundwater. The impacts of monitoring efforts on S/N loading and concentrations in ULARA groundwater are not assessed.

Total Maximum Daily Loads (TMDLs)

MM P30. TMDLs – Section 303(d) of the CWA requires States and Territories of the United States to identify water bodies that do not meet water quality standards (e.g., the 303(d) list of impaired water bodies) and then to establish TMDLs for each water body for each pollutant of concern. The TMDL is a calculation of the maximum amount of a pollutant from point sources and nonpoint sources that a water body can receive and still meet water quality standards, within a margin of safety and considering seasonal variation. When a TMDL is approved, controls on pollutants are expected to be implemented for point sources through limits in NPDES permits and for nonpoint sources through other means, such as BMPs. Implementation of TMDLs are generally expected to reduce TDS, nitrate, and chloride loadings and concentrations in groundwater through improvements in surface water quality that may recharge the basins.

Wastewater Salinity/Nutrient Source Control

MM P31. Septic-to-Sewer Drinking Waterwell Protection Project – The Septic-to-Sewer Drinking Waterwell Protection Project will reduce potential pollution and threats to public health caused by high-risk Onsite Wastewater Treatment Systems (OWTS). This project will remove 55 high-risk OWTS that are within 900 feet of 23 drinking water wells in the SFB. By eliminating the 55 OWTS and connecting them to the public sewer, the project will protect 14% of the City of Los Angeles' groundwater supply from potential contamination. This project will provide approximately 23 AFY of recycled water (via sewered wastewater flows) for non-potable uses and is expected to be implemented April 2016. By eliminating recharge of relatively untreated wastewater, the project is expected to reduce TDS, nitrate, and chloride loading and concentrations in groundwater.

Non-Potable Reuse

As mentioned in Section 4.2, there are future plans to expand the NPR distribution systems from all four WRPs. For the purposes of the SNMP, irrigation is the primary consideration since it can contribute to S/N loadings in the groundwater basins as opposed to industrial uses that do not recharge the basins. The numbers provided are cumulative AFY values that include existing demands.

MM P32. Burbank WP Projects from Burbank WRP – This project will provide up to 5,160 AFY of NPR water (existing + future) through the use of implementation projects in the SFB. These projects will include, but are not limited to, the Burbank Partnership Water Recycling Project (285 AFY). These projects increase TDS, nitrate, and chloride loadings to the basin. Concentrations of TDS are decreased because the concentrations in tertiary recycled water from BWRP are slightly lower than ambient groundwater in the SFB (Table 5-1). The concentration of chlorides is increased because the concentration from BWRP is higher than ambient groundwater. The concentrations of nitrate are presumed to increase because irrigation water that percolates is concentrated with respect to nitrogen through evapotranspiration and the addition of fertilizer and amendments.

MM P33. Glendale WP Projects from LAGWRP – This management measure will provide up to 1,396 AFY of NPR water (existing + future) to the SFB and 255 AFY to the Verdugo Basin through the use of implementation projects. These projects will include, but are not limited to, the Camino San Rafael Recycled Water Project (90 AFY), the Chevy Oaks Recycled Water Project (30 AFY), and the Hoover, Toll, & Keppel School Recycled Water Project. These projects increase TDS, nitrate, and chloride loadings to the basin. The concentrations of TDS and chlorides are increased because the concentrations from LAGWRP are higher than ambient groundwater. The concentrations of nitrate are presumed to increase as well because irrigation water that percolates is concentrated with respect to nitrogen through evapotranspiration and the addition of fertilizer and amendments. It is also estimated that approximately 3,100 AFY from LAGWRP will be delivered to end uses overlying the Raymond Basin.

MM P34. LADWP Projects from DCTWRP – This management measure will provide up to 1,948 AFY of NPR water (existing + future) through the use of implementation projects in the SFB. These projects will include, but are not limited to, the Hansen Dam Golf Course Water Recycling Project. Concentrations of TDS are decreased because the concentrations in tertiary recycled water from DCTWRP are lower than ambient groundwater in the SFB (Table 5-1). The concentration of chlorides is increased because the concentration from DCTWRP is higher than ambient groundwater. The concentrations of nitrate are presumed to increase because irrigation water that percolates is concentrated with respect to nitrogen through evapotranspiration and the addition of fertilizer and amendments.

MM P35. LADWP Projects from LAGWRP – This management measure will provide up to 1,191 AFY of NPR water (existing + future) through the use of implementation projects in the SFB. These projects will include, but are not limited to, the Los Angeles State Historic Park Water Recycling Project (190 AFY). These projects increase TDS, nitrate, and chloride loadings to the basin. The concentrations of TDS and chlorides are increased because the concentrations from LAGWRP are higher than ambient groundwater. The concentrations of nitrate are presumed to increase as well because irrigation water that percolates is concentrated with respect to nitrogen through evapotranspiration and the addition of fertilizer and amendments.

MM P36. Pasadena WP Projects from LAGWRP – This management measure will provide up to 3,100 AFY of NPR to PWP, outside of ULARA. This project is not expected to have any impact on groundwater quality in the ULARA Basins.

MM P37. Las Virgenes MWD Projects from Tapia WRP – This management measure will provide up to 1,040 AFY of NPR water from outside ULARA into LADWP's service area inside ULARA. These projects will include, but are not limited to, serving recycled water for landscape irrigation at Hidden Hills, Woodland Hills Golf Course, and Pierce College Extensions. Currently, the City of Los Angeles is also working on a potential conceptual project for seasonal storage, which would allow for an additional 590

AFY of NPR water, a total of 1,650 AFY. These projects increase TDS, nitrate, and chloride loadings to the basin. The concentrations of TDS and chlorides are increased because the concentrations from LAGWRP are higher than ambient groundwater. The concentrations of nitrate are presumed to increase as well because irrigation water that percolates is concentrated with respect to nitrogen through evapotranspiration and the addition of fertilizer and amendments.

MM P38. Two-Strike Park Recycled Water Project - CVWD has been looking into the long-term benefits of utilizing recycled water as a way of reducing potable water demands on the system to provide an alternative source of water to Two-Strike Park for irrigation purposes as well as groundwater recharge. Two-Strike Park is located within the hydrologic area of the Verdugo Basin. The Two-Strike Project uses CVWD's municipal wastewater, treated on an MBR / UV plant proposed to be located on site. Recycled water (effluent from the MBR / UV plant) will be used for irrigation and groundwater recharge. This project is anticipated to begin operating in April 2018. The impacts on loading and concentration from this project have yet to be determined.

5.2.3 Conceptual Management Measures

The conceptual management measures are numbered MM C1 through MM C12 in Table 5-3. These projects/programs/strategies are those that have been hypothetically identified, but may or may not begin until after the SNMP 2025 planning horizon.

Groundwater Remediation

MM C1. Glendale Water and Power Disinfection Operation – Glendale Water and Power will be considering converting from chlorine gas to sodium hypochlorite for its disinfection operations. These operations would be on groundwater wells and in facilities where the residual in the system will be increased. There are no impacts to TDS, nitrate, and chloride loadings or concentrations anticipated from this project.

Stormwater Capture/Runoff Management

MM C2. Additional LID Projects and Stormwater BMPs – Additional LID projects and stormwater BMPs may be implemented in the ULARA through the SNMP future planning period (refer to Management Measure Nos. MM E20 and MM P12). These projects are only conceptual at this time. Overall, LID/BMP projects potentially could increase TDS, nitrate, and chloride loadings and decrease concentrations due to the relatively low concentrations in surface water/stormwater compared with ambient groundwater.

MM C3. Mission Hills Green Belt – The Mission Hills Green Belt Project provides recreational opportunities with a watershed functional component to clean the stormwater runoff before it enters the Pacoima Spreading Grounds and Wash. This project increases stormwater capture by 100 AFY, which increases TDS, nitrate, and chloride loadings but reduces concentrations in groundwater.

MM C4. Sepulveda Basin Sports Complex Multi-Purpose Open Space – The Sepulveda Basin Sports Complex Multi-Purpose Open Space Project will be Phase II of the Sepulveda Basin Sports Complex Project. This conceptual project would include detention basins/cisterns underneath an open field area and stormwater treatment through vegetated areas. This project increases stormwater capture, which increases TDS, nitrate, and chloride loadings but reduces concentrations in groundwater.

MM C5. Sepulveda Basin Sports Complex Riparian Buffer – The Sepulveda Basin Sports Complex Riparian Buffer project would provide recreation enhancement along with stormwater treatment benefits. This project will connect to existing non-motorized trails. This project increases stormwater capture, which increases TDS, nitrate, and chloride loadings but reduces concentrations in groundwater.

MM C6. Taylor Yard River Park Parcel G2 – The Taylor Yard River Park Parcel G2 Project is a conceptual project that will increase the riparian habitat in the Los Angeles River Channel. This includes widening the channel bed and connecting it to the existing level of the overbank with a vegetated sloped bank that would be established with water harvesting features such as micro-grading and/or swales to capture and infiltrate water and plants that would survive season inundation and lay down in flood events. This project increases stormwater capture, which increases TDS, nitrate, and chloride loadings but reduces concentrations in groundwater.

MM C7. Water Quality Improvement Project - This project addresses water pollution coming from storm drains by helping to provide a funding source that will help cities pay for pollution prevention projects. To the extent that this project prevents contaminants from entering stormwater, it will reduce both loadings and concentrations of TDS, nitrate, and chloride in groundwater.

Conservation

MM C8. Senate Bill x7-7 and Other Activities – As described for Management Measure Nos. MM E24 and MM P29, conservation is a fundamental component of the GLAC water management planning, which has included aggressively implementing water conservation since the 1990s. Many local water agencies are signatories to the CUWCC memorandum of agreement for urban water conservation and also have UWMPs to ensure water supply reliability during normal, dry, and multiple dry years. The backbone of MWD's conservation program is the CCP, initiated in 1988, that contributes $195 per AF of water conserved to assist member agencies in pursuing urban BMPs and other demand management opportunities. All of the region's water suppliers have water conservation programs for their customers.

Local agencies are also developing water conservation master plans and conservation rate structures as well as working closely through IRWM planning efforts to develop coordinated water efficiency programs. To these ends, the GLAC IRWMP (GLAC IRWMP Leadership Committee, 2013) has been developed for the greater Los Angeles County area.

SB x7-7, enacted in 2009, requires each urban retail agency to establish in its UWMP a reduction goal to help California achieve a 20% statewide reduction in daily per capita water use by 2020. SB x7-7 requires urban water suppliers to calculate baseline water use and set an interim 2015 (half the 2020 target) and 2020 water use targets. One hundred fifty - seven South Coast urban water suppliers have submitted 2010 UWMPs to DWR. SB x7-7 provides options to meet these targets including shifting to more recycled water use.

The GLAC IRWMP provides estimates of water conservation target volumes (water use efficiency excluding water recycling) for the ULARA in 2035. Accordingly, existing water conservation efforts are planned to continue through the SNMP future planning period and beyond. Overall, SB x7-7 has the potential to reduce S/N loading and concentrations in groundwater, and is accordingly included as a management measure.

Water conservation can have mixed impacts on S/N loading. It has the potential to increase the TDS, chloride, and nitrate concentrations in wastewater discharged to the sewer due to reduced in-home water use. This is because the same amount of TDS is added through use, but the total volume of water used is less. On the other hand, to the extent that conservation reduces irrigation and associated irrigation return flows, it will decrease S/N loading.

MM C9. Xeriscape Policy – Some water agencies in the ULARA provide rebates for weather-based irrigation controls and turf removal programs for residential and commercial customers. Additional information is available on the MWD SoCal Water$mart website: http://socalwatersmart.com. These projects have the potential to reduce S/N loading and decrease concentrations in groundwater in the ULARA basins.

Source Water Salinity Control

MM C10. Bay Delta Conservation Plan – As mentioned under MM E37, this Project would modernize the Delta's major water systems by improving water conveyance, provide ecosystem restoration and improve water supply reliability. Currently, tides bring salt water from the Bay flowing east into the Delta. In some areas, there is a high saltwater influx into the export water supply due to the land being significantly lower than the water bearing channels. This project has the potential to reduce S/N loading and concentrations in groundwater in the ULARA by improving the overall quality of imported water supplies.

Wastewater Salinity/Nutrient Source Control

MM C11. Resident Automatic Water Softener (AWS) Controls (Bans and/or rebates) – There are currently no plans within the SFB to control residential AWS or implement voluntary rebate programs. Thus, this project is only conceptual. While AWS can add significant salt loading to the wastewater system, regulation of residential AWS has historically been a very contentious issue and there are significant hurdles facing local agencies that wish to enact controls. Any efforts to control or reduce the use of AWS would help to reduce salt (TDS and chloride) loading and concentrations in groundwater.

Nonetheless, the California Health and Safety Code Section 116786 authorizes a local agency to prospectively limit the availability, or prohibit the installation, of residential water softening or conditioning appliances that discharge to the sewer system through adoption of an ordinance if the following findings are made, substantiated by an independent study, and included in the ordinance:

- Limiting the availability, or prohibiting the installation, of the appliance is a necessary means of achieving compliance with waste discharge requirements.
- The local agency has adopted and is enforcing regulatory requirements that limit the volumes and concentrations of saline discharges from nonresidential sources in the community waste disposal system to the extent technologically and economically feasible.

In 2009, Assembly Bill 1366 added Section 13148 to the California Water Code that provides other mechanisms to control residential AWS. It only applies to specific hydrologic regions identified in the California Water Plan: the Central Coast, South Coast, San Joaquin River, Tulare Lake regions, and the Counties of Butte, Glenn, Placer, Sacramento, Solano, Sutter, and Yolo.[6] An agency is allowed to adopt an ordinance controlling residential AWS if the applicable RWQCB makes a finding at a public hearing that the control of residential salinity input will contribute to the achievement of water quality objectives based on:

- A TMDL that addresses salinity-related pollutants in a water segment;
- A SNMP for a groundwater basin or subbasin;
- WDR, WRR, or master reclamation permit for a supplier or distributor of recycled water; or
- A cease and desist order directed to a local agency.

An adopted ordinance can among, many options, require the removal of previously-installed residential AWS and/or prospectively prohibit the installation of residential AWS. If the agency includes in its

6 See http://www.water.ca.gov/groundwater/bulletin118/gwbasin_maps_descriptions.cfm and http://www.water.ca.gov/groundwater/bulletin118/maps/statewide_basin_map_V3_subbas.pdf

ordinance removal or replacement of previously installed softeners, it must develop a program to compensate the owner for the "reasonable value" of the removed residential AWS.

If a regional wastewater management agency were to adopt an ordinance, it does not have legal authority to enter residences and enforce the ban. Consequently, each city or local government within the agency's regional service area would have to adopt its own ordinance to implement and enforce the prospective ban.

The SNMP analysis indicates that existing and planned management measures are adequate to manage S/N sources for the sustainable protection of groundwater quality. However, future updates to the SNMP may consider AWS control measures if water quality changes in the future.

Recycled Water

MM C12. Direct Potable Reuse – Direct potable reuse (DPR) represents a concept project that could potentially be undertaken by any of the water/recycled water providers in ULARA at some point in the future. As described in the 2015 Framework for Direct Potable Reuse (Watereuse, 2015), DPR may be divided into two forms. The first form utilizes advanced treated water produced in an advanced water treatment facility (including reverse osmosis) and introduces that water upstream of an existing drinking water treatment facility. The second form of DPR utilizes advanced treated water produced in an advanced water treatment facility (that is also permitted as a drinking water treatment facility) and introduces the water downstream of an existing drinking water treatment facility or within the distribution system.

Either form of DPR could become a project in ULARA in the future. DPR projects are expected to produce a stream of brine concentrate that would represent an export of TDS, nitrate, and chloride from ULARA. This would likely mean that TDS, nitrate, and chloride loadings and concentrations would decrease in groundwater as the result of DPR projects.

6 Changing Conditions

This section provides a discussion of changing conditions that could impact groundwater quality and the achievement of goals to reduce S/Ns in groundwater. These changing conditions include land use and population growth, climate change, drought, and greenhouse gas emissions.

6.1 Land Use and Population Growth

The ULARA groundwater basins are overlain primarily by highly developed areas, as shown in Table 6-1, in the Cities of Burbank, Glendale, Los Angeles, San Fernando, and unincorporated areas.

Table 6-1: Current Land Use

Land Use	Percent Area Overlying ULARA Basins
Residential	61%
Commercial and Services	12%
Open Space and Recreation	9%
Transportation, Communication, Utilities	7%
Industrial	7%
Vacant	2%
Agriculture	1%
Urban Vacant	1%
Water	<1%
Mixed Commercial and Industrial	<1%
Mixed Urban	<1%

Data Source: Los Angeles County

One way to look at future land use is to use the UWMP for LADWP. According to the LADWP 2010 UWMP, housing for single-family and multi-family units is projected to increase by 18.1% total between 2010 and 2035. Commercial employment is projected to increase by 11.4% between 2010 and 2035, while industrial employment is projected to decrease by 9.7% between 2010 and 2035. Though the LADWP service area extends outside of the ULARA watershed and its four groundwater basins, this growth is expected to be representative of growth within ULARA. Table 6-2 provides the demographic projections for the LADWP service area. This household and employment growth indicates that residential and commercial land use could increase while industrial land use may decrease, potentially replacing vacant and/or open space in the already highly developed area.

Table 6-2: LADWP Demographic Forecast

	2010	2015	2020	2025	2030	2035
Single-Family Households	627,395	646,067	665,261	678,956	691,703	701,101
Multi-Family Households	764,402	804,013	846,257	880,580	914,125	942,846
Total Households	**1,391,797**	**1,450,080**	**1,511,518**	**1,559,536**	**1,605,828**	**1,643,947**
Average Annual Household Increase		**0.8% per year**	**0.8% per year**	**0.6% per year**	**0.6% per year**	**0.5% per year**
Commercial Employment	1,674,032	1,724,106	1,754,998	1,790,798	1,828,765	1,865,156
Industrial Employment	163,382	157,652	155,012	152,426	150,009	147,508
Total Employment	**1,837,414**	**1,881,758**	**1,910,010**	**1,943,224**	**1,978,774**	**2,012,664**
Average Annual Employment Increase		**2.4% per year**	**1.5% per year**	**1.7% per year**	**1.8% per year**	**1.7% per year**

Data Source: LADWP 2010 UWMP

Another way to look at future land use is to use the Southern California Association of Governments' (SCAG) 2012 Adopted Growth Forecast. The SCAG Adopted Growth Forecast for the cities within the ULARA basin area, including the cities of Glendale, Burbank, Los Angeles, San Fernando, and unincorporated areas indicates that housing and employment are expected to increase in the future. Total housing units are projected to increase by 23% total between 2008 and 2035, and employment is projected to increase by 10.7% between 2008 and 2035. Though the City of Los Angeles extends outside of the ULARA watershed and its four groundwater basins, this growth is expected to be representative of growth in the ULARA. Table 6-3 provides the demographic projections for each city and their totals. This household and employment growth indicates that residential and commercial/industrial land use could be expected to increase, potentially replacing vacant and/or open space in the already highly developed area.

Table 6-3: ULARA Cities' Demographic Forecast

	2008	2020	2035
Households			
Burbank	41,900	46,000	47,000
Glendale	72,200	75,200	78,600
Los Angeles	1,309,900	1,455,700	1,626,600
San Fernando	5,900	6,200	6,600
Total Households	**1,429,900**	**1,583,100**	**1,758,800**
Average Annual Household Increase		**0.9% per year**	**0.7% per year**
Commercial Employment	1,735,200	1,817,700	1,906,800
Industrial Employment	93,600	98,200	103,000
	90,300	102,300	114,700
	15,000	15,300	15,900
Total Employment	**1,934,100**	**2,033,500**	**2,140,400**
Employment Increase		**0.4% per year**	**0.4% per year**

Data Source: SCAG 2012 Adopted Growth Forecast

Although the population in the ULARA is predicted to increase, total use of potable supplies is projected to remain near 2015 levels through the end of the 2025 SNMP future planning period due to conservation. During this period, use of groundwater is expected to increase significantly, with increased recharge of recycled water and stormwater, and with numerous remediation projects making more groundwater available for use. These measures will allow more pumping in ULARA and will allow the region to decrease use of imported water.

6.2 Climate Change

The effects of climate change in California present many water supply challenges and unknowns. The sustainability of water supply sources will likely be impacted by warmer winter storms, reduced precipitation, winter snowpack, and surface water flows, significant dips in groundwater levels, more intense winter and spring runoff (due to precipitation occurring as rain instead of snow), and more extreme hydrologic variability between drier drought periods and wetter winter periods. Rainfall patterns locally are also likely to change with heavier rainfall periods (but reduced events) that potentially could overwhelm the flood control system, leading to less conserved stormwater, more property damage, and greater maintenance and operational demands (USBR, LACFCD, and LACDPW, 2013).

Partially in recognition of the water supply implications of greenhouse gas emissions, climate change, drought, and uncertainties and increasing costs associated with imported water supplies, the ULARA stakeholders have been planning and implementing projects to maximize the implementation of recycled water, stormwater, and conservation projects. Thus, consideration of climate change was a key factor in the development of projects and implementation measures to reduce reliance on expensive, energy-intensive (due to pumping, distribution, and other costs), and increasingly unreliable imported water supplies by replacing these supplies with drought-proof, reliable, safe, and sustainable recycled water for end uses. Various measures and studies to increase stormwater capture have also been implemented and planned, including LID projects. It is anticipated that projects and programs associated with the MS4 Permit will also result in increased stormwater capture.

As recognized in the DWR California Water Plan Update 2013 (DWR, 2013), conservation is a fundamental component of the South Coast region's water management planning. The South Coast Region includes all of Orange County and portions of Ventura, Los Angeles (including the ULARA), San Bernardino, Riverside, and San Diego counties. Water agencies in the South Coast have been aggressively implementing water conservation since the 1990s. The GLAC IRWMP has been developed to define a clear vision and direction for the sustainable management of water resources in the GLAC Region for the next 20 years.

The Water Conservation Act of 2009 (Senate Bill [SB] x7-7) requires each urban retail agency to establish in its UWMP a reduction goal to help California achieve a 20% statewide reduction in daily per capita water use by 2020. The UWMPs indicate the South Coast Hydrologic Region had a population-weighted baseline average water use of 188 gallons per capita per day with an average population-weighted 2020 target of 159 gallons per capita per day. In addition, although the population in the ULARA is predicted to increase, conservation programs are helping to maintain the total use of potable supplies near 2015 levels through the end of the 2025 SNMP future planning period.

6.3 Drought

Historically, California has experienced frequent periods of prolonged drought. Based on scientific projections, drought is expected to occur more frequently and for longer intervals due to climate change. While the current winter (Water Year 2015/2016) may experience higher than normal precipitation associated with the predicted El Niño conditions, experts say it is unlikely to erase impacts of California's four-year drought (2012 to 2015) (http://www.acwa.com/sites/default/files/news/water-supply-challenges/2015/11/acwa-el-nino-and-ca-drought-infographic.pdf). The recent drought has resulted in observations of new, record-high temperatures and record low snowpack for California. Five of the lowest 10 snowpacks on record have occurred in the last decade, including the past four years (2012 to 2015). The seasonal snowpack is a key element to California's water resources management, modulating (http://ca.gov/drought/topstory/top-story-45.html).

The current drought, as a result of the lack of precipitation, has impacted the following areas, which has affected imported water and groundwater supplies in the ULARA:

- Sierra Nevada Mountains which feed the Owens River, the Los Angeles Aqueduct, Northern California, the Sacramento-San Joaquin River Delta, and the California Aqueduct; and
- Western United States and the Rocky Mountains which feed the Colorado River.

Due to seriously diminished water supplies in the State, on January 17, 2014, Governor Jerry Brown declared a State of Emergency (Proclamation No. 1-17-2014, http://www.gov.ca.gov/news.php?id=18368). As part of his proclamation, the Governor directed State officials to take all necessary actions to prepare for drought conditions. On April 25, 2014, Governor Brown issued an Executive Order (Proclamation No. 4-25-2014, http://gov.ca.gov/news.php?id=18496) declaring a continued state of emergency due to severe drought conditions, with an emphasis on statewide conservation and included directives to strengthen the State's ability to manage water effectively under drought conditions. Directive No. 10 in the Executive Order states, "The Water Board [SWRCB] will adopt statewide general waste discharge requirements to facilitate the use of treated wastewater that meets standards set by the Department of Public Health, in order to reduce demand on potable water supplies." (Office of California Governor Edmund G. Brown, Jr., 2014b).

In direct response to the Governor's April 2014 Executive Order, the SWRCB adopted General Waste Discharge Requirements for Recycled Water Use (General Order No. WQ 2014-0090- DWQ; http://www.waterboards.ca.gov/board_decisions/adopted_orders/water_quality/2014/wqo2014_0090_dwq_revised.pdf) on June 3, 2014 to streamline permitting for recycled water use (i.e., relieve producers, distributors, and users of recycled water from the lengthy permit approval process) throughout the State. This General Order is intended to increase local water supplies by promoting the non-potable use of recycled water in communities grappling with drought conditions. Additionally, the General Order is consistent with the Recycled Water Policy that was adopted by the SWRCB in 2009 and amended in 2013, which required the development of SNMPs for all groundwater basins in California. Thus, all uses of recycled water allowed by the General Order must be consistent with the SNMPs that will be approved by the Regional Water Quality Control Boards. Importantly, the General Order did not modify existing permitted recycled water quality limits established for irrigation. If this was the case, this would have significantly limited the sustainable and cost effective use of recycled water to offset demand for raw and potable water supplies in the ULARA.

The ULARA stakeholders have proposed recycled water projects for implementation in the basins. Since some of the proposed recycled water projects in the ULARA actually reduce S/N loading or improve groundwater quality, they were also identified as implementation measures. Thus, the proposed recycled water projects and implementation measures developed by the ULARA stakeholders directly address the impacts of drought, while improving or maintaining high-quality groundwater in the basins.

Recognizing the implications of changing climatic conditions, ULARA stakeholders have developed a number of plans and programs to reduce reliance on imported water by increasing use of stormwater and recycled water.

6.4 Greenhouse Gas Emissions

Greenhouse gases, measured and evaluated in terms of carbon dioxide, are generated from the combustion of carbon-based fuels, principally wood, coal, oil, and natural gas. Greenhouse gas emissions are known to cause climate change at various scales, including local and regional. The amount of energy associated with various water sources depends on many factors, including the quality of the source water, the energy required for water treatment, the efficiency of conveyance and distribution systems, and the distance to approved end uses. In the ULARA, recycled water and groundwater require significantly less distance for transport to approved end uses compared with imported supplies, and thus results in substantial overall energy savings, mainly due to delivery.

From an energy standpoint, greater reliance on water conservation, recycled water, and stormwater provides significant energy benefits compared with imported water. These energy benefits provide significant reductions in greenhouse gas emissions in direct relation to their energy savings.

The ULARA stakeholders have recognized the importance of reducing greenhouse gas emissions. Water conservation programs are currently in place (thus, conservation was identified as an implementation measure), which not only conserve energy but may also result in reduced S/N loading, thus improving groundwater quality. To further meet the goals of the Recycled Water Policy and the Governor's drought proclamation, multiple projects have been proposed by the ULARA stakeholders to increase the use of recycled water (replacing and supplementing more energy-intensive imported water supplies). The use of recycled water in the ULARA has been proven to be an energy-efficient, safe, and reliable resource and has played a vital role in increasing the sustainability of the overall water supply. Impacts to air quality, including greenhouse gas emissions, will be evaluated as part of the CEQA process for the individual projects in the basins and was also assessed for the program alternatives presented in the Substitute Environmental Document.

7 Management Measure Challenges

The purpose of this section is to acknowledge the possible technical, institutional, economic, and regulatory challenges that could impact achievement of recycled water, stormwater, and imported water goals, objectives, and projects, as well as management measures to reduce S/Ns in groundwater. Accordingly, the implementation plan that will be adopted by the LARWQCB needs to provide flexibility in the event that the implementation schedules for key projects and management measures need to be adjusted to accommodate these challenges. Examples of challenges include the following:

Technical Challenges

- Treatment costs
- Space for treatment facilities
- Space for infrastructure
- Recycled water availability
- Imported water availability
- Stormwater availability
- Spreading grounds capacities

Regulatory Challenges

- California SWRCB DDW requirements
- LARWQCB requirements
- SWRCB requirements
- United States Environmental Protection Agency requirements
- California Water Code Section 1211 for changes in point or volume of wastewater discharge

Institutional Challenges

- Public acceptance
- Working relationships between water agencies, flood control agencies, groundwater agencies, wastewater management agencies, and municipalities
- Recycled water pricing

Economic Challenges

- Cost of recycled water treatment, conveyance, and brine disposal
- Availability of funding

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