New River QUAL2K Water Quality Model for the New River Dissolved Oxygen TMDL

Final Report
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Prepared for:

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and

California Regional Water Quality Control Board Colorado River Basin Region Palm Desert, California

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1.0 Executive Summary

This report describes model assumptions and calibration of the QUAL2K water quality model of the New River from the International Boundary to the outlet at the Salton Sea. Additional data was received from the Regional Board New River Implementation Monitoring Program, the International Boundary and Water Commission, as well as from USGS from their pesticide monitoring program. First priority in model calibration was the determination of temperature, dissolved oxygen, carbonaceous BOD, and ammonia. Secondary was the consideration of other nutrients, conductivity, suspended solids, alkalinity and pH. Phytoplankton, detritus, and pathogens were not calibrated due to limited data and other modeling limitations.

Calibration of the QUAL2K model was completed for the study date of July 17, 2006 corresponding to critical conditions of 30.5 °C headwaters temperature. Validation was performed for additional conditions of June 2006 at a headwaters temperature of 28.5 °C.

TMDL scenarios were evaluated to measure the potential improvement based on the Mexicali II Wastewater Conveyance and Treatment Project (USEPA, 2003) diversion of wastewater flows out of the New River basin upstream of the International Boundary. Following review by the Regional Board and EPA Region 9 and comments on calibration and scenario results, additional scenarios were devised in order to meet the water quality objective of 5.0 mg/L dissolved oxygen in the New River.

Results of model scenarios indicate that measurable water quality improvements have been achieved with implementation of the first phase of the Mexicali II project that was operational as of December 2006. Reduced BOD and improved DO at the International Boundary have resulted in improved conditions in the New River formerly exhibiting dissolved oxygen in the range of 0-1 mg/L for 30 km downstream of the International Boundary; however, dissolved oxygen is projected to remain between 1-2 mg/L in this reach during critical conditions. In order to meet the water quality objective of 5.0 mg/L throughout the entire New River, additional improvements would be necessary both in water quality at the International Boundary and in effluent quality from U.S. wastewater facilities and agricultural drains north of the border.

2.0 QUAL2K Model Setup

2.1 QUAL2K Model Geometry

Stream lengths were calculated by GIS layers for the National Hydrography Dataset (NHD) divided at major road crossings, drains or major tributary inputs, and other landmarks of hydraulic interest such as WWTPs or weirs/drop structures. A total of 33 segments were determined to be the minimum necessary to accurately represent the New River system from the International Boundary to the outlet at Salton Sea. The calculated stream lengths, segment designations, and additional elements are shown in Table 2-1. The number of elements (segments for internal calculations) was determined such that the range of element length is 0.33-2.75 km. Total segment lengths range from 0.33 to 11 km.

Table 2-1. Model segmentation, reach lengths, upstream distance from Salton Sea, calculation elements per segment, and weir definition for the New River QUAL2k model.

Reach#	Upstream	Downstream	Length (km)	Upstream (km)	#Elements	Weir
1	USGS_IB	CalexicoWWTP	1.08	104.934	2	
2	CalexicoWWTP	All-Am_Canal	1.65	103.286	3	
3	All-Am_Canal	CA_Hwy_98	3.22	100.069	3	
4	CA_Hwy_98	Clark_Rd	3.24	96.828	3	
5	Clark_Rd	Ferrell/Brucheri	2.71	94.118	3	
6	Ferrell/Brucheri	Lyons_Rd	2.94	91.173	3	
7	Lyons_Rd	Brockman_Rd	4.38	86.795	4	
8	Brockman_Rd	Greeson_Drn	1.88	84.915	3	
9	Greeson_Drn	Wormwood_Drn	5.82	79.098	5	
10	Wormwood_Drn	Drew_Rd	0.66	78.439	1	
11	Drew_Rd	Fig_Drn	1.01	77.429	2	
12	Fig_Drn	Interstate-8	1.76	75.673	3	
13	Interstate-8	Hwy80_EvanHewes	2.33	73.338	2	
14	Hwy80_EvanHewes	SeeleyWWTP	0.82	72.514	1	12x2m
15	SeeleyWWTP	BullheadSlough	1.37	71.149	2	
16	BullheadSlough	SaltCr_Slough	7.86	63.286	4	
17	SaltCr_Slough	Worthington_Rd	1.22	62.061	2	
18	Worthington_Rd	Rice3_Drn	7.31	54.752	4	
19	Rice3_Drn	Rice+ForresterRd	3.50	51.255	3	
20	Rice+ForresterRd	Keystone_Rd	5.19	46.066	5	
21	Keystone_Rd	N.Central_Drn	0.45	45.621	1	
22	N.Central_Drn	Hwy96	11.00	34.625	4	
23	Hwy96	Drop4	3.03	31.600	1	16x3m
24	Drop4	Drop3	2.53	29.074	1	16x2m
25	Drop3	BrawleyWWTP	1.28	27.799	2	
26	BrawleyWWTP	Spruce_Drn	2.12	25.680	2	
27	Spruce_Drn	Drop2	1.55	24.134	1	18x2m
28	Drop2	Kalin_Rd	9.86	14.271	5	
29	Kalin_Rd	Timothy2_Drn	1.62	12.649	3	
30	Timothy2_Drn	Gentry_Rd	1.73	10.916	3	
31	Gentry_Rd	Lack_Rd	4.38	6.536	4	
32	Lack_Rd	USGS_outlet	1.73	4.802	3	
33	USGS_outlet	Salton_Sea	4.80	0.000	4	

Widths were initially determined from USGS cross-section measurements used to develop rating tables at gaging sites (10254970 International Boundary and 10255550 Near Westmoreland). Widths were extrapolated between the known cross sections. Additional measurements were obtained from USGS based on recent flow data collected at Lack Road and at Drop 4 near Brawley. Cross-section profiles were analyzed for conversion into model geometry in the form of generalized Manning trapezoids with a bottom width and channel side-slope. Side-slopes were found to be consistently in the range 0.24, a typical angle of repose for a sandy channel.

Weir widths were estimated from aerial orthophotography downloaded from the USGS site (seamless.usgs.gov). An example of weir widths is shown in Figure 2-1 below. Weir heights were estimated to be consistent with determined stream elevations from GIS, but could be refined with local knowledge. QUAL2K assumes weirs to be of the "sharp-crested" variety for empirical re-aeration calculations, so a valid "effective" height for a different type of weir (determining how much aeration is observed at a weir based on the empirical formulation for sharp-crested weirs) may not necessarily correspond to the exact measured height.

2.2 QUAL2K Headwater Water Quality Inputs

Critical conditions for dissolved oxygen usually occur at times of high temperature and/or low streamflow. High temperature decreases oxygen solubility while increasing BOD decay rates and oxygen consumption. Low streamflow generally corresponds to higher concentrations of oxygen-consuming wastewater, slower average flow velocity, less re-aeration, and greater proportional impact of BOD and sediment oxygen demand. As discussed with EPA Region 9 and the Regional Board, critical conditions in the New

River are defined as the warmest summer period that includes the months of July and August.

For the QUAL2k initial calibration, the date of July 17, 2006 was chosen in order to correspond to a Regional Board sampling event. Water temperatures at the International Border in July and August frequently exceed 30 °C. Unfortunately, BOD5 samples were not analyzed for July and August, so the model input was estimated at 50 mg/L BOD5, determined from the range 40-70 mg/L BOD5 measured at all other times. Setmire (1984) observed intra-day fluctuations of water quality indicative of changing discharge conditions across the International Border. Therefore, it seems likely that the New River at present may continue to experience intra-day fluctuations in the range of 40-70 mg/L. In any case, caution should be taken in assuming whether model BOD5 on any given day might remain constant at the value of one analyzed sample. There is higher certainty that it would be within the range of historical samples. Input BOD5 was partitioned to 30 mg/L CBODslow and 20 mg/L CBODfast. The slow vs. fast fractions are used separately in the model calculations for oxygen consumption, based on different user-defined rates of first-order CBOD decay of 0.2/day and 0.4/day respectively. Headwaters characteristics are shown in Table 2-2.

Table 2-2. Flow and water quality parameters for model headwater (inflow) for July 17, 2006

Headwater Parameter	**Units**	**Value**
Streamflow	m^3/s	3.625 (128 cfs)
Temperature	°C	30.50
Conductivity	umhos	5786.00
Inorganic Solids	mg/L	46.00
Dissolved Oxygen	mg/L	0.66
CBODslow (est.)	mgO_2/L	30.00
CBODfast (est.)	mgO_2/L	20.00
Organic Nitrogen	ugN/L	5890.00
NH4-Nitrogen	ugN/L	8161.00
NO3-Nitrogen	ugN/L	200.00
Organic Phosphorus	ugP/L	3400.00
Inorganic Phosphorus (SRP)	ugP/L	5160.00
Phytoplankton	ugA/L	4.00
Detritus (POM)	mgD/L	0.00
Pathogen	cfu/100 mL	0.00
Alkalinity	$mgCaCO_3/L$	233.00
pH	s.u.	7.82

2.3 QUAL2K Tributary and Wastewater Inflows

Tributary/drain and wastewater inflows account for approximately two-thirds of the flow of the New River at its outlet at Salton Sea. Domestic WWTPs provide accurate flow averages as a part of monthly Discharge Monitoring Reports, which were obtained from

EPA's PCS database. Flows and water quality parameters for the two largest WWTPs (Calexico and Greeley) were obtained from PCS for July 2006. Monthly flow estimates for the remaining minor WWTPs were taken from the Regional Board draft TMDL, and nutrient values were assumed based on best professional judgment. WWTP and tributary/drain assumptions for July 17, 2006 calibration date are shown in Table 2-3 below. These values are input into the Point Sources model tab because each tributary is essentially similar to a point source.

Table 2-3. Flow and water quality parameters for model tributary/drain and WWTP inputs

Point source / drain inflow	km	Inflow (m3/s)	Temp (°C)	Cond (umhos)	ISS (mg/L)	DO (mg/L)	CBOD (mg/L)	org-N (ug/L)	NH3 (ug/L)	Nox (ug/L)	org-P (ug/L)	PO4 (ug/L)
Calexico_WWTP	104.93	0.1116	30.83	4000	28.30	4.07	29.90	2000	3940	13680	3240	3150
Greeson_Drain	84.92	0.9590	29.65	2672	130.00	4.09	2.00	2600	1900	1700	210	400
Wormwood_Drain	79.10	0.9590	29.65	2672	130.00	4.09	2.00	2600	1900	1700	210	400
Fig_Drain	77.43	0.5319	28.81	1792	130.00	4.55	2.00	2600	2200	2940	180	460
Seeley_WWTP	72.51	0.0057	30.00	4000	50.00	10.10	30.80	2000	2000	2000	2000	2000
Bullhead_Slough	71.15	1.5930	29.65	1936	130.00	7.45	2.00	2600	880	1700	210	400
SaltCreek_Slough	63.29	1.5930	29.65	1936	130.00	7.45	2.00	2600	880	1700	210	400
CentinelaPrisonWWTP	63.29	0.0263	30.00	4000	50.00	5.00	10.00	2000	2000	2000	2000	2000
ElCentroWWTP	62.37	0.0048	30.00	4000	50.00	5.00	6.40	2000	2000	2000	2000	2000
DateGardensMHP +McCabeSchools	54.75	0.0005	30.00	4000	50.00	4.30	8.20	2000	2000	2000	2000	2000
Rice_Drain	51.25	0.8866	29.09	1936	300.00	7.45	2.00	2920	880	2260	290	220
N.Central_Drain	45.62	0.6632	29.59	2164	17.00	1.24	2.00	3000	2400	0	80	810
Drop3_Drain	29.07	0.6632	29.65	2672	130.00	4.09	2.00	2600	1900	1700	210	400
Brawley_WWTP	27.80	0.1665	31.70	4000	12.90	3.40	11.20	3310	35140	1620	2000	2000
Spruce_Drain (Aug06)	25.68	0.6632	32.71	4171	38.00	7.25	2.00	930	0	12180	100	0
Timothy2_Drain	12.65	3.9009	29.28	2165	170.00	5.78	2.00	1200	0	2000	290	120
WestmorelandWWTP	10.08	0.0070	30.00	4000	50.00	4.40	24.40	2000	2000	2000	2000	2000

color key:

measured value for July06
average value
assumed same as other measured inputs
estimated (BPJ) value
unusual or suspect value

Drain water quality data were obtained from two Annual Reports from Imperial Irrigation District's Revised Drain Water Quality Improvement Plan, required under the New River Siltation TMDL. The IID Annual Reports provide monthly measurements of field parameters and laboratory analyses for nutrients, with the notable exceptions of BOD and COD. For those drains that were not measured, reasonable values were used from nearby drains, with care taken to use most representative, i.e. not outlier data.

Drain flows, since they are not measured by IID, had to be estimated by other means. Fortunately, Setmire (1984) published multiple longitudinal transects of the New River. Total flows were back-calculated from the difference between the two USGS gages at the International Border and near Westmoreland. Known domestic point sources were subtracted from the total. Inflows for the remaining drains were calculated from the difference between the Setmire measured flows in 1984, scaled proportionally to the measured USGS streamflow from July 17, 2006. Results for the drain flow analysis are shown in Table 2-4.

Table 2-4. Estimated tributary/drain flows from analysis based on scaled flows from Setmire (1984)

Landmark	Measured Flow CFS (Setmire 1984)	Inflows	Flow CFS scaled to 2006 USGS	CFS-total non-WWTP	CMS non-WWTP	CMS-each
Calexico	115		128.0			
		CalexicoWWTP 4.6 CFS				
Clark	130		162.8			
Lyons	150		187.8			
		Greeson, Wormwood		67.7	1.92	0.96
Drew	160		200.3			
		Fig		18.8	0.53	0.53
Hwy80-EvanHewes	175		219.1			
		SeeleyWWTP, BullheadSlough, SaltCrSlough		112.5	3.19	1.59
Worthington	265		331.8			
		Rice3		31.3	0.89	0.89
Keystone	290		363.1			
		N.Central, BrawleyWWTP, Spruce, Drop3		70.3	1.99	0.66
Rutherford(D2)	350		438.3			
		Timothy2		137.7	3.90	3.90
Gentry	450		563.5			
WestmorelandUSGS	460		576.0			

2.4 QUAL2K Weather

Weather inputs for the critical conditions day were derived from the CIMIS Meloland station rather than NCDC due to superior data availability. Air temperature, dew point and wind speed are used in calculations for heat transfer, evaporation, and surface re-aeration. An example of air temperature and dewpoint is shown in Figure 2-2 below.

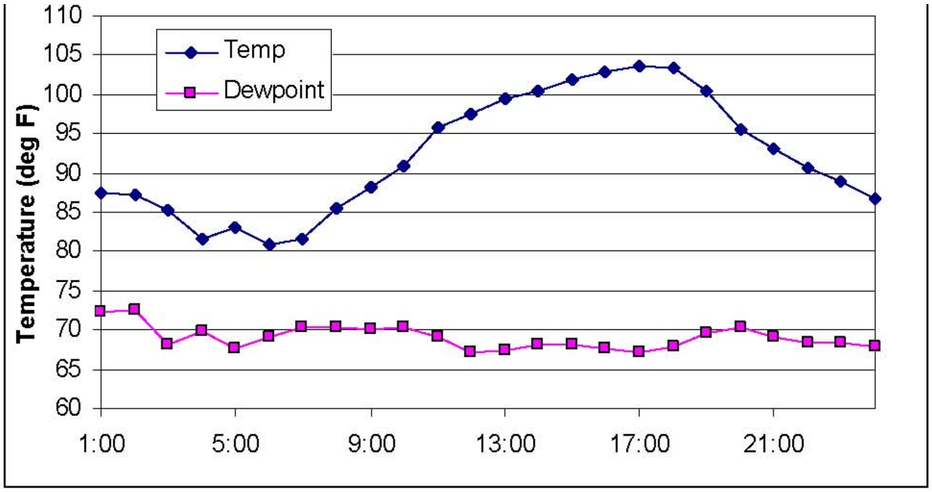


Figure 2-2. Air temperature and dew point on July 17, 2006 from Meloland CIMIS weather station.

3.0 QUAL2K Calibration

3.1 Geometric considerations for Manning Flow equation

When calibrating the QUAL2K model, it became apparent that DO levels in the New River are most sensitive to residence time and stream velocity. Velocity also determines re-aeration (turbulent oxygen diffusion from the atmosphere) from the empirical function known as the O'Connor/Dobbins formulation. Observed sensitivity to CBOD decay rates, aeration formulation, and characterization of CBOD inputs (fast or slow) were less than the sensitivity to channel slopes, Manning geometry, and calculated velocity. Residence time and stream velocity were determined explicitly by the Manning equation for open channel flow (as in Chapra et al.[2006]):

$$Q\ [\text{m3/s}] = (S_0^{1/2} * A_c^{5/3}) / (n * P^{2/3})$$

Where S_0 is the bottom slope [m/m], A_c is channel cross-sectional area [m^2], P is the wetted perimeter, and n is a non-dimensional roughness coefficient. Velocity is simply the calculated unit flow per cross-sectional area.

Channel slope was determined by GIS interpretation of DEM data, constrained by the known datums at the two USGS gages. Actual surveys of weirs or bridges, if obtained, could potentially be more accurate for assessing individual segments. In calibrating the model, a redoubled effort was made to ensure that segment elevations and therefore slopes were as accurate as possible with the method used, based on the limitations of the GIS data.

As a calibration factor, Manning's roughness parameter *n* was chosen to be 0.045, consistent with a "clean, winding channel with some weeds" (Chow et al. 1988, cited in Chapra et al. 2006). Bottom width, as shown in Table 3, ranges from 5.0m at the International Border to 14.0m at the USGS site near Westmoreland. Surface width varies as a function of flow and depth, in accordance with the user-specified sideslope of 0.24 m/m.

Fortunately, Setmire (1984) conducted a dye study in order to characterize time-of-travel in the New River under similar flow conditions. Model results for time-of-travel are shown in Figure 3-1. Measurement points from Setmire (1984) are at the USGS site near Westmoreland (4.8 km from Salton Sea), Worthington Rd (62.0 km), and Keystone Rd. (46.0 km).

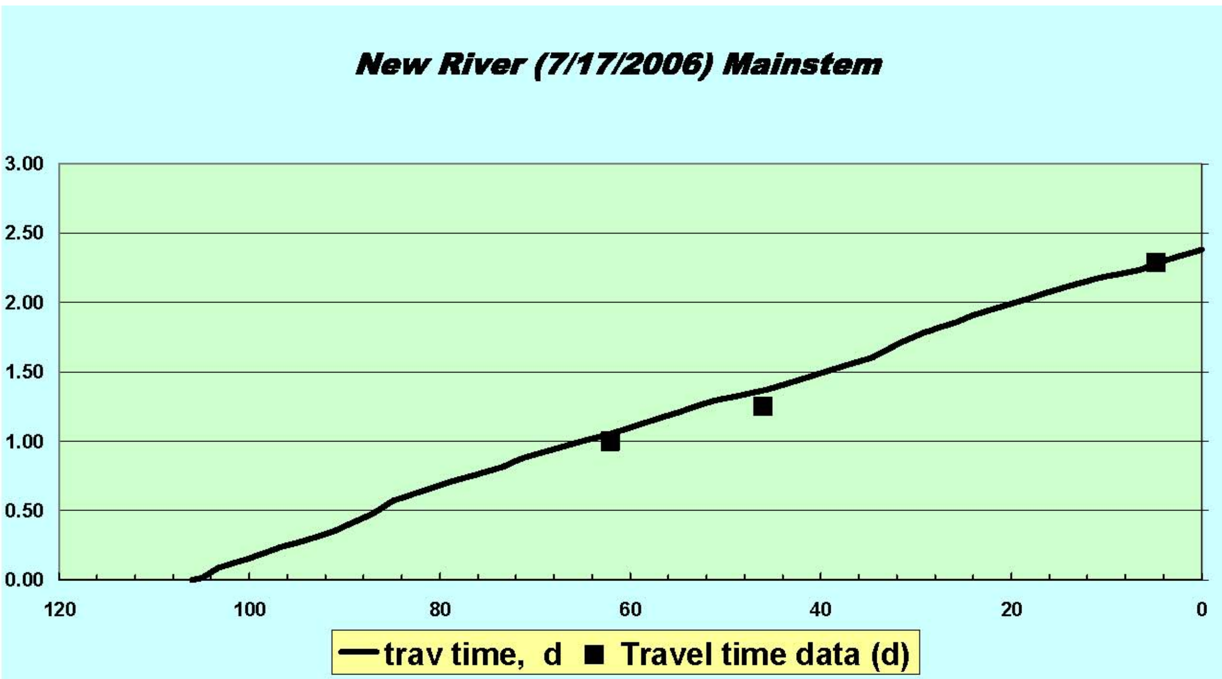


Figure 3-1. QUAL2K model time-of-travel (days) as a function of kilometers in the New River calculated based on segment Manning geometries (slope, width, *n*) compared to dye-study data measured by Setmire (1984).

QUAL2K streamflow calibration is shown in Figure 3-2 below.

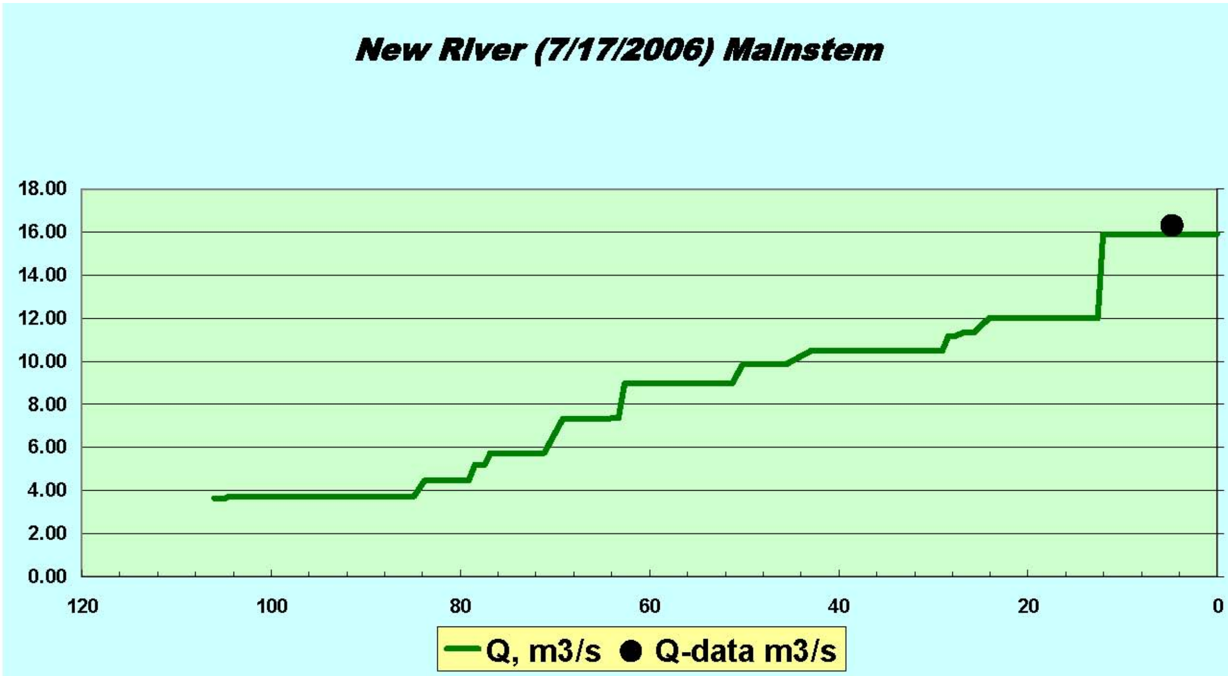


Figure 3-2. QUAL2K model longitudinal streamflow (m3/s) for July 17, 2006 as a function of kilometers from the outlet.

Table 3-1. Manning formula parameters for QUAL2K stream segments.

Reach#	Manning formula parameters		
	Roughness *n*	Bottom Width (m)	Sideslopes (m/m)
1	0.045	5.00	0.24
2	0.045	5.07	0.24
3	0.045	5.20	0.24
4	0.045	5.33	0.24
5	0.045	5.44	0.24
6	0.045	5.56	0.24
7	0.045	5.74	0.24
8	0.045	5.82	0.24
9	0.045	6.06	0.24
10	0.045	6.08	0.24
11	0.045	6.13	0.24
12	0.045	6.20	0.24
13	0.045	6.29	0.24
14	0.045	6.33	0.24
15	0.045	6.38	0.24
16	0.045	6.70	0.24
17	0.045	6.75	0.24
18	0.045	7.05	0.24
19	0.045	7.20	0.24
20	0.045	7.41	0.24
21	0.045	7.43	0.24
22	0.045	7.88	0.24
23	0.045	8.00	0.24
24	0.045	8.48	0.24
25	0.045	8.72	0.24
26	0.045	9.12	0.24
27	0.045	9.42	0.24
28	0.045	11.29	0.24
29	0.045	11.60	0.24
30	0.045	11.93	0.24
31	0.045	12.76	0.24
32	0.045	13.09	0.24
33	0.045	14.00	0.24

3.2 Dissolved Oxygen Calibration

Once the model geometry was refined in terms of widths and slopes, and the appropriate time-oftravel was achieved, the dissolved oxygen calibration was much improved, as shown in Figure 33 below.

Headwaters DO input is 0.66 mg/L as measured on July 17, 2006. Model results show pronounced, extremely-low levels below 1 mg/L for the first 30 km downstream of the International Border. The first Regional Board monitoring site is at Evan Hewes Highway at 73.3 km, with measured DO of 0.98 mg/L. Immediately downstream of the highway,

there is a rock weir that is described in Setmire (1984) which re-aerates the New River to approximately
2.5 mg/L according to QUAL2K. Despite additional drain and WWTP inflows of higher DO, carbonaceous decay continues to deplete DO until the weirs at Drop4, Drop3, and Drop2, at 31.6 km, 29.0 km, and 24.1 km, respectively. Measured DO at Drop2 was 5.21 mg/L.

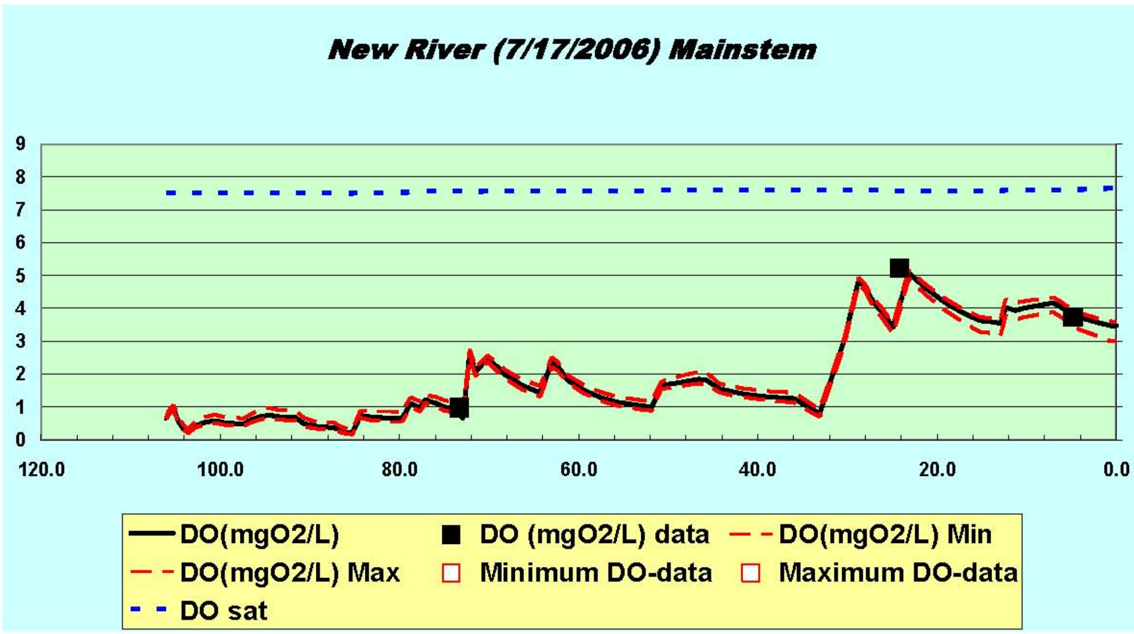


Figure 3-3. QUAL2K model longitudinal dissolved oxygen (mg/L) for July 17, 2006 as a function of kilometers from the outlet. (0.0=outlet at Salton Sea)

For the initial calibration, the headwaters input DO was defined in QUAL2K as 0.66 mg/L assumed constant for the entire day of July 17, 2006. Additional continuous DO and temperature data were used to define a diurnal range of fluctuation for model input.

3.3 QUAL2K Validation

The QUAL2K model was tested for another time period, June 13, 2006. Headwater conditions were 28.5 °C and 70.0 mg/L total BOD5 and 0.29 mg/L DO. Tributary and headwater flows were adjusted for a headwaters flow of 153 CFS and 593 at the outlet USGS gage. Water quality inputs were adjusted accordingly.

It was determined that with the calibrated weir widths and heights, the calculated reaeration rate underestimated DO at Drop 2 where it was measured to be 7.73. Other dates of lower temperatures and non-critical conditions featured a similar phenomenon—where DO conditions are measured to be nearly saturated at the Drop 2 sampling site. This indicates significant reaeration from the weirs at Drop 2 and Drop 4. The weir reaeration formula in the model may not be robust to calculate reaeration at these points, under such severe conditions. For the QUAL2K model, reach reaeration factor ka was specified for the Drop 2 and Drop 4 reaches as 30/day and 40/day, respectively. Results for the validation run with adjustments are shown in Figure 3-4, below.

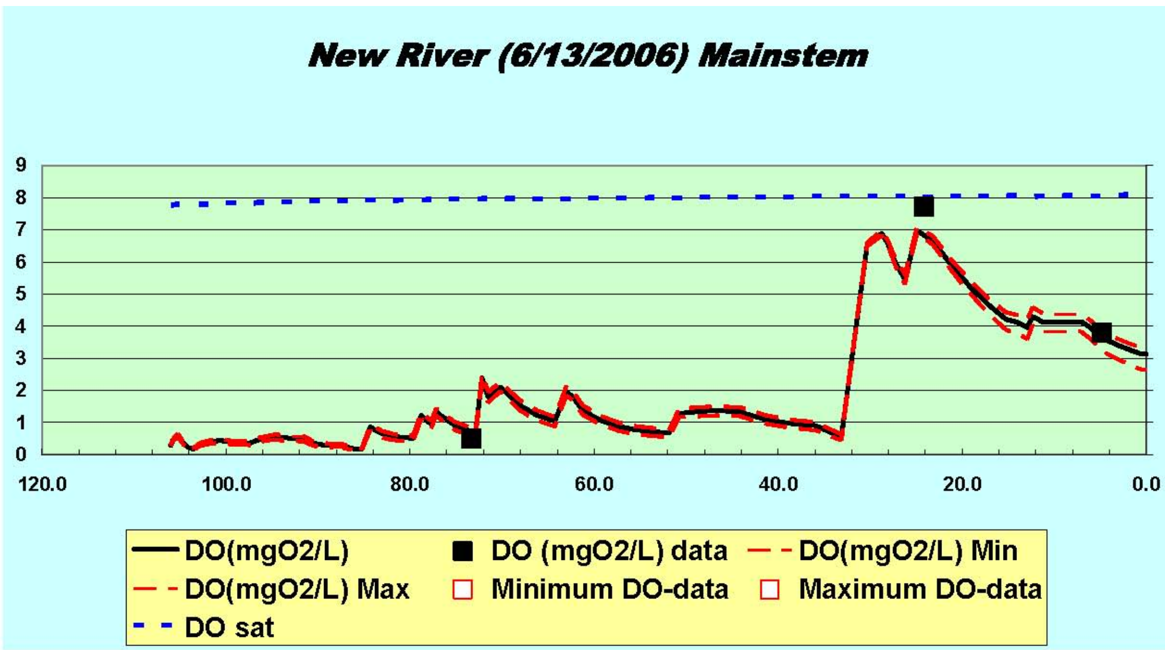
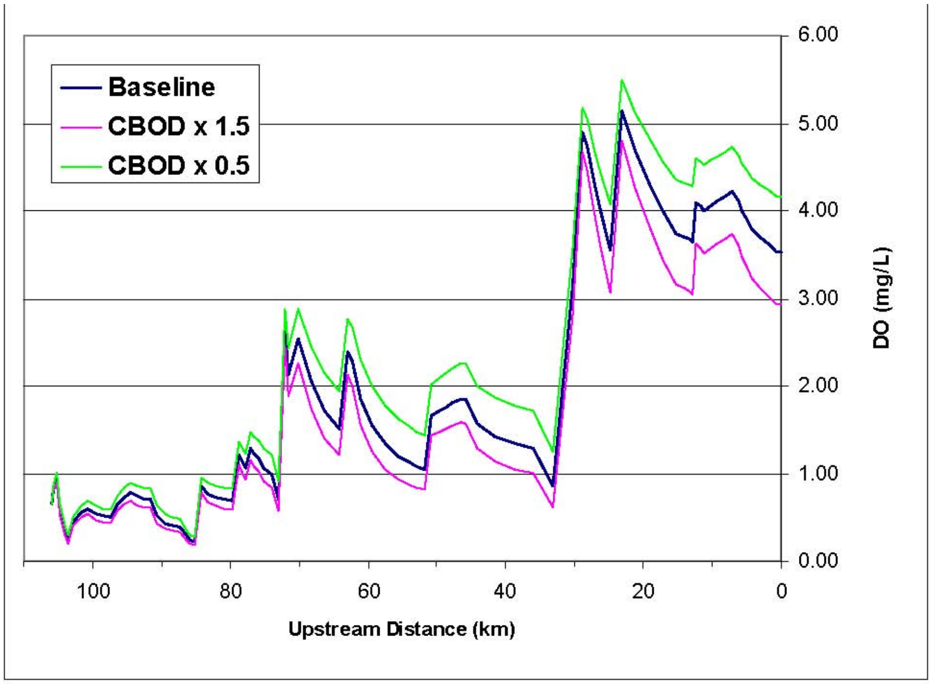


Figure 3-4. QUAL2K model longitudinal dissolved oxygen (mg/L) for June 13, 2006 as a function of kilometers from the outlet.

3.4 QUAL2K Sensitivity Analysis

The QUAL2K model was run to test the sensitivity of DO results to parameter input variability. Parameters tested were headwaters dissolved oxygen, CBOD, and ammonia; and segment sediment oxygen demand. In addition, a scenario was included with 30 percent reduction in drain flows to characterize the effects of possible future irrigation allocation reductions. Sensitivity to input CBOD (baseline, 50 percent and 150 percent) at the headwaters is shown in Figure 3-5.



Fiqure 3-5. Model dissolved oxvaen sensitivitv to CBOD in headwaters.

This implementation of the QUAL2K is relatively insensitive to the SOD values used and more sensitive to CBOD inputs and NH4. Headwaters dissolved oxygen boundary effects are only seen in the first 5-10 km at the calibration condition, but are more apparent farther downstream in the more oxygen-sensitive condition of TMDL scenarios (i.e.with less BOD and higher overall DO, there is a greater effect of altering the headwaters condition). Reducing drain flows by 30 percent resulted in a decrease in DO values in the range of 0-8 percent.

4.0 TMDL Model Scenarios

4.1 Evaluation of Mexicali II Wastewater Conveyance Project

As requested by the Regional Board and EPA Region 9, TMDL scenarios were prepared based on the current condition, and two future scenarios based on projected flow and pollutant reductions based on the Mexicali II project (USEPA, 2003). Furthermore, since the above scenarios do not meet the 5.0 mg/L water quality objective for dissolved oxygen, an additional TMDL scenario was prepared that is projected to meet the objective. All scenarios were run at the critical condition of headwater temperature at 30.5 deg C. Headwaters DO is assumed to be
5.0 mg/L per international agreement as a baseline.

The Current Condition is based on a recent flow average (157443 AF/y or 217.3 CFS) and average BOD5 of 36.4 mg/L. Since the scenario definition is based on average flows, rather than a specific date in time, the “Current Condition” will hereinafter be described as the “Model Baseline” scenario. As is customary in TMDL analysis, the model baseline scenario includes WWTP flows at permit limits for flow and 30-day-average BOD5, while retaining the average characterized value for other constituents (discharged NH4, DO, etc.). Permit limits for the wastewater facilities are shown in Table 4-1 below.

Table 4-1. Permit limits for NPDES WWTP facilities discharging to the New River.

NPDES facility	Km from outlet	Permit Flow (MGD)	Permit Flow (CMS)	Permit BOD5 (30-day avg. mg/L)
Calexico_WWTP	104.9	4.3	0.1884	30
Seeley_WWTP	72.5	0.2[1]	0.0088	45
CentinelaPrisonWWTP	63.3	0.6	0.0263	45
ElCentroWWTP	62.4	8.0	0.3505	30
Date Gardens MHP	54.8	0.01[1]	0.0004	30
McCabe Union	54.8	0.0015[1]	0.00007	30
Brawley_WWTP	27.8	5.9	0.2585	45
WestmorelandWWTP	10.1	0.5	0.0219	30

[1] NPDES permit limit not available, average used

The first Future Condition is based on an estimated flow reduction of 13.7 MGD from the Mexicali II project, which diverts wastewater out of the New River basin. The first phase of the Mexicali II project was put into operation in approximately December, 2006 (Regional Board, personal communication). The Regional Board provided 2007 sampling data from IBWC that indicates average BOD5 of 19.5 mg/L, which is a significant reduction from baseline. Reductions were estimated for nutrient constituents of NH4 50 percent, and other nutrients reduced 25 percent based on interpretation of projections from the Mexicali II Environmental Assessment (USEPA, 2003). Modeled estimated nutrient reductions may be adjusted by EPA or Regional Board staff based on additional monitoring data that will become available.

The second Future Condition is based on a total flow reduction of 20.1 MGD due to the next phase of the Mexicali II project due to be completed by 2014. BOD5 is estimated to be approximately 15 mg/L with reductions in NH4 and other nutrients 60 percent and 40 percent, respectively. These reductions may be adjusted or refined with further analysis of additional data, but are thought to be reasonable based on existing data.

Current (model baseline), Future Condition 1 and Future Condition 2 scenarios are detailed in Table 4-2, below. All three of these scenarios consist of altered flow, DO, and constituent values at the headwaters (International Border). No changes were made to flows or pollutant loadings north of the border.

Table 4-2. Scenarios for Model Baseline, Future Condition 1, and Future Condition 2. Constituent values are estimated for the headwaters at the International Boundary based on Mexicali II phase 1 and 2.

Scenario	Flow (CMS)	Flow (CFS)	DO (mg/L)	CBOD (mg/L)	NH4 (mg/L)	N-org (mg/L)	NO3-N (mg/L)	P-org (mg/L)	SRP (mg/L)
Baseline	6.15	217.3	5.0	36.4	9.30	3.65	0.23	1.47	1.70
Future 1	5.55	196.1	5.0	19.5	4.65	2.74	0.17	1.10	1.28
Future 2	5.27	186.2	5.0	15.0	3.72	2.19	0.14	0.88	1.02

Results of the Model Baseline, Future Condition 1, and Future Condition 2 are shown in Figure 4-1, below.

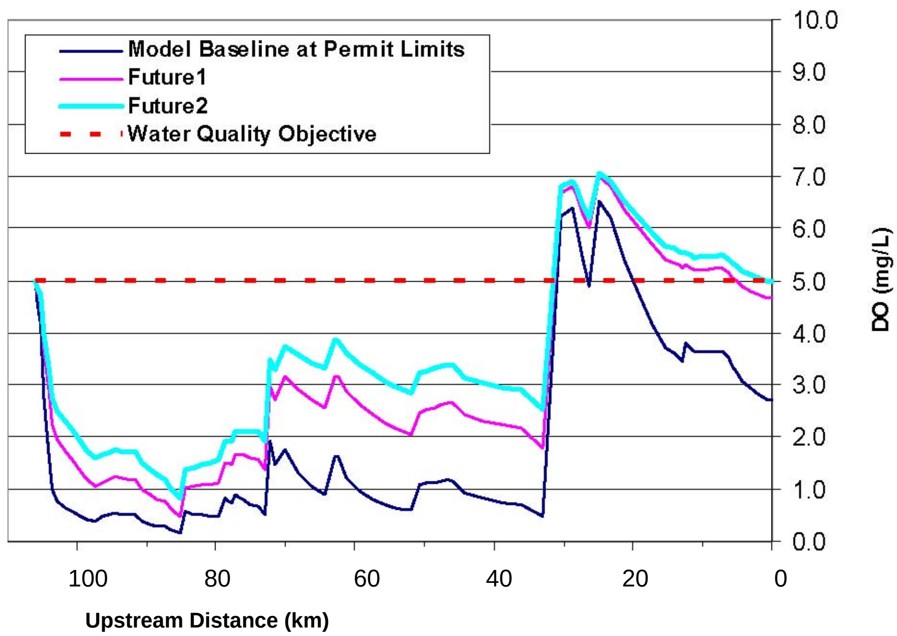


Figure 4-1. QUAL2K model longitudinal dissolved oxygen (mg/L) for Baseline, Future1, and Future2 scenarios as a function of kilometers from the outlet (0.0 = outlet at Salton Sea).

A few conclusions may be drawn from the model results of these three scenarios. First, neither of the scenarios based on the Mexicali II project meet the 5.0 mg/L water quality objective. Second, the Future Condition 2 scenario does result in DO greater than 5.0 mg/L downstream of the Drop 4 structure, but only in the final 30 km to the outlet at the Salton Sea.

The critical spatial region for lowest instream DO is the 30 km from the International Boundary upstream of the rock weir at Seeley. This region exhibits modeled dissolved oxygen in the range of 1.0-2.0 mg/L primarily due to CBOD decay and nitrification of

NH4. Therefore, in order to reach the TMDL water quality objective of 5.0 mg/L, further reductions are necessary—either at the International Boundary or from the Calexico WWTP which is the only NPDES facility in this region, and the only inflow for the first 20 km.

4.2 TMDL Reductions Necessary to Meet Water Quality Objective

As a first step, an effort was made to determine if attainment of the water quality objective of 5.0 mg/L is possible from reductions at the International Boundary alone (the model headwaters condition). Headwater NH4 was reduced to 0.5 mg/L and CBOD reduced to 8.0 mg/L (approximate reductions of 87 percent and 47 percent, respectively from Future Condition 2 at the International Boundary). Results of this first step are shown in Figure 4-2 below.

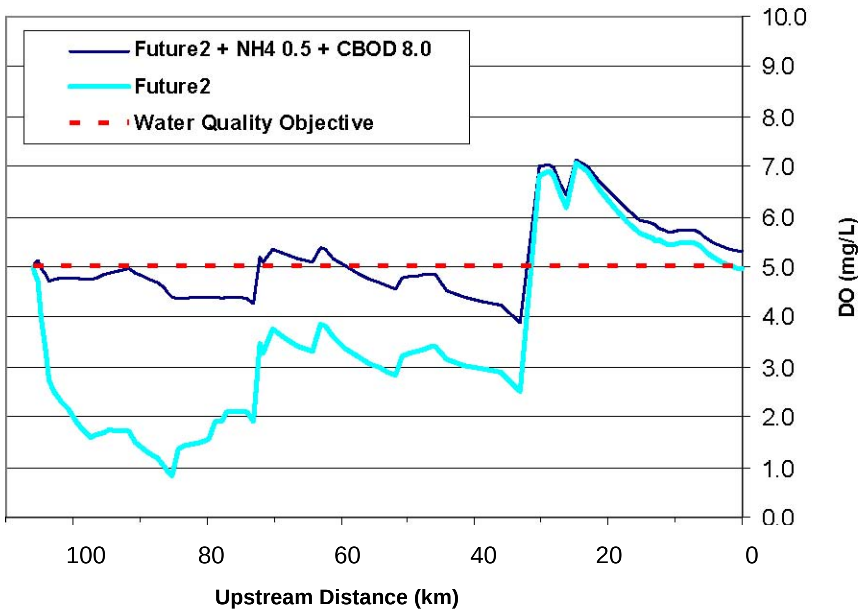


Figure 4-2. QUAL2K model longitudinal dissolved oxygen (mg/L) for the Future2 scenario compared to the further reduction of headwater CBOD to 8.0 mg/L and NH4 to 1.0 mg/L

It was discovered that, clearly, 5.0 mg/L can not be attained from the International Boundary to km70 based on the headwaters conditions and with additional loading from the WWTP at Calexico. With reduction of ammonia to zero at the International Boundary, 5.0 mg/L could be attained to km80 (data not shown) but further reductions would be necessary (allocated to Calexico WWTP or the drains) to maintain 5.0 mg/L downstream of km80.

Regardless, only with a headwaters dissolved oxygen greater than 5.0 mg/L would there be any assimilative capacity for headwaters CBOD and NH4 and inflow from the Calexico WWTP. At this point, a difficult decision must be made in order to maintain 5.0 mg/L in the upper section of the New River: 1) Maintain a minimum DO of 5.0 mg/L at the International Boundary, plus reduce headwaters NH4 to near zero and allocate some reductions to the Calexico WWTP, or 2) Require additional assimilative capacity at the International Boundary with a DO of 5.5 mg/L or greater, plus additional reductions to headwater CBOD, NH4, and/or reduced allocation to the Calexico WWTP, and/or requiring 5.0 mg/L from Calexico WWTP and tributary irrigation drains.

For reference, existing Calexico WWTP (km105) and Greeson Drain (km85) inflows were measured at approximately 4.0 mg/L DO in July 2006. Wormwood Drain enters at km79.6 and DO was assumed to be equal to Greeson Drain at 4.0 mg/L.

In order to achieve 5.0 mg/L in the upper section of the New River (International Boundary to 50 km) it is necessary to increase tributary inflow DO to at least 5.0 mg/L and reduce NH4 loading from Calexico WWTP and other slough or drain inflows to no greater than 1.0 mg/L NH4. This scenario is shown in Figure 4-3 below. To summarize, the necessary conditions for the scenario results shown in magenta are as follows:

International Boundary DO at 5.5 mg/L
International Boundary CBOD at 8.0 mg/L
International Boundary NH4 at 1.0 mg/L
Calexico WWTP, Greeson Drain, and Wormwood Drain DO at 5.0 mg/L
Calexico WWTP, Greeson Drain, and Wormwood Drain NH4 at 1.0 mg/L

The resulting DO concentrations in the New River exceed the water quality objective to approximately km45, but further reductions are necessary to exceed 5.0 mg/L below that point.

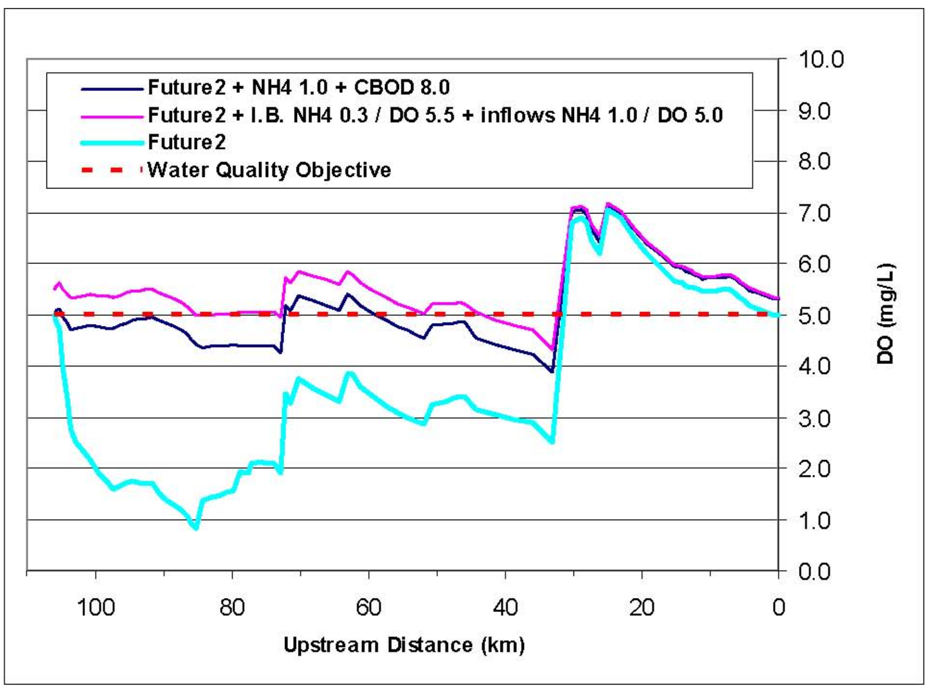


Figure 4-3. QUAL2K model longitudinal dissolved oxygen (mg/L) for the Future2 scenario compared to extensive further changes, including headwaters at 5.5 mg/L and U.S. drain and WWTP reductions.

Further reductions to headwaters and point sources were made in order to reach the water quality objective of 5.0 mg/L throughout the New River. These include:

International Boundary DO at 6.0 mg/L
International Boundary CBOD at 5.0 mg/L
International Boundary NH4 at 0.3 mg/L
All inflow (WWTP, Drains) DO at 5.0 mg/L
Calexico WWTP, El Centro WWTP, and ALL drain NH4 at 0.7 mg/L
Calexico WWTP, El Centro WWTP CBOD at 15 mg/L
(current permits 30 mg/L BOD5)

Results of this analysis is denoted in green in Figure 4-4 below in the TMDL scenario.

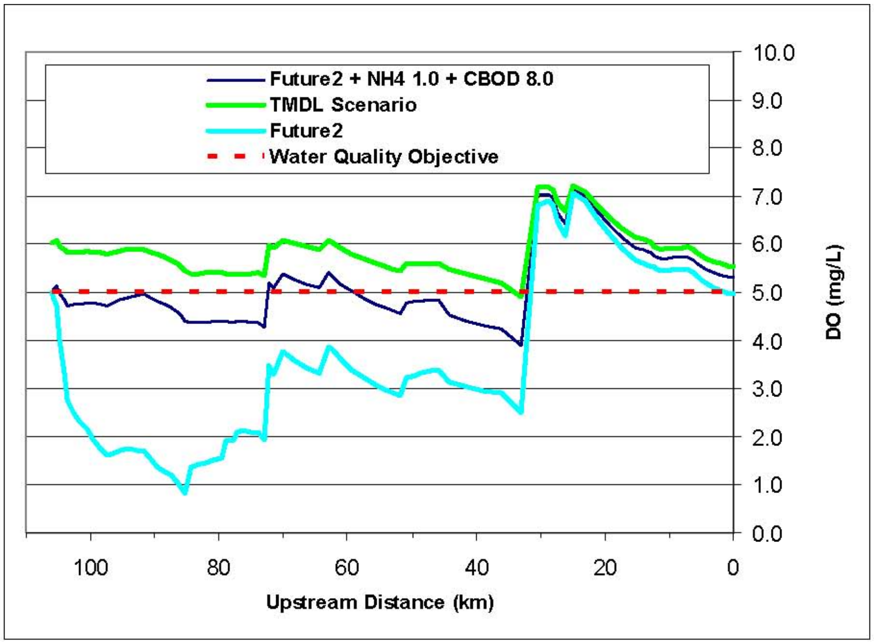


Figure 4-4. QUAL2K model longitudinal dissolved oxygen (mg/L) for extensive further changes, including headwaters at 6.0 mg/L and U.S. drain and WWTP reductions.

At the present condition (Future Condition 1) of the New River near the International Boundary with low DO and elevated CBOD and NH4, any reduction to U.S. WWTP permit limits or improvements in drain water quality would not likely result in a discernable improvement in New River dissolved oxygen. Yet, in the hypothetical TMDL scenario, even with major reductions at the headwaters, a significant reduction in CBOD and/or NH4 would still be necessary to achieve 5.0 mg/L.

The constituent values indicated above are examples based on the current implementation of the model. Regional Board and USEPA staff are encouraged to utilize the QUAL2K model to examine alternatives for TMDL allocations. Adaptive management is recommended based on accumulation of new critical conditions data collected in summer 2007 and in the future.

5.0 References

Chapra, Steve, Greg Pelletier and Hua Tao, 2006. QUAL2K: A Modeling Framework for Simulating Rivers and Stream Water Quality (Version 2.04) Documentation.

Colorado River Basin RWQCB, 2003. Quality Assurance Project Plan for New River Siltation/Sedimentation TMDL Implementation. March, 2003.

Colorado River Basin RWQCB, 2006. Quality Assurance Project Plan: Monitoring of the Water Quality of the New River at Mexicali and the International Boundary (Calexico, CA). February 2006.

Colorado River Basin RWQCB, 2006. Draft 9-11-06 TMDL and Implementation Plan for Dissolved Oxygen in the New River, Imperial County, California.

Imperial Irrigation District's Revised Drain Water Quality Improvement Plan, Annual Project Report: February 2005—January 2006.

Imperial Irrigation District's Revised Drain Water Quality Improvement Plan, Annual Project Report: January 2006—December 2006.

Setmire, 1984. Water Quality Conditions in the New River. USGS Report.

Thomann, R.V. and J.A. Mueller. 1987. Principles of Surface Water Quality Modeling and Control. HarperCollins Publishers, New York.

USEPA, 2003. Wastewater Conveyance and Treatment Project for the Mexicali II Service Area: Environmental Assessment. August, 2003.

USEPA, 2006. BASINS GIS data layers. http://www.epa.gov/waterscience/basins/b3webdwn.htm

United States Geological Survey. 2007. Surface Water Data for California: Daily Streamflow Statistics.

Addendum

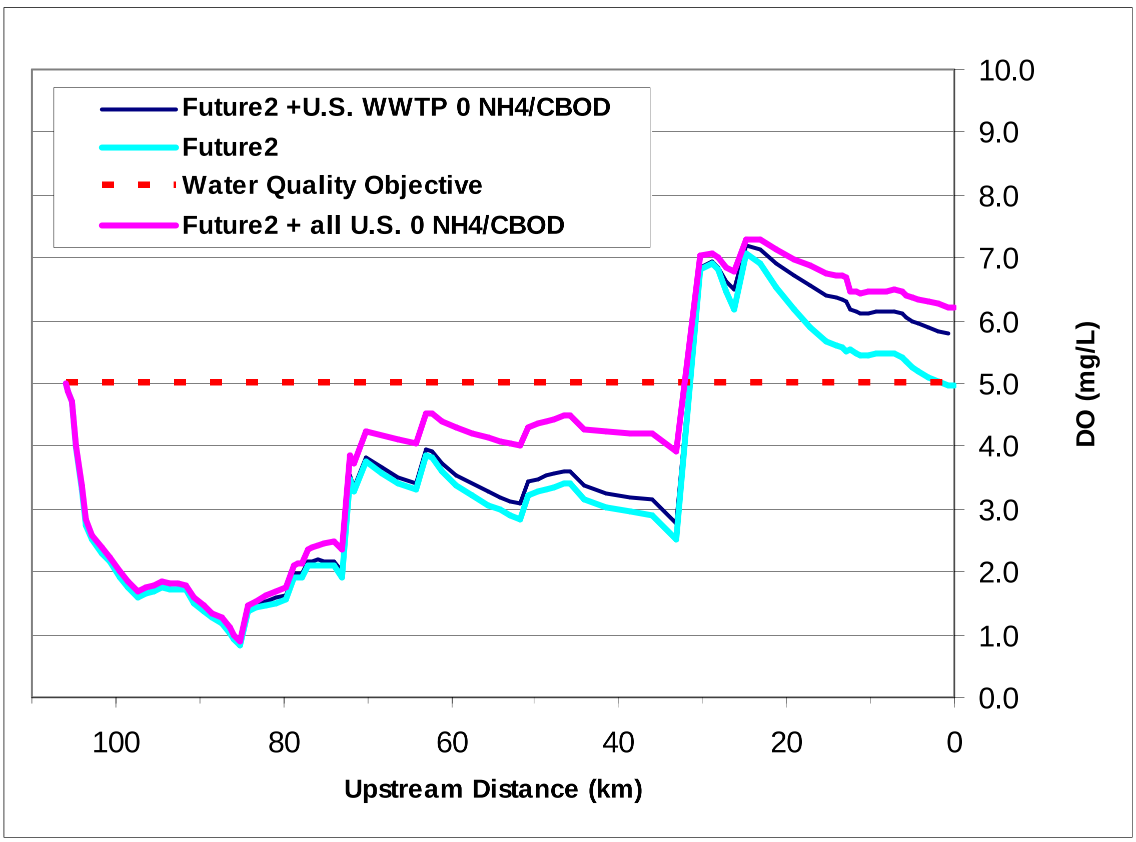
Flow Origins and Sensitivity to U.S. Reductions

The major influence to the upper New River is the International Boundary inflow, which is 100 percent of the model headwaters 106 km from the Salton Sea. At the Future Condition 2 scenario (full implementation of Mexicali II project) this is approximately 5.3 m^3/s. By comparison, the Calexico WWTP is less than 0.2 m^3/s entering at km105. Greeson Drain (0.96 m^3/s at km85) is the only additional modeled inflow prior to km80. Other flows are shown in Table 2-3 of the Final Modeling Report.

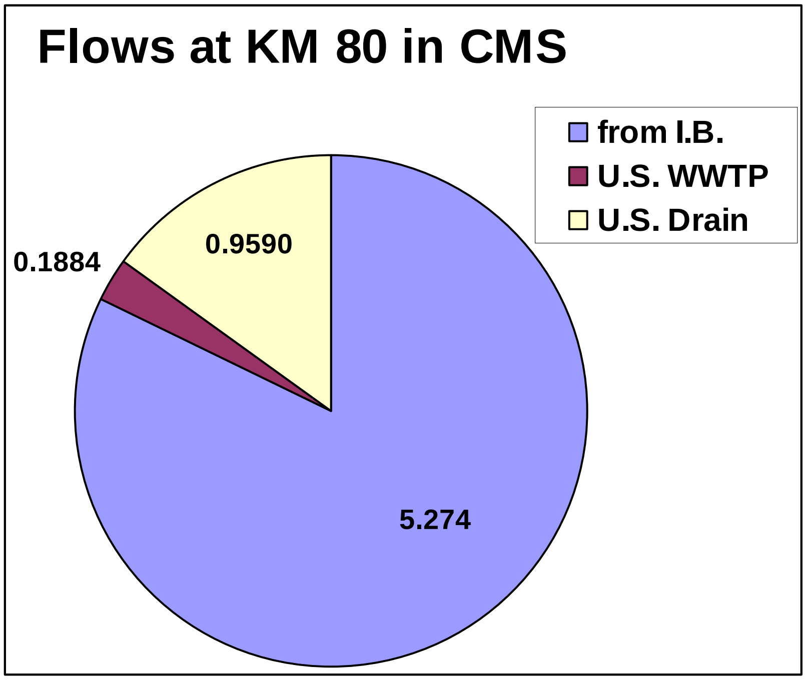
Two additional scenarios were modeled to determine the maximum sensitivity of New River DO to reductions in U.S. WWTPs and drain/tributary inputs. These scenarios confirm that most of the oxygen depletion in the upper river is due to oxygen-consuming NH4 and CBOD from the International Boundary (I.B.).

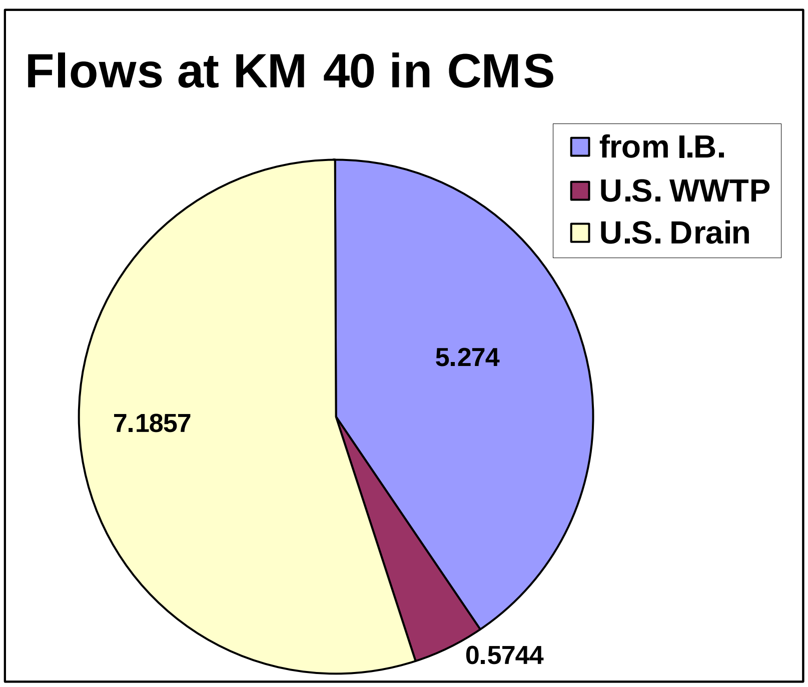
The figure below shows model Future Condition 2 scenario with:

A) all U.S. WWTP discharges changed to 0 CBOD and 0 NH4 (dark blue)
B) all U.S. WWTP, also all drain/tributary inputs changed to 0 CBOD and 0 NH4 (magenta)



The proportions of the flow origins may give some insight into sensitivity of New River DO conditions to each source.





TMDL MODEL SCENARIOS

Overall Approach

The overall approach is to model the existing BOD, DO, and NH_3 loads utilizing the New River QUAL2K Water Quality computer model, and then reduce loads of BOD and NH_3 loads until the WQO DO would be expected to be met. For BOD and NH_3 the load will be set through consideration of the observed relationships with dissolved oxygen (BOD and NH_3) as well as the simulated natural pre-developed conditions.

SUMMARY OF DISSOLVED OXYGEN MODELING RUNS FOR NEW RIVER

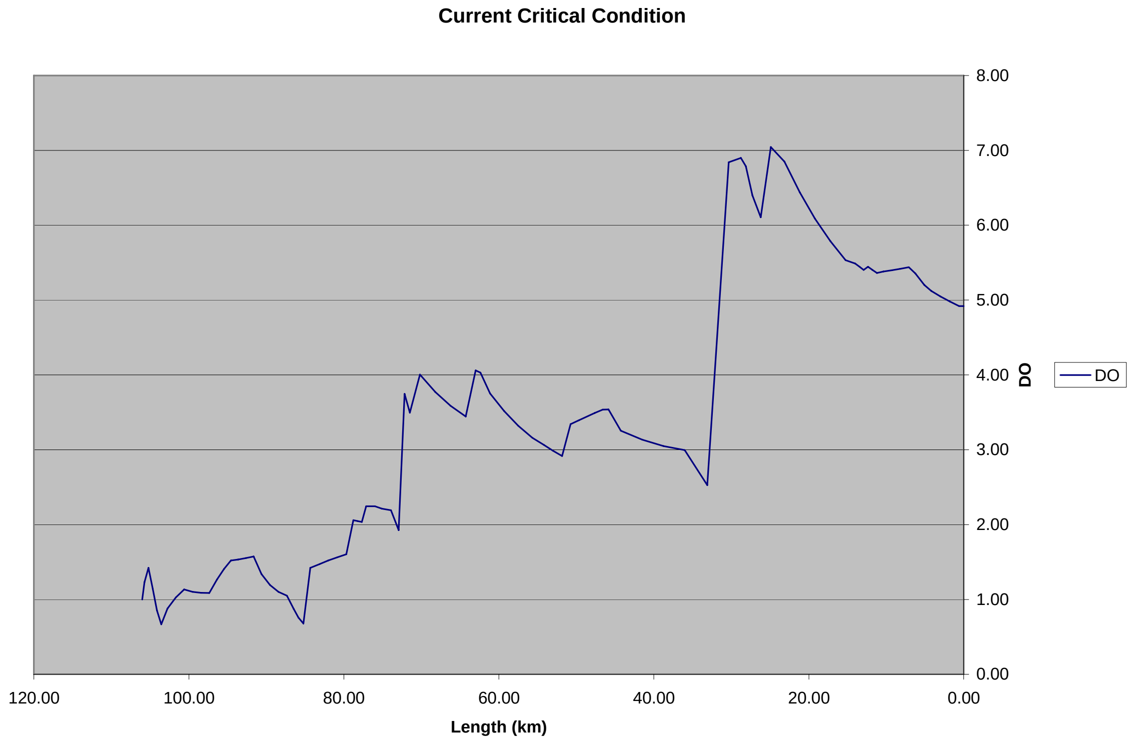
Modeling Scenarios:

<u>A. Current critical conditions</u>

Baseline Assumptions: <u>At International Border</u>
Flow Rate = 3.62 cm^3/sec (128 cfs)
DO = 1
BOD = 19.5
NH4 = 4,650 ugN/L or 4.65 mg/L

Summary of Findings: DO is generally between 1 and 2 for the first 33 km. DO increases to between 3 and 4 for the next 42 km. For the remaining 31 km to the Salton Sea, DO is above 5 and is therefore attaining the standard.

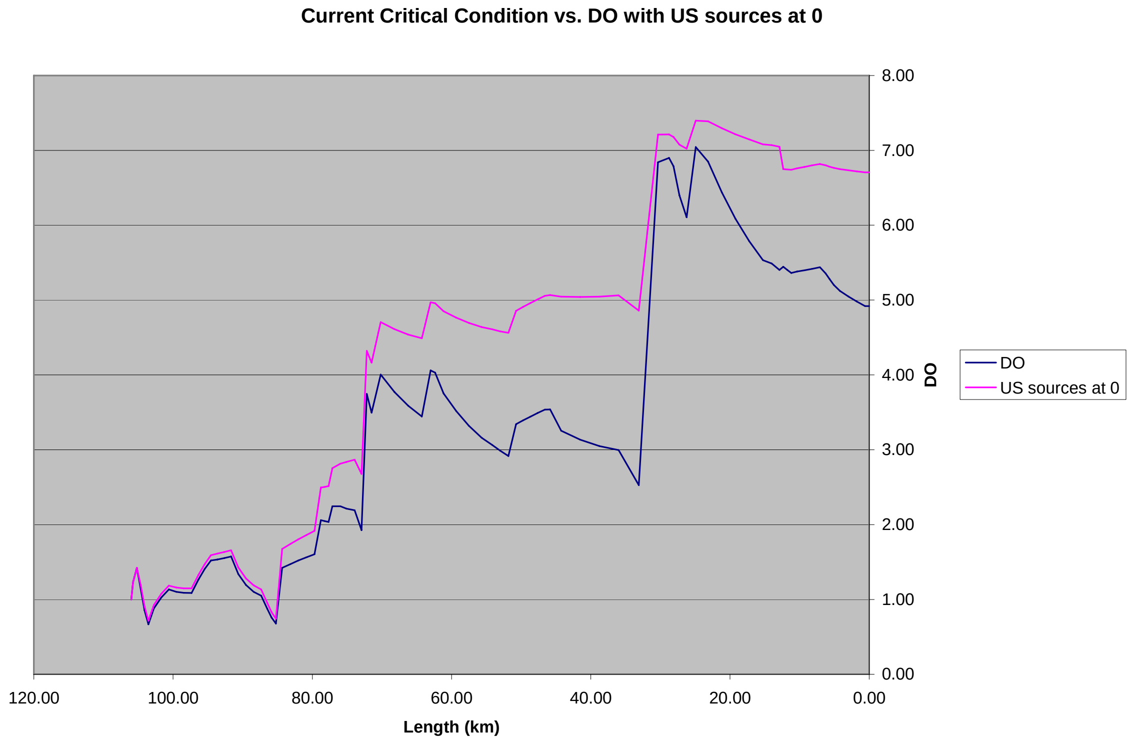
For purposes of this summary, the New River will be split into 3 segments (1st segment - approx. 30% of river, 2nd segment - approx. 40% of river, and 3rd segment - approx. 30% of river).



B. Maximum possible effect of US source reductions

Baseline Assumptions: - No change to Mexico's effluent
- US point sources (WWTPs and Drains) all with minimum 5 DO and zero BOD, NH4, and other nutrients

Summary of Findings: DO in the 1st segment of the river is hardly affected, showing that attainment is not possible without a change in effluent at the Int'l Border. DO in the 2nd segment is improved, however, even if US side pollutants were eliminated entirely, this would only enable an additional 14km of river to meet the standard.



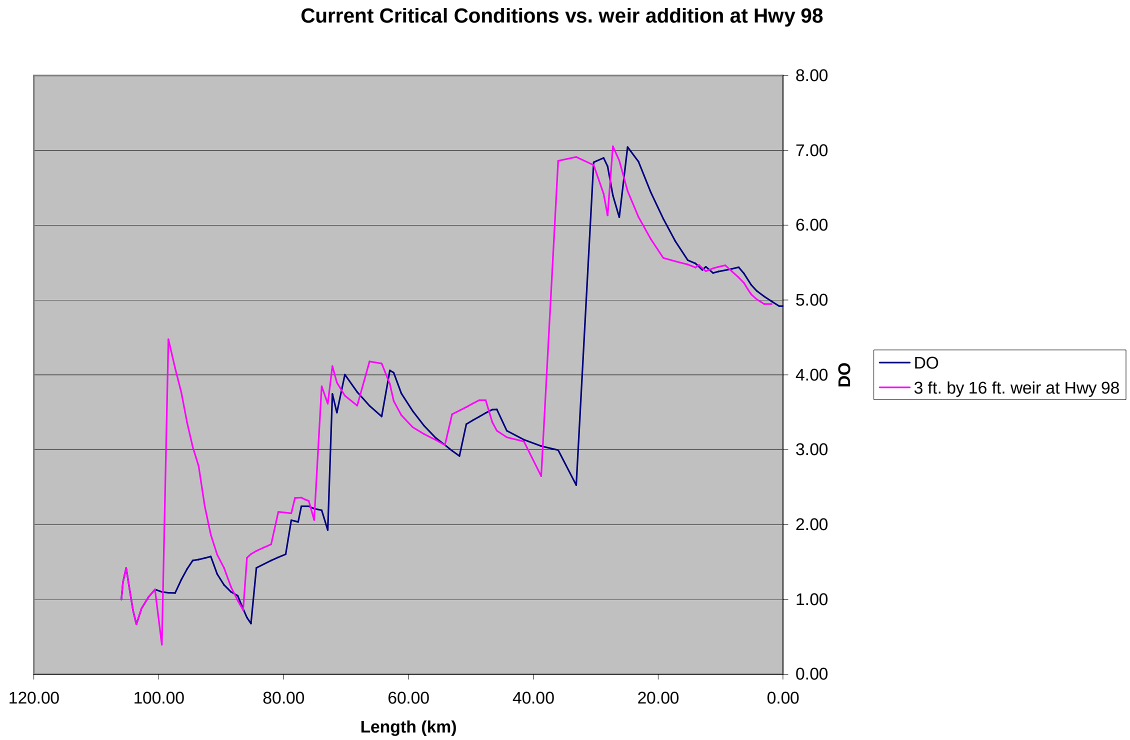
C. Effects of adding weirs on the US side

1. Weir at Hwy 98

Baseline Assumptions: - No change to Mexico's effluent

- 3 ft. high, 16 ft. wide weir added at Hwy 98 (note: modeling additional weirs alters the model's river distance assumptions – more exact estimates may require recalibration)

Summary of Findings: The weir dramatically increases DO at the 98th km of the 1st segment such that it peaks above 4, however, DO is only improved in a 10 km stretch before dropping back down to 1.

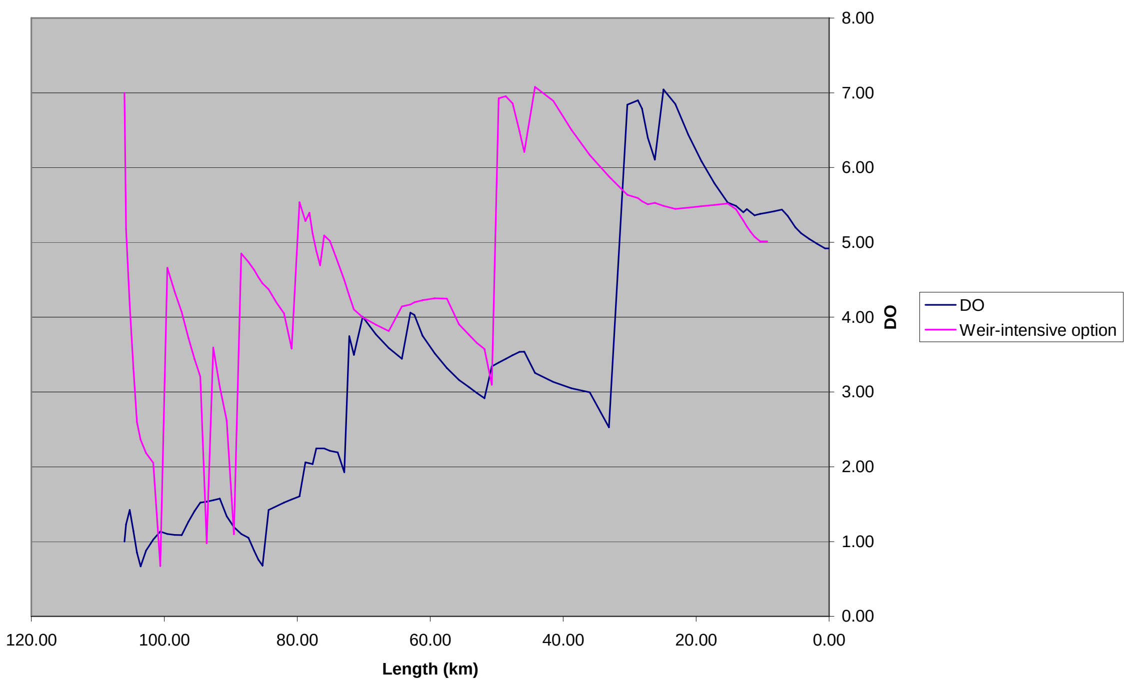


<u>2. Weir-intensive scenario, plus oxygen pumping</u>

Baseline Assumptions: - DO of 7 at Int'l Border resulting from an oxygen pump
- Multiple weirs added on the US side (note: this scenario does not consider engineering feasibility)

Summary of Findings: A series of peaks and dips in DO occurs. Overall, DO would be improved in the 1st segment of the river but not enough to attain the standard. Also, while oxygen-pumping could presumably increase DO at the border, it drops to 1 a short distance thereafter.

Current Critical Condition vs. multiple US weirs

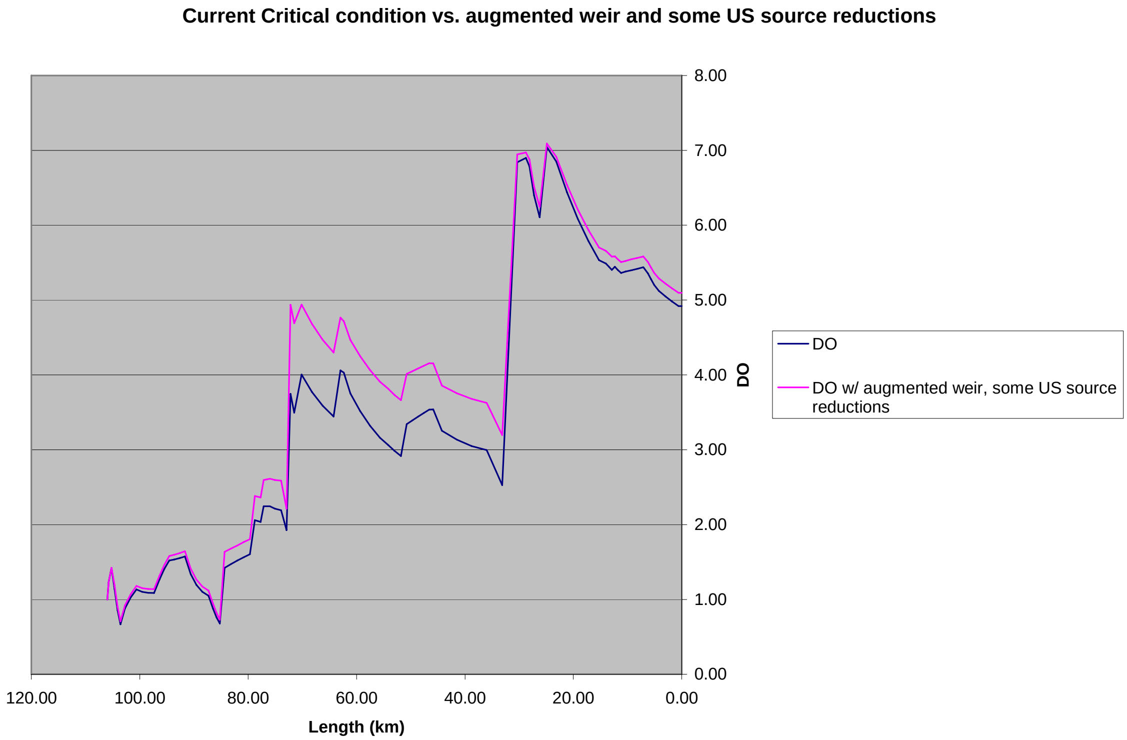


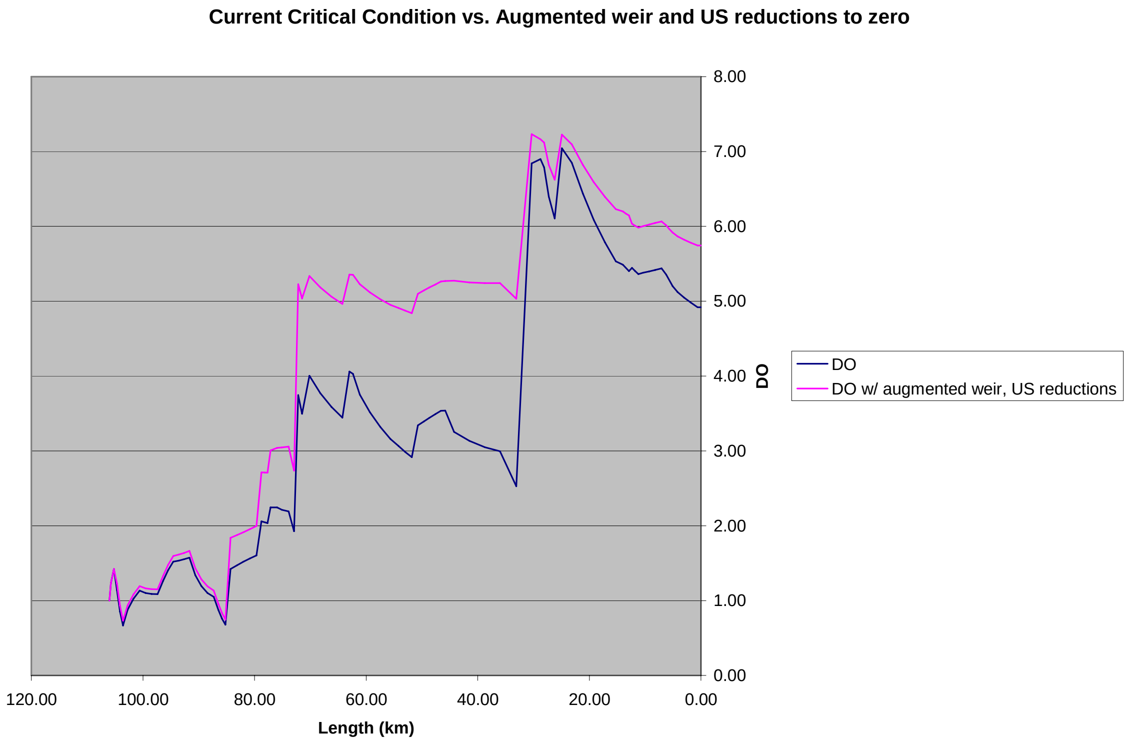
<u>3. Weirs with a focus on the 2nd 40 km segment of New River</u>

Baseline Assumptions: - Existing 2 ft. by 12 ft. weir at Hwy 80 (Evans Hewes) augmented to 3 ft. by 16 ft.

- Plus the following two model runs:
    1. US source reductions through N. Central Drain – improvements in DO, BOD, and NH4 at key point sources and drains
    2. US sources through N. Central Drain reduced to zero

Summary of Findings: The augmented weir raises DO to 5 at Hwy 80. Combined with US source reductions in model run 1, DO rises by about 1 in the 2nd segment of the river but the standard is not attained. In model run 2, with US sources at zero, the standard is attained throughout the 2nd segment.

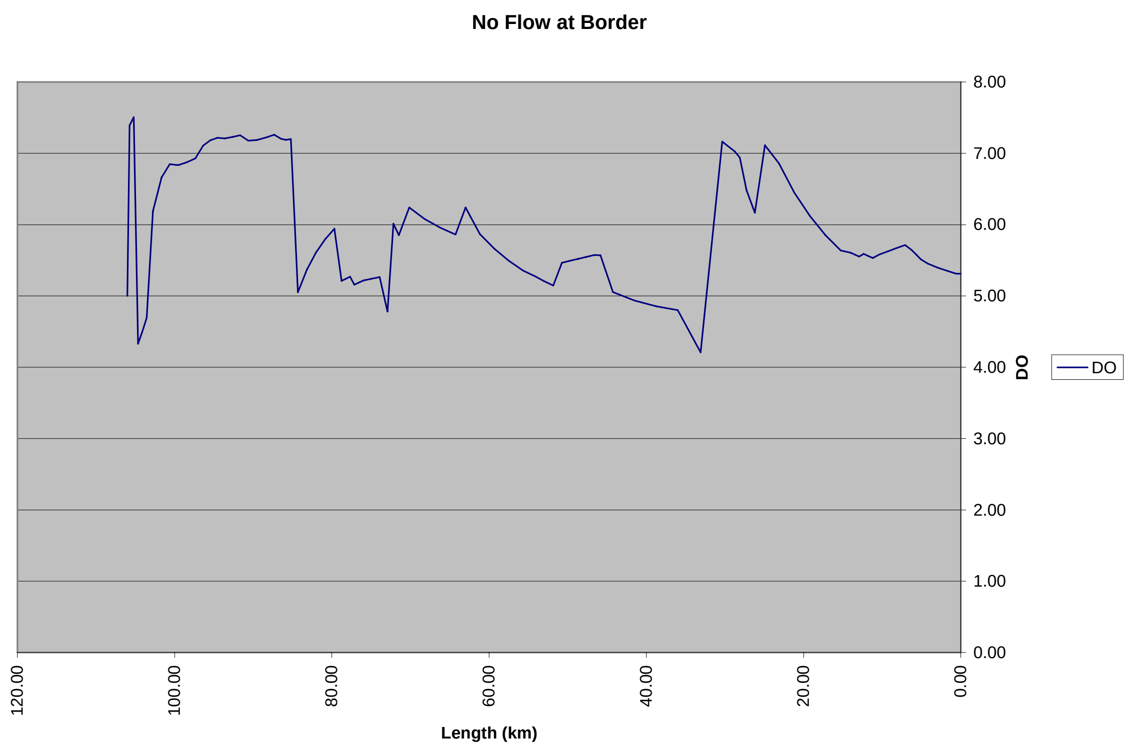




D. No flow from Mexico

Baseline Assumptions: - Flow rate at border reduced to zero

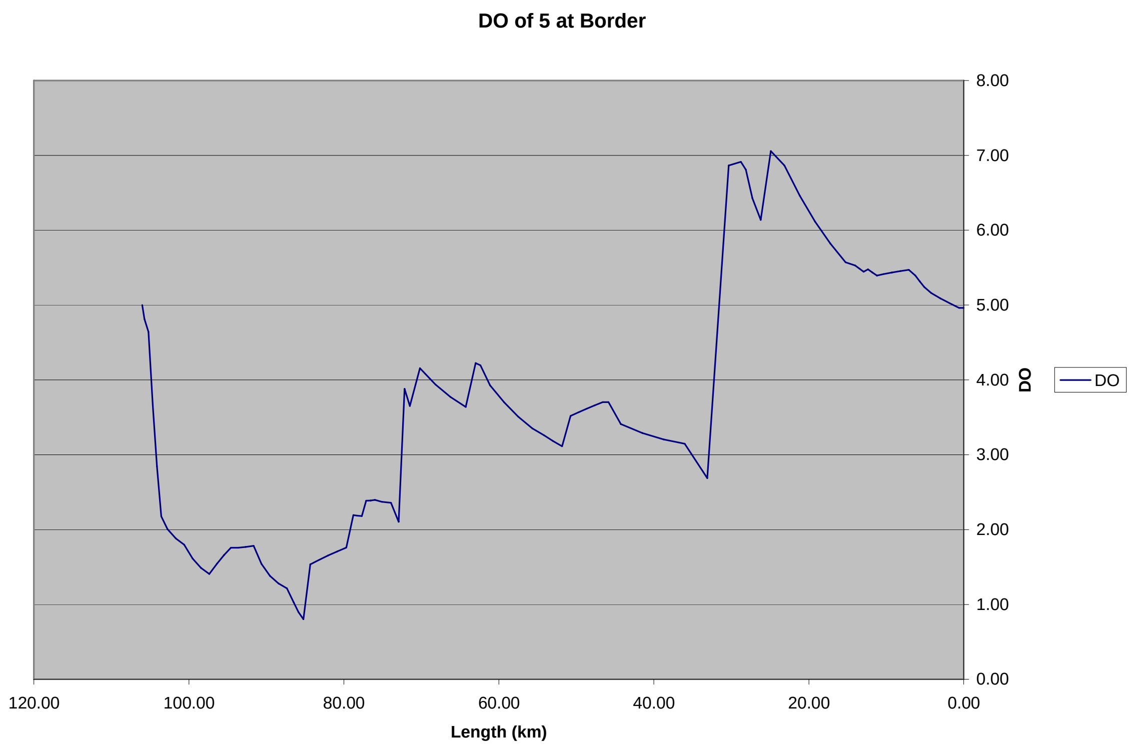
Summary of Findings: The DO standard is attained in the New River with the exception of three locations (totaling 14 km) in which DO drops below 5 but remains above 4. US source reductions would be needed to raise DO above 5 throughout New River.



E. Dissolved oxygen alone improved at border under current Mexican-American treaty

Baseline Assumptions: - DO increased to 5 at Int'l Border

Summary of Findings: Absent reductions in BOD or nutrients from current levels, DO dips to below 2 within 4 km.


DO of 5 at Border
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
DO
DO
120.00
100.00
80.00
60.00
40.00
20.00
0.00
Length (km)

F. Improvements in BOD and NH4 from Mexico's effluent

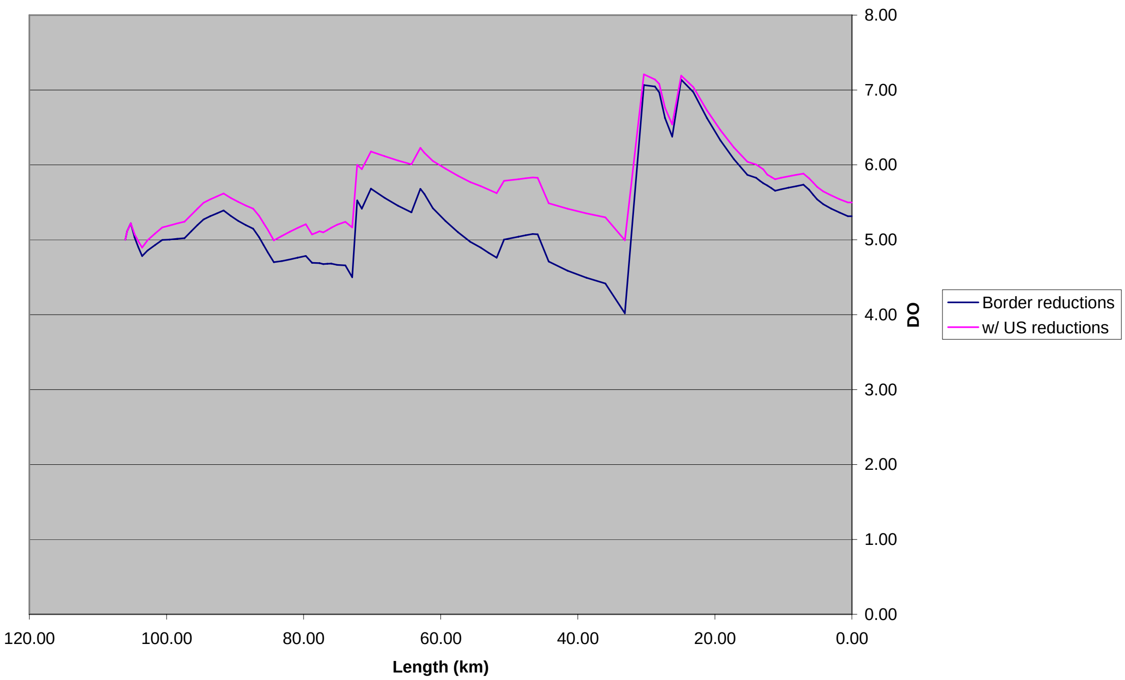
<u>1. Nutrient Removal + Filtration plus US source reductions</u>

Baseline Assumptions: Two model runs:

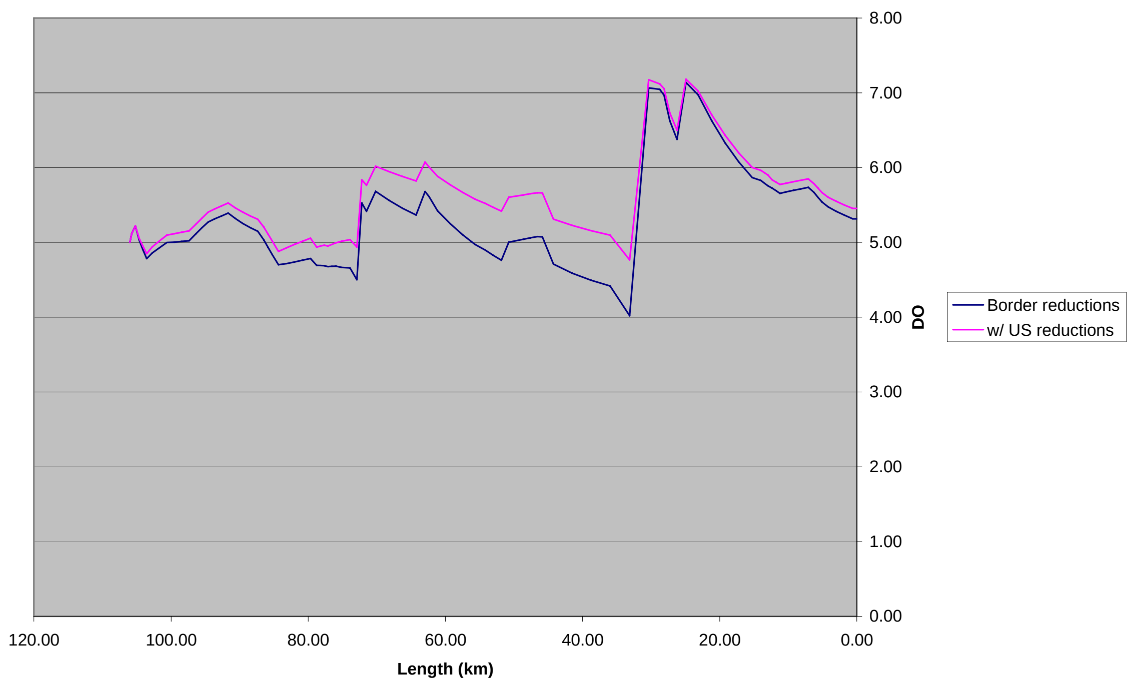
1. At Int'l Border DO=5, **BOD=5, NH4=0.5** mg/l and no US source reductions
2. In addition to the above assumptions, US source reductions through N. Central Drain – 8 BOD at WWTPs and maximum 0.5 mg/L NH4 at WWTPs and drains

Summary of Findings: Reductions in BOD and NH4 from Mexico's effluent go a long way towards improving DO, raising it to above 4 throughout the 1st and 2nd segments of New River. However, this is not sufficient to attain the DO standard. Reducing BOD to a maximum of 8 and NH4 to a maximum of 0.5 from US sources through the N. Central Drain demonstrates attainment.

F.1. BOD and NH4 reductions at Border vs. On both sides of Border

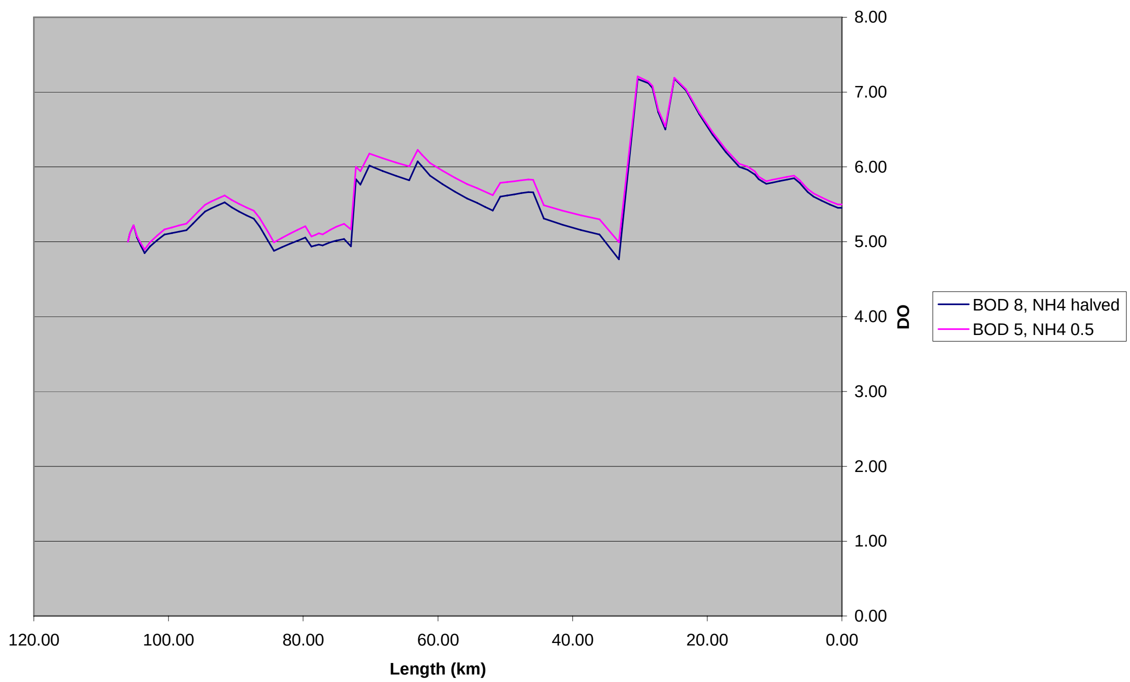


F.1.a. BOD and NH4 reductions at Border vs. On both sides of Border



The chart titled "Model Run F.1_Sensitivity of DO to US Reductions" shows the incremental difference in DO with more modest US source reductions of 15 BOD at WWTPs and NH4 reduced 50% below current levels at WWTPs and drains.

Model Run F.1_Sensitivity of DO to US Reductions

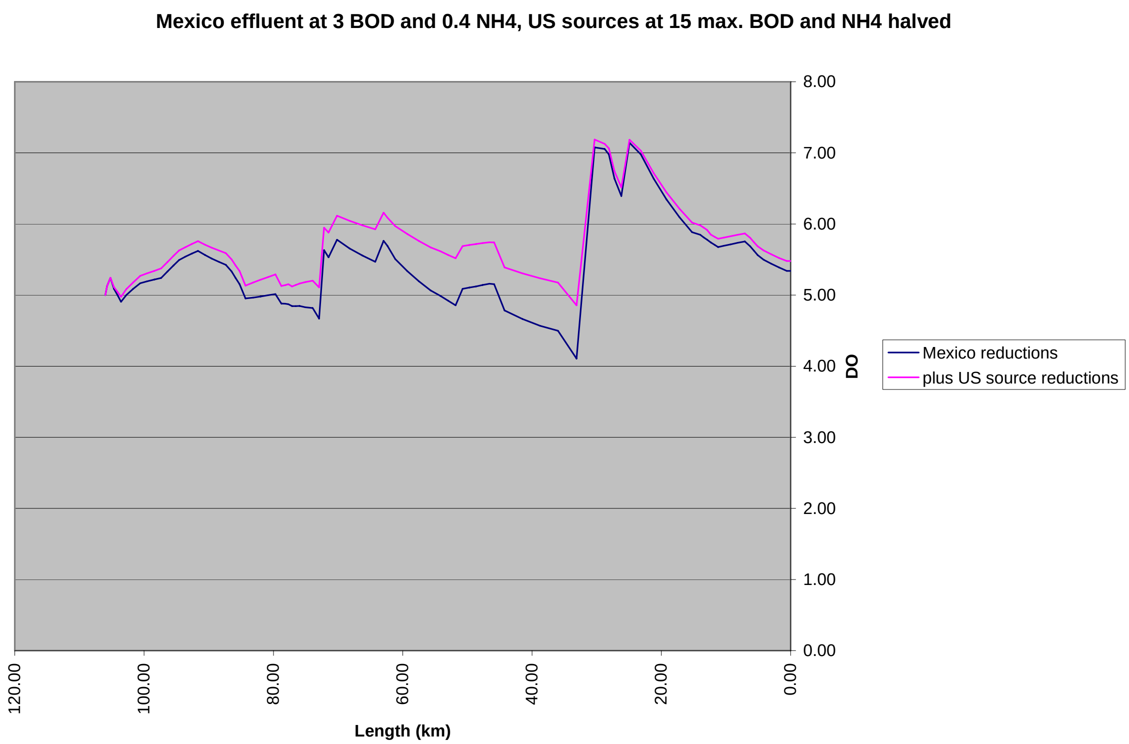


<u>2. Nutrient Removal + High Lime + Filtration plus US source reductions</u>

Baseline Assumptions: Two model runs:

1. At Int'l Border DO=5, **BOD=3, NH4=0.4** mg/l and no US source reductions
2. In addition to the above assumptions, US source reductions through N. Central Drain – 15 BOD at WWTPs and NH4 reduced 50% below current levels at WWTPs and drains

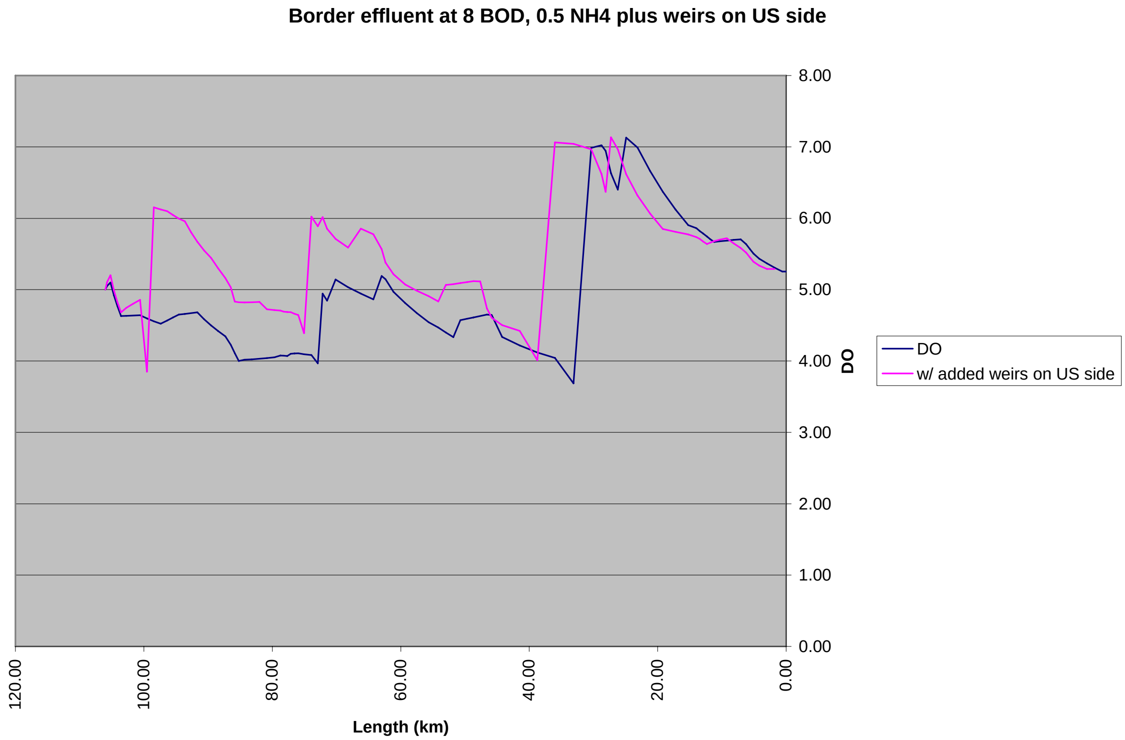
Summary of Findings: The incremental difference of further reducing BOD and NH4 from Mexico's effluent results in slightly higher DO relative to option F.1. This alone is not sufficient to demonstrate attainment, however, attainment can be reached with fewer reductions from US sources relative to option F.1.



<u>3. Nutrient Removal to achieve 8 BOD and 0.5 NH4 plus US weirs</u>

Baseline Assumptions: - At Int'l Border DO=5, BOD=8, NH4=0.5
- 3 ft. by 16 ft. weir added at Hwy 98
- Augmented weir at Hwy 80 (Evans Hewes) to 3 ft. by 16 ft.

Summary of Findings: The combined effect of improvements to Mexico's effluent and US-side weirs raises DO above 5 for approximately 40 km, cumulatively, in the 1st and 2nd segments. However, DO dips to 4 so attainment is not achieved.

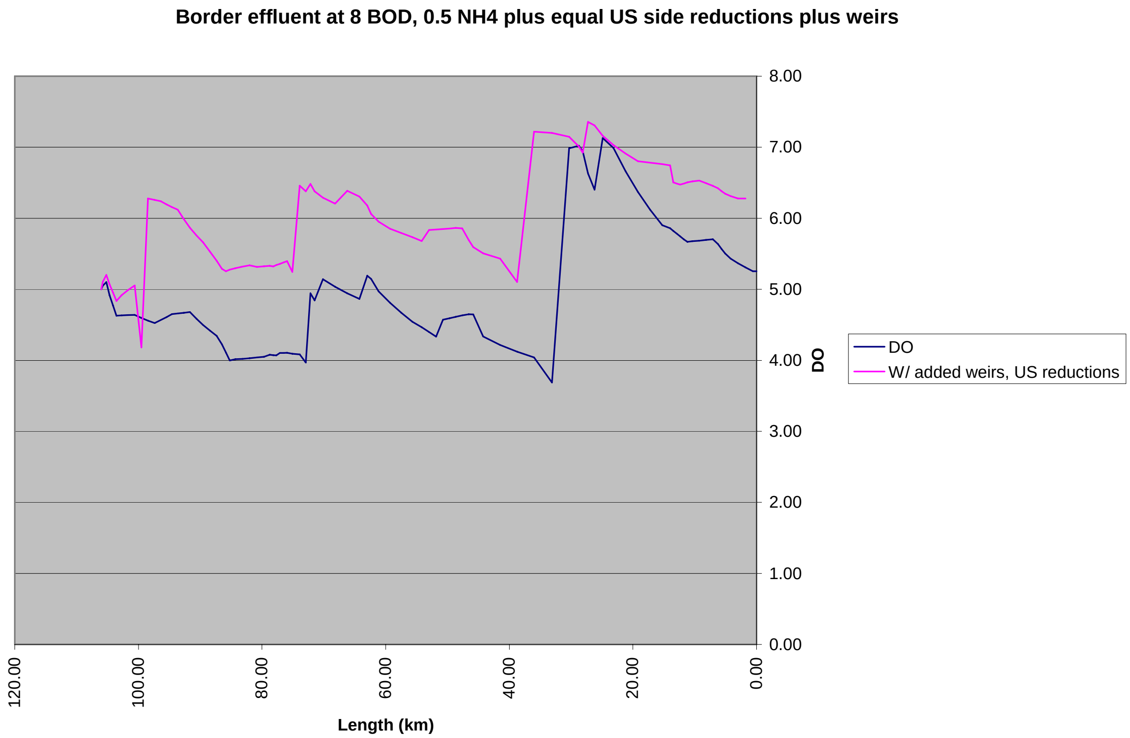

Border effluent at 8 BOD, 0.5 NH4 plus weirs on US side
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
DO
120.00
100.00
80.00
60.00
40.00
20.00
0.00
Length (km)
DO
w/ added weirs on US side

<u>4. Scenario F.3 plus US source reductions</u>

Baseline Assumptions:
- At Int'l Border, DO=5, BOD=8, NH4=0.5
- 3 ft. by 16 ft. weir added at Hwy 98
- Augmented weir at Hwy 80 (Evans Hewes) to 3 ft. by 16 ft.
- US source reductions at WWTPs and drains such that DO is no lower than 5, BOD no higher than 8, and NH4 no higher than 0.5 mg/L

Summary of Findings: The combined effect of improvements in Mexico's effluent, US-side weirs, and US-side reductions is sufficient to achieve attainment in all but the first 8 km of the 1st segment where DO dips below 5 in some locations but still remains above 4.

Results from model scenarios that reduce BOD and NH4 from Mexico's effluent reveal that incremental source reductions on the US side are needed to attain the DO standard throughout New River.



ATTACHMENT 1 (REVISED)

PROPOSED DISSOLVED OXYGEN TOTAL MAXIMUM DAILY LOAD (TMDL) FOR THE FIRST TWELVE MILE SEGMENT OF THE NEW RIVER DOWNSTREAM OF THE INTERNATIONAL BOUNDARY

Summary of Proposed Action

This Total Maximum Daily Load (TMDL) proposal describes water quality impairments for dissolved oxygen (DO) in the New River at International Boundary, and establishes procedures to control impairments. Under the federal Clean Water Act (CWA), water quality standards (WQSs) consist of designated beneficial uses, numeric or narrative water quality criteria (a.k.a. water quality objectives (WQOs), California Water Code (CWC), Section 13241) that protect beneficial uses, and an antidegradation policy requirements. CWA, Section 303(d) requires states to identify impaired surface waters that do not meet WQSs, and to establish TMDLs for pollutants causing impairments. A TMDL is the total amount of a given pollutant that a given waterbody can assimilate without violating WQOs, and is equal to the sum of pollutant allocations for point and nonpoint sources, including natural sources and a margin of safety to address uncertainties.

The New River originates approximately 20 miles south of the International Boundary with Mexico, and flows northward across the border for about 60 miles until it empties into the Salton Sea. Average yearly flows of the New River in cubic feet per second (cfs) from 2003 to 2007 are as follow:

Year	Average Flow of New River @ International Boundary (cfs)	Average Flow of New River into Salton Sea (cfs)
2003	153	569
2004	155.5	~~580~~602
2005	17~~7~~9.9	623~~31~~
2006	1~~63~~56	584~~94~~
2007	124.5	574

The New River is the second largest tributary to the Salton Sea, contributing about 32% of the Sea's total inflow. The New River is comprised of agricultural return flows from Imperial Valley and Agricultural, Municipal and Industrial wastes from Mexico.

The New River is on the CWA, Section 303(d) List because of impairments including low DO that violates WQOs established in the Water Quality Control Plan (Basin Plan) for the Colorado River Basin Region. Recent water quality analyses of the New River at International Boundary indicate low concentrations of DO (< 5 mg/l) as a result of waste discharge from Mexicali, Mexico ~~Historically, the two major sources of dissolved organic matter to the New River, which cause lower DO, have been: (1) NPDES facilities (waste water treatment plants) that discharge wastes, and (2) the municipality of Mexicali, Mexico, which has an inadequate sewage infrastructure that discharges raw and partially treated sewage~~ to the New River and its tributaries in Mexico. ~~Other sources and activities that contribute to the soluble organic matter load in the New River include agricultural discharges, storm water runoff, and trash discharged to the River in Mexico and the United States.~~ These concentrations violate: (1) narrative and numeric standards in the *Water Quality Control Plan for the Colorado River Basin Region* (Basin Plan) (Colorado River Basin Regional Water Quality Control Board 2006), and (2) narrative standards in Minute No. 264 of the Mexican-American Water Treaty (*Recommendations for solution of the New River border sanitation problem at Calexico, California/Mexicali, Baja Norte*, 1980). The violation of these standards indicates the impairment to designated beneficial uses for the New River due to low DO levels that endanger aquatic life, wildlife and public health.

To restore New River beneficial uses regarding DO, the proposed TMDL establishes a numeric target for DO as no less than 5 mg/l. Loading of wastes which increase biological oxygen demand (BOD) and ammonia (NH_3) to the New River from all point and nonpoint sources should not cause the DO levels to be below the numeric target at any day of the year.

This TMDL proposal requests cooperation from Mexico to implement actions to prevent wastewater discharges into the New River in Mexicali from producing conditions that violate the TMDL, and the assistance of the U.S. federal government to work with Mexico in this endeavor. This TMDL also recommends actions for other third party cooperating agencies and organizations with an interest in New River water quality. Regional Board staff will track TMDL implementation, monitor water quality progress, enforce provisions, and propose modifications of the TMDL to the Regional Board if necessary, in accordance with a time schedule.

ATTACHMENT 2 (REVISED)

PROPOSED DISSOLVED OXYGEN TOTAL MAXIMUM DAILY LOAD (TMDL) FOR THE FIRST TWELVE MILE SEGMENT OF THE NEW RIVER DOWNSTREAM OF THE INTERNATIONAL BOUNDARY

SCIENTIFIC COMPONENTS OF THE TMDL TO REVIEW

Background

The following table describes the components of a TMDL.

Component	Purpose
Project Definition~~Problem Statement (Project and Watershed Description)~~	~~Identifie~~Describess the impairment being addressed by the ~~basis for~~ TMDL, identifies the project area, provides important information relevant to the 303(d) listing, and generally identifies any key information affecting the development of the TMDL (e.g., major sources, management issues, regulatory issues). ~~development, Water Quality Standards (WQSs) issues and impairments that prompted TMDL development~~
Data and Source Analysis	Characterizes the amount of pollutants entering the receiving water from various sources (e.g., point, nonpoint, and natural sources of pollution)
Critical Conditions and Seasonal Variations	Describes the critical condition/seasonality with the strongest impact on pollutant loading.
Numeric Target	Identifies specific in-stream goals and endpoints for the TMDL which ensure attainment of applicable WQSs
Linkage Analysis	Specifies the critical quantitative link between applicable WQSs and the TMDL. Loading capacity reflects the amount of a pollutant that may be delivered to the waterbody and still achieve WQSs (as the WQSs are interpreted through the Numeric Target)
TMDL Calculation and Allocations (Load Allocations, Waste Load Allocations, Margin of Safety)	Provides the calculations for total allowable loads and allocation of these loads among different sources such that applicable WQSs are attained, while accounting for seasonal variation and uncertainty in the analysis of the data
Implementation and Monitoring Plan	Specifies nonpoint source Management Practices, point source controls, a Monitoring Plan to assesses TMDL implementation and provide for TMDL adjustment as needed, and other actions necessary to implement the TMDL

"The statute mandate for external scientific peer review (Health and Safety Code Section 57004) states that the reviewer's responsibility is to determine whether the scientific portion of the proposed rule is based upon sound scientific knowledge, methods, and practices.

We request that you make this determination for each of the following issues that constitute the scientific basis of the proposed regulatory action. An explanatory statement is provided for each issue to focus the review."

Required Issues to be addressed in Peer Review

1. ~~**Problem Statement (Project and Watershed Description)**~~**Project Definition** – This section describes ~~The~~ DO impairment ~~is described within the context of the~~in the New River at the International Boundary~~watershed~~. Low levels of ~~dissolved oxygen (~~DO~~)~~ in the water column threatens fish and wildlife communities that utilize New River habitat downstream of the International Boundary and violate New River's WQSs. A TMDL implementation plan to achieve WQSs is proposed. The TMDL implementation focuses on monitoring and controlling known causes of low DO from Mexico.

2. **Data and Source Analysis** – The source analysis for this TMDL identifies and quantifies natural and human-related Biological Oxygen Demand (BOD) and Ammonia (NH_3) sources to the New River. Data and information used in the source analysis were obtained from the Regional Board, the United States Geological Survey (USGS), the Imperial Irrigation District (IID), the United States International Boundary and Water Commission (IBWC), Wastewater Treatment Plants, and others.

3. **Critical Conditions and Seasonal Variations** - This section describes the critical condition/seasonality with the strongest impact on organic matter loading. Identifying these conditions is important to achieve DO WQOs and TMDL numeric targets.

4. **Numeric Targets** – The numeric target for dissolved oxygen for this TMDL was developed to protect all beneficial uses of the New River, and is equal to the Water Quality Objectives (WQOs) set forth in the Regional Board's Basin Plan. To satisfy human health criteria and adequately protect aquatic habitats, management practices that reduce organic waste will be utilized to implement this TMDL.

5. **TMDL Calculation and Allocations and Linkage Analysis** - This TMDL assigns allocations for BOD and NH_3 to all point and nonpoint sources of waste into the New River expressed as kilogram per day, to ensure protection of beneficial uses. These allocations were based on a QUAL2K water quality computer model that links BOD, NH_3, and DO, and was developed by Tetra Tech Inc. for the USEPA. Allocations are applicable to ~~throughout~~ the New River at International Boundary impaired designated segment ~~drain system~~.

6. **Implementation Plan** – This implementation is different from other TMDLs because it relies on the assistance of U.S. Federal Government to deal with another country (Mexico). The implementation plan requests cooperation from Mexico to implement actions to prevent wastewater discharges into the New River in Mexicali from producing conditions that violate the TMDL~~. The implementation plan also requires the three (3) waste management facilities located along the banks of the New River in Calexico, Brawley and Imperial, and the eight (8) NPDES facilities discharging to the New River watershed, to maintain compliance with their Regional Board Orders (permits).~~

7. **Monitoring Plan** - Regional Board staff will track TMDL implementation, monitor water quality progress, enforce provisions, and propose modifications of the TMDL to the Regional Board if necessary, in accordance with a time schedule. Two types of monitoring will be performed; water quality monitoring, and implementation tracking.

OVERARCHING QUESTIONS

Reviewers are not limited to addressing only the specific issues presented above, and are asked to contemplate the following "big picture" questions.

(a) In reading the staff technical reports and proposed implementation language, are there any additional scientific issues that are part of the scientific basis of the proposed rule not described above? If so, please comment with respect to the statute language given above.

(b) Taken as a whole, is the scientific portion of the proposed rule based upon sound scientific knowledge, methods, and practices?

Reviewers should also note that some proposed actions may rely significantly on professional judgment where available scientific data are not as extensive as desired to support the statute requirement for absolute scientific rigor. In these situations, the proposed course of action is favored over no action.

The preceding guidance will ensure that reviewers have an opportunity to comment on all aspects of the scientific basis of the proposed Board action. At the same time, reviewers also should recognize that the Board has a legal obligation to consider and respond to all feedback on the scientific portions of the proposed rule. Because of this obligation, reviewers are encouraged to focus feedback on the scientific issues that are relevant to the central regulatory elements being proposed."

ATTACHMENT 3

PROPOSED DISSOLVED OXYGEN TOTAL MAXIMUM DAILY LOAD (TMDL) FOR THE FIRST TWELVE MILE SEGMENT OF THE NEW RIVER DOWNSTREAM OF THE INTERNATIONAL BOUNDARY

SCIENTIFIC PROFESSIONALS INVOLVED IN GUIDING TMDL DEVELOPMENT

Amrhein, Christopher. University of California, Riverside.

Anderson, Michael. University of California, Riverside.

Bali, Khaled. University of California Cooperative Extension.

Barnum, Douglas. U.S. Geological Survey.

Black, Glenn. Department of Fish and Game.

Crayon, Jack. Department of Fish and Game. Bermuda Dunes.

Gao, Peng. University of California Cooperative Extension.

Guerrero, Juan. University of California Cooperative Extension.

McGrew, Ed. United States Filter Corporation.

Pasternack, Gregory. University of California, Davis.

Robertson, Dale. U.S. Geological Survey.

Robertson, Robert. Coachella Valley Water District.

Rodriguez, Cheryl. United States Bureau of Reclamation.

Schladow, Geoffrey. University of California, Davis.

Setmire, James. U.S. Geological Survey, Retired

Wallender, Wesley. University of California, Davis.

ATTACHMENT 4

PROPOSED DISSOLVED OXYGEN TOTAL MAXIMUM DAILY LOAD (TMDL) FOR THE FIRST TWELVE MILE SEGMENT OF THE NEW RIVER DOWNSTREAM OF THE INTERNATIONAL BOUNDARY

SALTON SEA TRANSBOUNDARY WATER SHED MAP

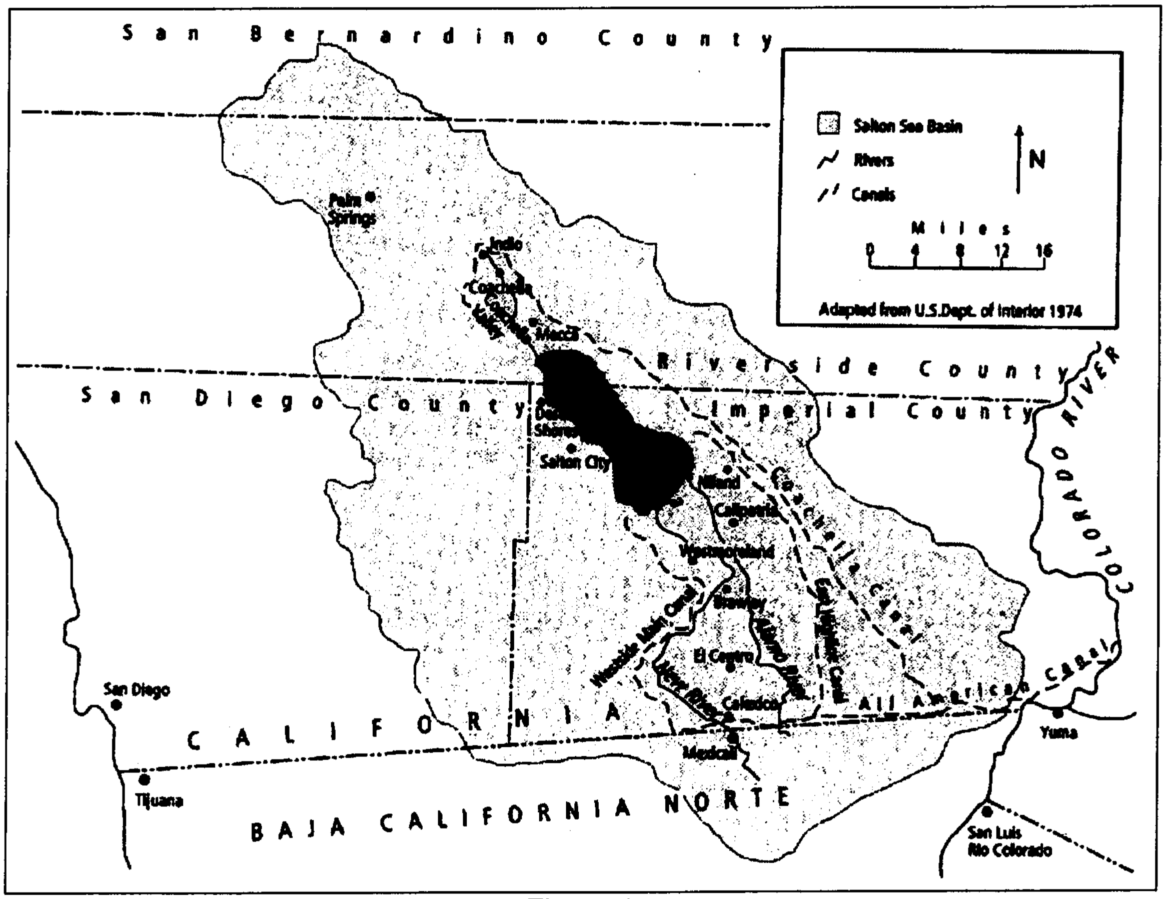


Figure 1

ATTACHMENT 5

GUIDANCE TO REVIEWERS

1. Reviewers are not allowed to discuss the proposal with those listed in Attachment 3 for each request. These are the individuals who participated in development of the proposal.

2. Discussions between staff and reviewers are not permitted. Reviewers may request clarification of certain aspects of the review process or the documents sent to them. Clarification questions and responses must be in writing. Clarification questions about reviewers' comments by staff and others affiliated with the organization requesting the review, and responses to them, also must be in writing. These communications will become part of the administrative record.
   Independent peer review is characterized by no interactions, or a limited number of them. The organization requesting independent review should be careful that organization-reviewer communications do not become a collaboration, or are perceived by others to have become so. The reviewers are not technical advisors.

3. Confidentiality of Reviewers' Identities and Release of Review Comments: Each reviewer's identity may be kept confidential until that person's comments are received by the organization that has requested the review. After the comments are received, the reviewer's identity and comments must be made available to anyone requesting them.

4. Before and During the External Review: Reviewers are under no obligation to disclose their identity to anyone enquiring, and we recommend that they keep their role as reviewer confidential until after their reviews have been submitted.

5. Requests to Reviewers by Third Parties to Discuss Comments: Reviewers may be approached by parties representing special interests, the press, colleagues, or others, after they have submitted their reviews. Reviewers are under no obligation to discuss their comments with any party, and we recommend that they do not. All outside parties are provided an opportunity to address a proposed regulatory action during the public comment period and at the Cal/EPA organization Meeting where the proposal is considered for adoption. Discussions outside these provided avenues for comment could

seriously impede the orderly process for vetting the proposal under consideration.