Attachment A to Resolution No. R12-010
Los Angeles River Nitrogen Compounds and Related Effects TMDL

This TMDL was adopted as Resolution No. R03-009 by:
The Regional Water Quality Control Board on July 10, 2003.

This TMDL was approved by:

The State Water Resources Control Board on November 19, 2003.
The Office of Administrative Law on February 27, 2004.
The U.S. Environmental Protection Agency on March 18, 2004.

This TMDL was amended and adopted as Resolution No. R03-016 by:
The Regional Water Quality Control Board on December 4, 2003.

This amended TMDL was approved by:
The State Water Resources Control Board on March 24, 2004.
The Office of Administrative Law on September 27, 2004.
[U.S. Environmental Protection Agency approval not required for amendment to Implementation Plan].

This TMDL was amended and adopted as Resolution No. R12-010 by:
The Regional Water Quality Control Board on December 6, 2012.

This amended TMDL was approved by:
The State Water Resources Control Board on June 4, 2013.
The Office of Administrative Law on June 9, 2014.
The U.S. Environmental Protection Agency on August 7, 2014.

The effective date of this TMDL is: August 7, 2014.

Table 7-8.1. LOS ANGELES RIVER NITROGEN COMPOUNDS AND RELATED EFFECTS TMDL: Elements

Element	Los Angeles River Nitrogen Compounds and Related Effects TMDL
Problem Statement	Reaches of the Los Angeles River and its tributaries were listed as impaired for nitrogen compounds (ammonia, nitrate, and nitrate) and related effects such as algae, pH, odor, and scum on the 2002 303(d) list. These reaches were listed because numeric and narrative water quality objectives for nitrogen compounds and related effects were exceeded, thereby impairing warm, freshwater, and wildlife habitats, and recreation beneficial uses.

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Numeric Target *(Interpretation of the numeric water quality objective, used to calculate the load allocations)*	Numeric targets for this TMDL are listed as follows: a) Total ammonia as nitrogen (NH_3-N) Numeric targets are dependent on the temperature and pH of receiving waters as well as the presence of early life stages (ELS) of fish. One-hour average numeric targets are based on the last three years of temperature and pH data for receiving waters correspondent to major discharge points. Thirty-day average numeric targets are equations that incorporate site-specific water effects ratios (WERs). ***Receiving water correspondent to major discharge point*** ***One-hour average*** Los Angeles River Reach 5 (within Sepulveda Basin) and Reach 4 (Riverside Dr. to Sepulveda Dam)- Donald C. Tillman WRP 4.7 mg/L Los Angeles River Reach 3 (Riverside Dr. to Figueroa St.) - Los Angeles/ Glendale WRP 8.7 mg/L Burbank Western Channel - Burbank WRP 10.1 mg/L ***Receiving water correspondent to major discharge point*** ***Thirty-day average*** Los Angeles River Reach 5 (within Sepulveda Basin) - Donald C. Tillman WRP ELS Present (from April 1 – September 30) $CCC = \left(\frac{0.0676}{1+10^{7.688-pH}} + \frac{2.912}{1+10^{pH-7.688}} \right) * 0.854 * MIN(2.85, 2.85 * 10^{0.028*(25-T)})$ ELS Absent (from October 1 – March 31) $CCC = \left(\frac{0.0676}{1+10^{7.688-pH}} + \frac{2.912}{1+10^{pH-7.688}} \right) * 0.854 * 2.85 * 10^{0.028*(25-Max(T,7))}$ Los Angeles River Reach 4 (Sepulveda Dam to Riverside Dr.) - Donald C. Tillman WRP ELS Absent (year round) $CCC = \left(\frac{0.0676}{1+10^{7.688-pH}} + \frac{2.912}{1+10^{pH-7.688}} \right) * 0.854 * 2.85 * 10^{0.028*(25-Max(T,7))}$ Los Angeles River Reach 3 (Riverside Dr. to Figueroa St.) - Los Angeles/ Glendale WRP ELS Present (from April 1 – September 30) $CCC = \left(\frac{0.0676}{1+10^{7.688-pH}} + \frac{2.912}{1+10^{pH-7.688}} \right) * 0.854 * MIN(2.85, 2.85 * 10^{0.028*(25-T)})$ ELS Absent (from October 1 – March 31)

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	$$CCC = \left(\frac{0.0676}{1 + 10^{7.688 - pH}} + \frac{2.912}{1 + 10^{pH - 7.688}} \right) * 0.854 * 2.85 * 10^{0.028*(25 - Max(T,7))}$$ Burbank Western Channel - Burbank WRP ELS Absent (year round) $$CCC = \left(\frac{0.0676}{1 + 10^{7.688 - pH}} + \frac{2.912}{1 + 10^{pH - 7.688}} \right) * 0.92 * 2.03 * 10^{0.028*(25 - Max(T,7))}$$ In addition, the highest four-day average within the 30-day period shall not exceed 2.5 times the 30-day average numeric target. b) Nitrate-nitrogen and nitrite-nitrogen ***Constituent*** ***Thirty-day average*** ***All reaches and tributaries*** Nitrate-nitrogen (NO_3-N) 8 mg/L Nitrite-nitrogen (NO_2-N) 1 mg/L Nitrate-nitrogen plus nitrite-nitrogen (NO_3-N + NO_2-N) 8 mg/L Numeric targets to address narrative objectives required to protect warm freshwater and wildlife habitats are intended to implement the narrative objectives and may be revised based on the results of monitoring and studies conducted pursuant to the implementation plan.
Source Analysis	The principal source of nitrogen compounds to the Los Angeles River is discharges from the Donald C. Tillman Water Reclamation Plant (WRP), the Los Angeles-Glendale WRP, and the Burbank WRP. During dry weather period, the major POTWs contribute 84.1% of the total dry weather nitrogen load. Urban runoff, stormwater, and groundwater discharge may also contribute nitrate loads. Further evaluation of these sources is set forth in the Implementation Plan.
Linkage Analysis	Linkage between nutrient sources and the instream water quality was established through hydrodynamic and water quality models. The Environmental Fluid Dynamics Code 1-D was used to model the hydrodynamic characteristics of the Los Angeles River and the Water Quality Analysis Simulation Program was used to model water quality. Additional studies were conducted to develop the residence time and determine the nutrient uptake rates by algae.
Wasteload Allocations (for	1. Major point sources:

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point sources)	a) Total ammonia as nitrogen (NH_3-N):* ***POTW*** ***One-hour average WLA*** Donald C. Tillman WRP 4.2 mg/L Los Angeles-Glendale WRP 7.8 mg/L Burbank WRP 9.1 mg/L ***POTW*** ***Thirty-day average WLA*** Donald C. Tillman WRP ELS Absent (year round) $CCC = 0.90 * \left(\frac{0.0676}{1+10^{7.688-pH}} + \frac{2.912}{1+10^{pH-7.688}} \right) * 0.854 * 2.85 * 10^{0.028*(25-Max(T,7))}$ Los Angeles-Glendale WRP ELS Present (from April 1 – September 30) $CCC = 0.90 * \left(\frac{0.0676}{1+10^{7.688-pH}} + \frac{2.912}{1+10^{pH-7.688}} \right) * 0.854 * MIN(2.85, 2.85 * 10^{0.028*(25-T)})$ ELS Absent (from October 1 – March 31) $CCC = 0.90 * \left(\frac{0.0676}{1+10^{7.688-pH}} + \frac{2.912}{1+10^{pH-7.688}} \right) * 0.854 * 2.85 * 10^{0.028*(25-Max(T,7))}$ Burbank WRP ELS Absent (year round) $CCC = 0.90 * \left(\frac{0.0676}{1+10^{7.688-pH}} + \frac{2.912}{1+10^{pH-7.688}} \right) * 0.92 * 2.03 * 10^{0.028*(25-Max(T,7))}$ In addition, the highest four-day average within the 30-day period shall not exceed 2.5 times the 30-day average wasteload allocation. * It would be consistent with the findings and assumptions of this TMDL to calculate total ammonia WLAs based on temperature and pH data from the most recent three years of monitoring data when incorporating WLAs into permits. In applying this approach, 90th percentile pH data shall be used to establish one-hour average WLAs and the 50th percentile of pH and temperature data shall be used to establish 30-day average WLAs. The procedure for translation of objectives into effluent limitations specified in Chapter 3 of this Basin Plan, as amended by Resolution R02-011 and R04-022, shall be used to translate WLAs into permit effluent limitations. Regardless of the SSO and SSO-derived WLAs, for discharges regulated under this TMDL with concentrations below site-specific water quality objectives, effluent

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	limitations shall ensure effluent concentrations do not exceed the level of water quality that can be reliably maintained by the facility's applicable treatment technologies existing at the time of permit issuance, reissuance, or modification unless anti-backsliding requirements in Clean Water Act section 402(o) and anti-degradation requirements are met. When developing effluent limitations in these circumstances, consideration shall include, but is not limited to, existing and projected facility flows for the permit term and the corresponding effect on the facility's capability to reduce ammonia concentrations and, where chlorine disinfection is used, the addition of ammonia during the treatment process to control the formation of trihalomethanes (THMs), if relied upon by the facility. It is not the intent for these performance based limits to have the effect of de-rating Water Reclamation Plants that are operating below their permitted design capacities. Regional Water Board staff may consider recommendations from a Regional Water Board-led workgroup that will be charged with evaluating alternative methodologies for calculating effluent limitations for discharges with concentrations below site-specific water quality objectives. Permit compliance with anti-degradation and anti-backsliding requirements shall be documented in permit fact sheets. b) Nitrate-nitrogen (NO_3-N), nitrite-nitrogen (NO_2-N), and Nitrate-nitrogen plus nitrite-nitrogen (NO_3-N + NO_2-N): ***Constituent*** ***Thirty-day average WLA**** NO_3-N 7.2 mg/L NO_2-N 0.9 mg/L NO_3-N + NO_2-N 7.2 mg/L *Receiving water monitoring is required on a weekly basis to ensure compliance with the water quality objective. 2. <u>Minor point sources</u>: Waste loads are allocated to minor point sources enrolled under NPDES or WDR permits including but not limited to Tapia WRP, Whittier Narrows WRP, Los Angeles Zoo WRP, industrial and construction stormwater, and municipal storm water and urban runoff from municipal separate storm sewer systems (MS4s): a) Ammonia wasteload allocations (WLAs) for minor point sources are listed below by receiving waters:* ***Water Body*** ***One-hour average WLA*** Los Angeles River above Los Angeles-Glendale WRP (LAG) 4.7 mg/L

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Los Angeles River below LAG
8.7 mg/L

Los AngelesTributaries
10.1 mg/L

Water Body
Thirty-day average WLA

Los Angeles River Reach 6 (above Balboa Blvd.)
1.6 mg/L

Los Angeles River Reach 5 (within Sepulveda Basin)
ELS Present (from April 1 – September 30

$$CCC = \left(\frac{0.0676}{1+10^{7.688-pH}} + \frac{2.912}{1+10^{pH-7.688}} \right) * 0.854 * MIN(2.85, 2.85 * 10^{0.028*(25-T)})$$

ELS Absent (from October 1 – March 31)

$$CCC = \left(\frac{0.0676}{1+10^{7.688-pH}} + \frac{2.912}{1+10^{pH-7.688}} \right) * 0.854 * 2.85 * 10^{0.028*(25-Max(T,7))}$$

Los Angeles River Reach 4 (Sepulveda Dam To Riverside Dr.)
ELS Absent (year round)

$$CCC = \left(\frac{0.0676}{1+10^{7.688-pH}} + \frac{2.912}{1+10^{pH-7.688}} \right) * 0.854 * 2.85 * 10^{0.028*(25-Max(T,7))}$$

Los Angeles River Reach 3 (Riverside Dr. To Figueroa St.)
ELS Present (from April 1 – September 30)

$$CCC = \left(\frac{0.0676}{1+10^{7.688-pH}} + \frac{2.912}{1+10^{pH-7.688}} \right) * 0.854 * MIN(2.85, 2.85 * 10^{0.028*(25-T)})$$

ELS Absent (from October 1 – March 31)

$$CCC = \left(\frac{0.0676}{1+10^{7.688-pH}} + \frac{2.912}{1+10^{pH-7.688}} \right) * 0.854 * 2.85 * 10^{0.028*(25-Max(T,7))}$$

Los Angeles River Reach 2
2.4 mg/L

Los Angeles River Reach 1
2.4 mg/L

Los Angeles River Tributaries
2.3 mg/L (excluding Whittier Narrows)

Whittier Narrows Thirty-Dave Average WLA
ELS Present (from April 1 – September 30)

$$CCC = \left(\frac{0.0676}{1+10^{7.688-pH}} + \frac{2.912}{1+10^{pH-7.688}} \right) * 0.854 * MIN(2.85, 3.04 * 10^{0.028*(25-T)})$$

ELS Absent (from October 1 – March 31)

$$CCC = \left(\frac{0.0676}{1+10^{7.688-pH}} + \frac{2.912}{1+10^{pH-7.688}} \right) * 0.854 * 3.04 * 10^{0.028*(25-Max(T,7))}$$

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	In addition, the highest four-day average within the 30-day period shall not exceed 2.5 times the 30-day average wasteload allocation. * It would be consistent with the findings and assumptions of this TMDL to calculate total ammonia WLAs based on temperature and pH data from the most recent three years of monitoring data when incorporating WLAs into permits. In applying this approach, 90th percentile pH data shall be used to establish one-hour average WLAs and the 50th percentile of pH and temperature data shall be used to establish 30-day average WLAs. The procedure for translation of objectives into effluent limits specified in Chapter 3 of this Basin Plan, as amended by Resolution R02-011 and R04-022, shall be used to translate WLAs into effluent limitations. Regardless of the SSO and SSO-derived WLAs, for discharges regulated under this TMDL with concentrations below site-specific water quality objectives, effluent limitations shall ensure effluent concentrations do not exceed the level of water quality that can be reliably maintained by the facility's applicable treatment technologies existing at the time of permit issuance, reissuance, or modification unless anti-backsliding requirements in Clean Water Act section 402(o) and anti-degradation requirements are met. When developing effluent limitations in these circumstances, consideration shall include, but is not limited to, existing and projected facility flows for the permit term and the corresponding effect on the facility's capability to reduce ammonia concentrations and, where chlorine disinfection is used, the addition of ammonia during the treatment process to control the formation of trihalomethanes (THMs), if relied upon by the facility. It is not the intent for these performance based limits to have the effect of de-rating Water Reclamation Plants that are operating below their permitted design capacities. Regional Water Board staff may consider recommendations from a Regional Water Board-led workgroup that will be charged with evaluating alternative methodologies for calculating effluent limitations for discharges with concentrations below site-specific water quality objectives. Permit compliance with anti-degradation and anti-backsliding requirements shall be documented in permit fact sheets. b) WLAs for nitrate-nitrogen, nitrite-nitrogen, and nitrate-nitrogen plus nitrite-nitrogen for minor discharges are listed below: ***Constituent*** ***Thirty-day average WLA*** NO_3-N 8.0 mg/L NO_2-N 1.0 mg/L NO_3-N + NO_2-N 8.0 mg/L
Load Allocation *(for nonpoint sources)*	The Source Assessment indicates that nitrogen loads from nonpoint sources are negligible compared to loading from point sources and their contribution is adequately accounted for in the margin of safety. Consequently, load allocations will not be developed unless it is determined they are necessary after load reductions are effected through implementation of the wasteload allocations. Additional monitoring is included in the implementation plan to verify the nitrogen nonpoint source contributions.
Implementation	1. Refer to Table 7-8.2

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	2. The Implementation Plan includes upgrades to the WRPs discharging to Los Angeles River for removal of ammonia, nitrate, and nitrite. At the discretion of the Regional Board, the following interim limits for ammonia, and nitrate plus nitrite will be allowed for major point sources for a period not to exceed 3.5 years from the effective date of this TMDL. Effluent limits for the individual compounds NO_3-N, and NO_2-N are not required during the interim period. ***Interim Limits for NH_3-N*** ***Total ammonia as Nitrogen*** ***POTW*** ***Daily Maximum**** ***Monthly Average**** Donald C. Tillman WRP 21.7 mg/L 21.0 mg/L Los Angeles-Glendale WRP 19.4 mg/L 16.5 mg/L Burbank WRP 24.1 mg/L 22.7 mg/L *The monthly average and daily maximum interim limits are based on the 95th and 99th percentiles of effluent performance data reported by dischargers. ***Nitrite-nitrogen + Nitrate-nitrogen*** ***Monthly Average*** 8.0 mg/L The Implementation Plan also includes additional studies to evaluate the effectiveness of nitrogen reductions on related effects such as algae growth, odors and scum. Ammonia and nitrate reductions will be regulated through effluent limits prescribed in NPDES permits.
Margin of Safety	An explicit margin of safety of 10% of the ammonia, nitrate, nitrite and nitrate + nitrite loads is allocated to address uncertainty in the sources and linkage analyses. In addition, an implicit margin of safety is incorporated through conservative model assumptions and statistical analysis.
Seasonal Variations and Critical Conditions	The critical condition identified for this TMDL is based on low flow condition. The driest six months of the year are the most critical condition for nutrients because less surface flow is available to dilute effluent discharge.

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Monitoring	Tillman, LA-Glendale, Burbank, and Whittier Narrows POTWs must conduct confirmatory receiving water monitoring to verify that water quality conditions are similar to those of the 2003 ammonia WER study period. Confirmatory monitoring will include concurrent chemistry* and toxicity receiving water monitoring. Confirmatory monitoring will be supplemental to three species toxicity testing required in the NPDES permits and must utilize *Hyallela azteca* as the test organism. Temperature, pH, and ammonia receiving water data will be collected at the time and location of collection of the toxicity samples. Monitoring of chemistry and toxicity testing should include a minimum of three sample events per year for three years. Monitoring sites should be representative of those investigated in the Los Angeles River during the SSO study, as well as one location in the reach immediately downstream of where the SSO is applied. Two of the three sample events should be conducted during dry weather. Following the first three-year monitoring cycle, if there is no increase in toxicity attributable to ammonia, monitoring may be reduced to once every year at each site, as appropriate. The number and type of events during the year should be as described above. If confirmatory monitoring indicates toxicity due to ammonia or a change in the waterbody that could impact the calculation or application of the SSOs, including either its chemical characteristics or the aquatic species present, including early life stages of fish, the POTW shall develop and submit a plan for reevaluating the SSOs to the Executive Officer. *Chemistry monitoring to include all nitrogen species, including total ammonia, as well as pH, hardness, temperature, sodium, potassium, calcium, BOD, sulfate, total dissolved solids, and chloride. In the event that ammonia concentrations at Tillman, LA-Glendale, Burbank, or Whittier Narrows POTW are consistently at levels below effluent limitations that would be set without use of the SSO, monitoring to confirm the SSOs is not necessary.

Table 7-8.2. IMPLEMENTATION SCHEDULE **Implementation Tasks**	**Completion Date**
1. Apply interim limits for NH_3-N and NO_3-N + NO_2-N to major Publicly Owned Treatment Works (POTWs). 2. Apply Waste Load Allocations (WLAs) to minor point source dischargers and MS4 permittees. 3. Begin to include monitoring for nitrogen compounds in NPDES permits for minor NPDES dischargers above 0.1 mgd as permits are renewed.	March 23, 2004
4. Submittal of a Monitoring Work Plan by MS4 permittees to estimate nitrogen loadings associated with runoff loads from the storm drain system for approval by the Executive Officer of the Regional Board. The Work Plan will include monitoring for ammonia, nitrate, and nitrite. The Work Plan may include a phased approach wherein the first phase is based on monitoring from the existing mass emission station in the Los Angeles River. The results will be used to calibrate the linkage analysis. The Work Plan will also contain protocol and a schedule for implementing additional monitoring if necessary. The Work Plan will also propose triggers for conducting source identification and implementing BMPs, if necessary. Source identification and BMPs will be in accordance with the requirements of MS4 permits.	March 23, 2005
5. Submittal of a Workplan by major NPDES permittees to evaluate the effectiveness of nitrogen reductions on removing impairments from algae odors, scums, and pH for approval by the Executive Officer of the Regional Board. The monitoring program will include instream monitoring of algae, foam, scum, pH, and odors in the Los Angeles River. In addition, groundwater discharge to Los Angeles River will also be analyzed for nutrients to determine the magnitude of these loadings and the need for load allocations. The Workplan will include protocol and schedule for refining numeric targets for nitrogen compounds and related effects such as excessive algae in the Los Angeles River. The Workplan will also contain protocol and a schedule for identification of limiting nutrients.	March 23, 2005
6. Submission of a special studies Workplan by the City of Los Angeles to evaluate site-specific objectives for ammonia, nitrate, and nitrite, including the following issues: pH and temperature distribution downstream of the D.C. Tillman WRP to determine the point of compliance for ammonia, establishment of ammonia WLAs based on seasonality.	March 23, 2005
2. Submission of all results from Task 6, and results from water effects ratio study for ammonia which has been performed by the City of Los Angeles.	No later than September 23, 2006

Table 7-8.2. IMPLEMENTATION SCHEDULE **Implementation Tasks**	**Completion Date**
8. Regional Board considers site-specific objectives for ammonia, nitrate, nitrite and nitrite + nitrate and revision of wasteload allocations based on results from Tasks 6 and 7. The Regional Board will consider factors such as seasonal variation, averaging periods, and water effects ratios when determining whether it is appropriate to adopt site-specific objectives for ammonia. If a site specific objective is adopted by the Regional Board, and approved by relevant approving agencies, this TMDL will need to be revised, readopted, and reapproved to reflect the revised water quality objectives.	No later than September 23, 2007
9. Interim limits for ammonia and nitrate + nitrite expire and WLAs for ammonia, nitrate, nitrite, and nitrate + nitrite apply to major point sources.	September 23, 2007
10. Complete evaluation of monitoring for nutrient effects and determine need for revising wasteload allocations, including but not limited to establishing new WLAs for other nutrient and related effects such as algal growth	March 23, 2008
11. Regional Board considers results of Tasks 5 and 10 and revises or establishes WLAs as appropriate.	March 23, 2009