



Water Quality Progress Report

Stockton Deep Water Ship Channel – Dissolved Oxygen

(Approved 2007)

WATER QUALITY STATUS

- TMDL targets achieved
- Conditions improving
- Improvement needed
- Data inconclusive

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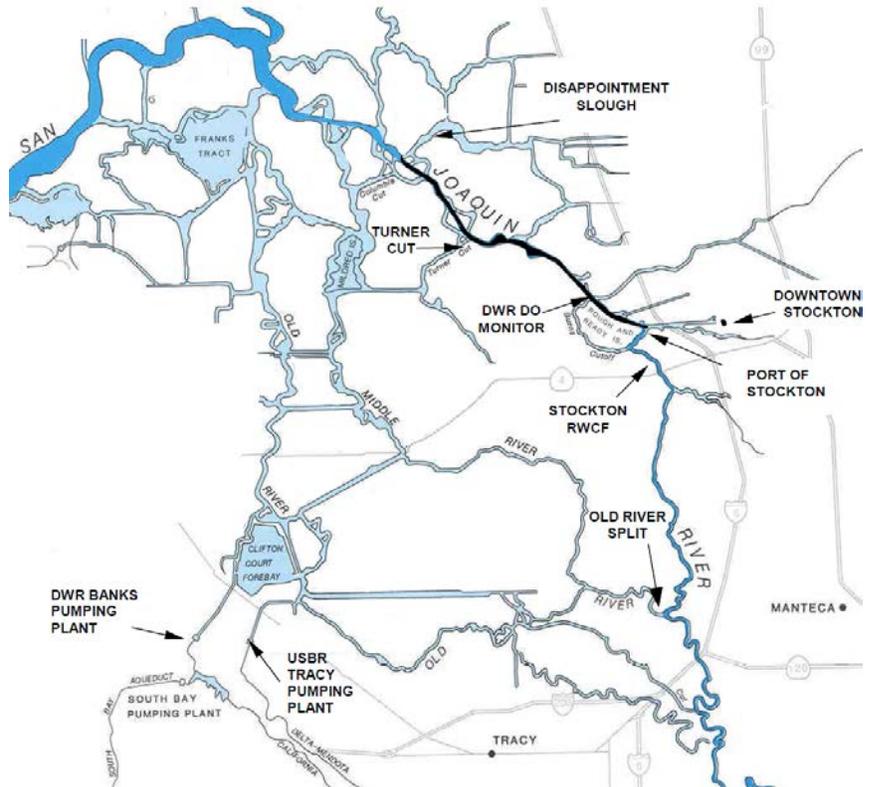
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Total Maximum Daily Load (TMDL) Summary

Waterbody – Stockton Deep Water Ship Channel (DWSC) portion of the San Joaquin River (SJR). The source area for oxygen demanding substances includes portions of the SJR watershed that drain downstream of Friant Dam and upstream of the confluence of the SJR and Disappointment Slough (see map below). This segment of the SJR is also influenced by the tide.



Stockton Deep Water Ship Channel (black segment) and Surrounding Area

Water Quality Goals

Dissolved Oxygen to exceed 5.0 milligrams per liter (mg/L) at all times on the San Joaquin River within the Delta and to exceed 6.0 mg/L between Turner Cut and Stockton from September 1 through November 30 to protect aquatic life beneficial uses.

Targeted Attainment Date –Compliance with waste load allocations and load allocations for oxygen demanding substances and their precursors, and development of alternate measures to address non-load related factors is required by **December 31, 2011**.

Water Quality Impairment – Dissolved oxygen in the water column is needed by fish, aquatic insects, and plankton for respiration. Low dissolved oxygen levels are unhealthy for aquatic life – they can stress or kill aquatic species and can block migrating salmon. Oxygen levels can be depleted by decaying aquatic plants, chemical reactions, reduced flow through the channel, and channel depth. Temperature and salinity also affect dissolved oxygen content. Low dissolved oxygen is most likely to

occur from June to October (when temperatures are higher) and conditions are worse during drier years (when flow through the system is reduced).

Native and migratory fish suffer from low levels of dissolved oxygen in the Stockton DWSC. In 1998, this segment of the SJR was added to the California List of Impaired Waterbodies for frequent low dissolved oxygen measurements (particularly during the 1990s) at a monitoring station on the north end Rough & Ready Island.

Pollutant Sources – There are three main factors contributing to this dissolved oxygen impairment:

- **Pollution Loading:** Water carrying nutrients such as nitrogen and phosphorus and other organic material enters the DWSC from precipitation runoff, storm water pipes, and industrial and wastewater treatment pipes. Organic material in the DWSC drives bacterial reactions, which consume oxygen and support growth of aquatic plants. These plants eventually decay and consume available oxygen in the water column. Some chemicals that enter the DWSC also consume oxygen when they react in the water column. These processes that consume oxygen contribute to low dissolved oxygen concentrations.
- **Channel Geometry:** Channel geometry (depth and width) of the DWSC reduces velocity of water moving through the channel, which increases the amount of time that water stays in the DWSC. Increasing residence time of water in the channel increases biological oxygen demand and depletes dissolved oxygen levels.
- **Flow:** Low SJR flow through the DWSC increases residence time and biological oxygen demand and decreases dissolved oxygen levels.

Loading Capacity and Allocations – The loading capacity is the maximum amount of a contaminant or stressor that can be assimilated by the waterbody without exceeding the TMDL numeric targets (equal to the water quality objectives for this TMDL). When dissolved oxygen concentrations are below the water quality objectives, the loading capacity for oxygen demand in the water column has been exceeded. Net oxygen demand is defined as the sum of all chemical, biological, and physical mechanisms that add or remove dissolved oxygen from the water column. The net oxygen demand over and above the loading capacity is the excess net oxygen demand (ENOD).

The TMDL assigns responsibility for reducing ENOD to the parties collectively responsible for *sources* of oxygen-demanding substances (pollution loading) as well as those responsible for the DWSC geometry and reduced flow from the SJR. All of these responsible parties will need to coordinate to implement control measures that eliminate ENOD in the DWSC. The ENOD reductions for *sources* of oxygen-demanding substances are defined as:

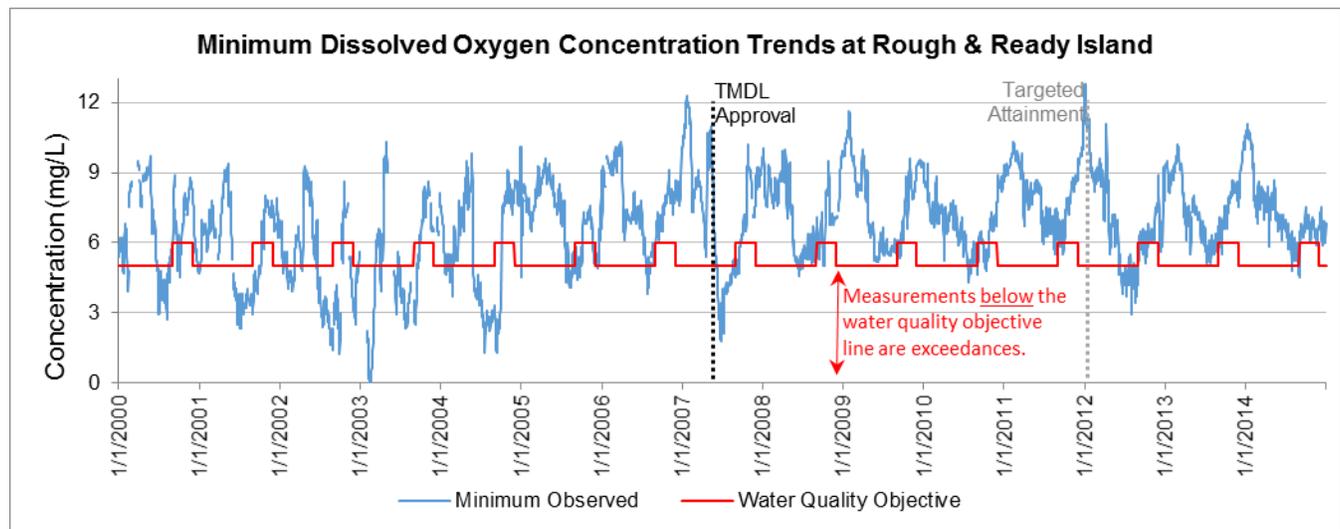
- Thirty percent is allocated as a waste load allocation to the City of Stockton Regional Wastewater Control Facility (RWCF).
- Sixty percent is allocated as a load allocation to nonpoint sources of algae and its precursors upstream of the DWSC. Nonpoint sources include discharges from irrigated lands.
- Ten percent is allocated as a reserve for unknown sources and impacts, and known or new sources that have no reasonable potential to impact, including waste load allocations for point sources set at their corresponding effluent limitations applicable on January 28, 2005.

The TMDL includes a phased approach to allow more time to gather additional information on sources and linkages to the dissolved oxygen impairment, while continuing to make improvements to dissolved oxygen conditions. Phase I of the TMDL required water quality studies to be completed and alternate means developed to address the impairment. These studies were focused on understanding specific sources of oxygen demanding substances and their precursors to further refine wasteload and load allocations. Phase I studies were completed in December 2013, and a full-scale fully operational aeration facility was constructed and demonstrated in the Stockton DWSC as an alternate means to address the impairment. Phase II of the TMDL requires the review of allocations and implementation provisions based on the results of the studies and dissolved oxygen conditions in the DWSC. In November 2014, Central Valley Regional Water Quality Control Board (Water Board) staff

developed a draft report with recommendations for future actions to address the dissolved oxygen impairment. This report recommended continued implementation of the current TMDL without modifications to the allocations. Resolution R5-2015-0008 was adopted by the Water Board in February 2015 and approves the continuation of the Control Program for the Dissolved Oxygen Impairment in the Stockton Deep Water Ship Channel.

Is Water Quality Improving?

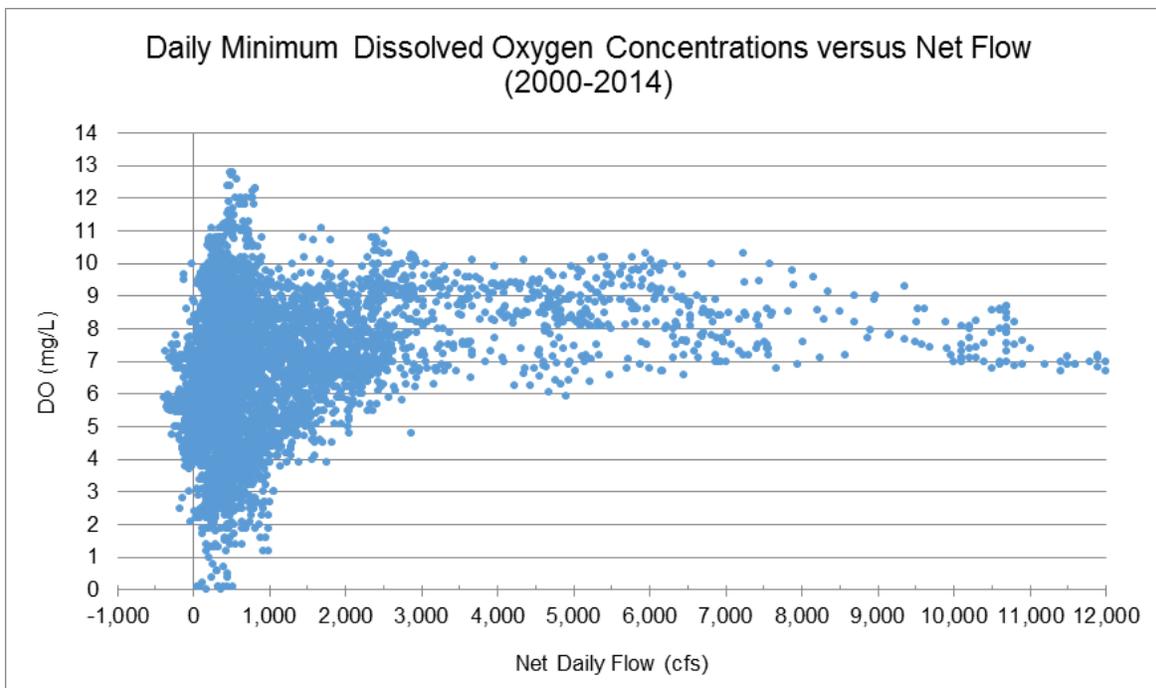
Water quality objectives are not consistently being met, however dissolved oxygen concentrations in the Stockton DWSC are improving. In general, at the Rough & Ready Island continuous monitoring station in the DWSC, There are significantly fewer exceedances of the dissolved oxygen water quality objective in the years following adoption of the TMDL. Exceedances occurring after 2007 are smaller magnitude (i.e., the minimum concentrations are not as low as the historical measurements) and duration (i.e., the concentration returns to the water quality objective or above in less time). It is also important to note that the graphs show the minimum dissolved oxygen concentration for each day with data. This represents a worst case scenario since the low oxygen conditions may have only lasted for a short period of time (minutes or hours rather than full days). Exposure to low oxygen conditions that is very brief (i.e., minutes) is likely not harmful to aquatic life.



This chart displays the measured daily minimum dissolved oxygen concentrations (mg/L) over time. The TMDL was approved on February 27, 2007. Use of the daily minimum represents a worst case scenario as these excursions may have been short in duration (minutes and hours, rather than full days).

An Aeration Facility was constructed in 2006-2007 in the Stockton DWSC. The facility improves dissolved oxygen concentrations in the channel near Rough & Ready Island and downstream; however, the distribution of aerated water upstream is limited. It may be necessary to modify the existing facility or to construct an additional facility upstream near Channel Point to improve upstream conditions. An Aeration Agreement is in place among stakeholders to fund the operation and maintenance of the aeration facility through 2016. Long-term funding is necessary to maintain these improved conditions.

In addition, flow is a primary driver of dissolved oxygen conditions in the channel. This is shown by the lower dissolved oxygen measurements in the graph below, particularly below 2,000 cubic feet per second (cfs). Proposed projects such as the Bay-Delta Conservation Plan, the State Water Quality Control Board's Delta flow objectives, and the proposed United States (U.S.) Army Corps deepening of the Stockton DWSC have the potential to change the flow dynamics through the channel. Future actions to mitigate impacts in the channel from these projects will likely be necessary.



This chart displays the relationship between daily minimum dissolved oxygen concentrations (mg/L) measured at the Rough and Ready Island monitoring station versus net daily flow (cfs) measured at the U.S. Geological Survey Garwood Flow Station located upstream of the Stockton DWSC.

TMDL Progress – Implementation activities and milestones

Implementation Activity	Target Date	Status	Progress Details
A study plan describing how ongoing studies and future studies will address information needs.	7/31/2005	Complete	<ul style="list-style-type: none"> • Strategy developed by Technical Working Group (TWG).
Technical studies that identify and quantify sources, growth mechanisms, and impacts of oxygen demanding substances on dissolved oxygen in DWSC.	12/2008	Complete	<ul style="list-style-type: none"> • Upstream studies completed in 2008 (link). • U.S. Army Corps Report 2008 (link). • External peer review completed in 2013 (link). • Downstream studies completed 2013 and reports submitted in September 2014 (link).
Permits: Require NPDES permits and Waste Discharge Requirements (WDRs) to comply with TMDL. These are regularly updated on a compliance schedule.	12/31/2011	Complete	<ul style="list-style-type: none"> • City of Stockton RWCF Permit (2008 link); updated in 2014 (link) • Stockton RWCF meeting waste load allocations with facility upgrade. • Conditional Waiver and WDRs continue to reduce upstream nonpoint loading (link).
Prohibition to Discharge: When net daily flow in the DWSC near Stockton	12/31/2011	Complete	<ul style="list-style-type: none"> • These prohibitions are in effect (link).

Implementation Activity	Target Date	Status	Progress Details
is less than 3,000 cubic feet per second, unless dissolved oxygen objectives in the DWSC are being met.			
Water Rights: Consider amending water right permits to reduce actions that cause flow declines through the DWSC. Require new rights and transfers to evaluate and mitigate impacts on reduced flow and excess net oxygen demand conditions in the DWSC.	None specified	In progress	<ul style="list-style-type: none"> • The Phase II Water Quality Control Plan Update will address dissolved oxygen conditions in the DWSC. • The State Water Quality Control Board has an ongoing requirement to consider potential impacts.
Water Quality Certification requires evaluation and full mitigation for projects that increase the cross-sectional area of the DWSC and reducing flow through the DWSC.	Not applicable	In progress	<ul style="list-style-type: none"> • This is an ongoing requirement to consider potential impacts.
Review allocations and implementation provisions based on the results of the oxygen demand and precursor studies and the prevailing dissolved oxygen conditions in the DWSC.	02/06/2015	Complete	<ul style="list-style-type: none"> • November 2014 Water Board staff developed a draft report with recommendations for future actions to address the dissolved oxygen impairment. New allocations are not proposed in this report. • Resolution R5-2015-0008 was adopted in February 2015 (link).
Develop alternate actions to address non-load related factors.	12/31/2011	Complete	<ul style="list-style-type: none"> • Aeration Facility constructed in 2006-2007; demonstrated from 2008-2010; and, funded for operations 2012-2014 (link).
Other implementation activity: Nitrifying biotowers and engineered wetlands were added to the City of Stockton's RWCF in 2006 to reduce ammonia discharges to the SJR.	None specified	Complete	<ul style="list-style-type: none"> • Since July 2007, the City of Stockton's nitrification system has reduced the effluent ammonia (as nitrogen) concentration (link).

What Next?

Additional actions by the Regional Water Board and State Water Board are needed to consistently meet water quality goals. These actions may include: 1) working with stakeholders to develop a new operating agreement for the aeration facility that identifies funding sources and additional funding partners, 2) establishing minimum flows for supporting dissolved oxygen objectives and amending state permits to provide needed flows, 3) adding additional water quality monitoring stations within the channel to better characterize dissolved oxygen concentrations under various flows, and 4) evaluating watershed sources of nutrients and identifying methods for minimizing nutrient inputs to the channel.

Information Source Documents

- **Final Basin Plan Amendment** – Amendments to the Water Quality Control Plan For the Sacramento River and San Joaquin River Basins For The Control Program for Factors Contributing to the Dissolved Oxygen Impairment in the Stockton Deep Water Ship Channel ([link](#))
- **State Water Quality Control Board and Central Valley Water Board TMDL Resolutions and EPA Approval** ([link](#))
- **Basin Plan Language for the DO TMDL** – see pages 36.04 and 37.01 of the Basin Plan ([link](#))
- **Central Valley Water Board General Page for TMDL** ([link](#))
- **San Joaquin River DO TMDL Technical Working Group** ([link](#))
- **San Joaquin River Dissolved Oxygen TMDL - Implementation Activities** ([link](#))
- **San Joaquin River Dissolved Oxygen TMDL - Required Studies** ([link](#))
- **TMDL Performance Report** ([link](#))
- **San Joaquin River Dissolved Oxygen Control Program Implementation Draft Staff Report** – Provides Central Valley Water Board Staff recommendations on future actions to address the impairment and allocations ([link](#))
- **Resolution R5-2015-0008** – Approves the continuation of the Control Program for the Dissolved Oxygen Impairment in the Stockton Deep Water Ship Channel ([link](#))
- **Army Corps Technical Papers** – available on Central Valley Water Board website (scroll down to the U.S. Army Corps of Engineers section) ([link](#))
- **Link to real time data for DO in Stockton DWSC**