Lost River Modeling Scenarios
Scenario 1D – Variable Load Reduction TMDL Except for Impoundments

6/22/2005

Current Scenario List

1A. Variable Load Reduction TMDL
1B. 60% Load Reduction (run through Wilson)
1C. Variable Load Reduction Except for Dissolved Phosphorus (run through Wilson)
1D. Variable Load Reduction TMDL Except for Impoundments
2. External Loading Only (using Upper Klamath Lake/Klamath River Existing Conditions)
3A. Variable Load Reduction TMDL with Malone at Existing Conditions (run through Wilson)
Shade 30% Reduction to Solar Radiation Except in Wilson, Tule, and Lower Klamath Lakes

Additional Scenarios

- Variable Load Reduction TMDL with Malone at Existing Conditions (meet WQS in riverine portions only)
- Equal Concentration TMDL
- Equal Load Reduction TMDL
- External Loading Only with Upper Klamath Lake TMDL Results

Scenario 1D (Variable Load Reduction TMDL Except for Impoundments) Overview

This scenario is identical to Scenario 1A (TMDL scenario), except that dissolved phosphorus levels were not reduced, and DO criteria were not achieved in all the Oregon impoundments. Harpold, Wilson, and Anderson-Rose Reservoirs, and the Klamath Straits Drain were identified as impoundments for the purpose of this analysis. Only riverine criteria were evaluated for compliance, although Harpold Reservoir also achieved compliance (due to reductions required to meet other compliance points). The analysis was performed for 1999. Results for this scenario are presented in the plots below.

Assumptions

- Nitrogen and BOD boundary conditions were reduced equally (within each waterbody).
- SOD was reduced by the same % as boundary condition reductions (e.g., 20% boundary condition reduction would result in a 20% SOD reduction). This is based on the linear assumption, as described in Chapra 1997, and has been widely used in TMDL development when sediment diagenesis is not explicitly simulated. The SOD reduction ratio for all the downstream waterbodies was calculated based on the lumped loading from all tributaries, distributed loadings, as well as the contribution from upstream waterbodies. For example, the reduction of loading to Waterbody #1 also influences SOD reduction in Waterbody #2. The loading used to calculate the SOD reduction is on an annual basis, and ammonia, nitrite/nitrate, and CBOD were used as the corresponding constituents. Since the loading reduction ratio of each of the four constituents can be different, the average of the calculated reduction ratio for the four constituents was used as the SOD reduction ratio.
- Boundary condition DO was kept at incoming levels when above water quality criteria; otherwise, it was set to OR's most stringent water quality criteria (6.5 mg/L – which is based on the OR 30-day average criteria). This is based on the assumption that implementation in the watershed will enable DO levels for incoming water to achieve the water quality criteria. If

the incoming water does not achieve the criteria, in-stream DO levels will violate the criteria at some locations (primarily where watershed return flow dominates).

- No change in temperature for boundary conditions
- The maximum algae concentration was forced to the 15 ug/L standard or lower (only when it was higher than the standard). This is based on the assumption that implementation in the watershed will reduce algae concentrations for the incoming water (based on corresponding nutrient reductions).
- Consistent % reductions were assigned for all segments upstream of Tule Lake (1 through 6) and for all segments from Tule Lake to the Klamath River (7 through 12).
- No MOS was explicitly considered in the modeling.
- OR minimum, 7-day average, and 30-day average DO criteria were all evaluated and achieved for riverine sections (i.e., all sections except Harpold, Wilson, and Anderson-Rose Reservoirs, and the Klamath Straits Drain).
- The CA minimum DO criterion was evaluated and achieved for all CA segments.
- Critical locations for compliance with wq criteria (see map on the following page):
    - Lost River at Gift Road (LRGR)
    - Lost River at Keller Bridge (LRKB)
    - Harpold Dam (LRHD)
    - Lost River at Stevenson Park (LRSP)
    - Lost River at Olene Gap (LROG)
    - Wilson Dam (LRWRC)
    - Lost River at Dehlinger Road (LRDR)
    - Lost River at Hwy 39 n/w of Merrill (LR39)
    - Anderson-Rose Dam (LRAR)
    - Lost River at Stateline Road – OR/CA border (LRSR)
    - Lost River at East-West Road (LREW)
    - Tule Lake (TLTO)
    - Lower Klamath Refuge/Lake (LKL)
    - Klamath Straits Drain at Stateline Road – OR/CA border (KSDSR)
    - Klamath Straits Drain at Township Road (KSDTR)
    - Klamath Straits Drain at Hwy 97 (KSD97)
    - Klamath Straits Drain at (KSDM)

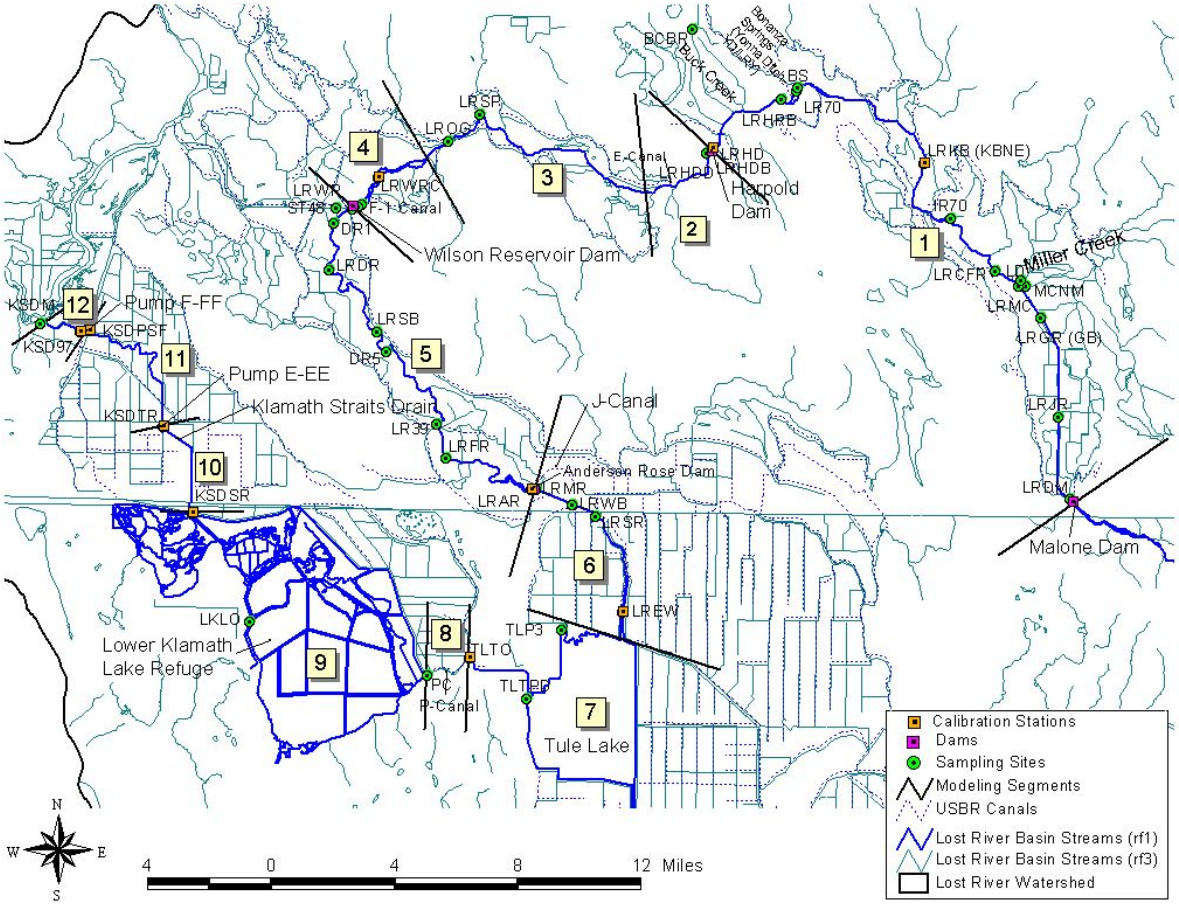
Load Reductions Required to Achieve Water Quality Criteria (in riverine sections for OR and in all sections for CA)

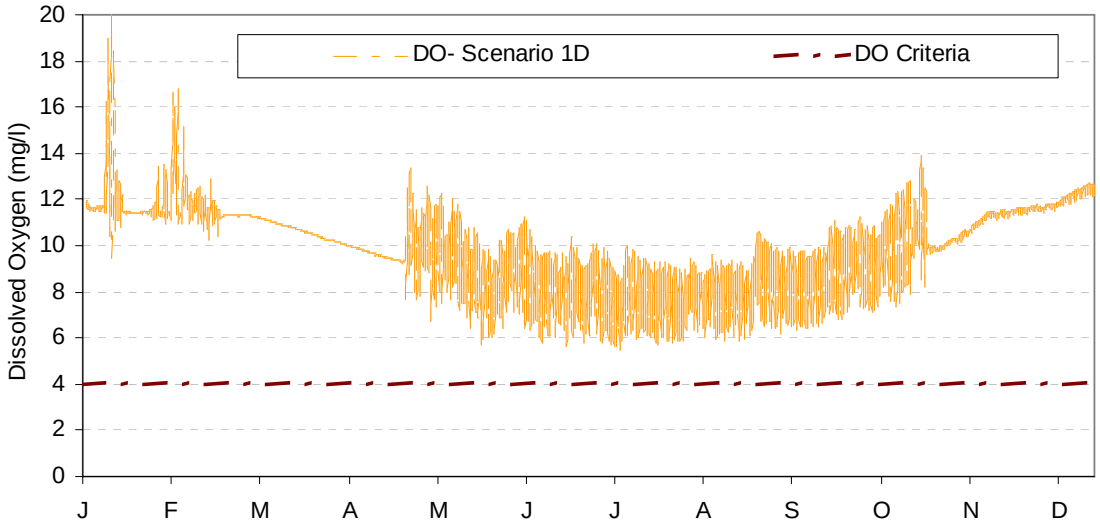
Waterbody #	Reduction %
1	50
2	50
3	50
4	50
5	50
6	50
7	49
8	49
9	49
10	49
11	49
12	49

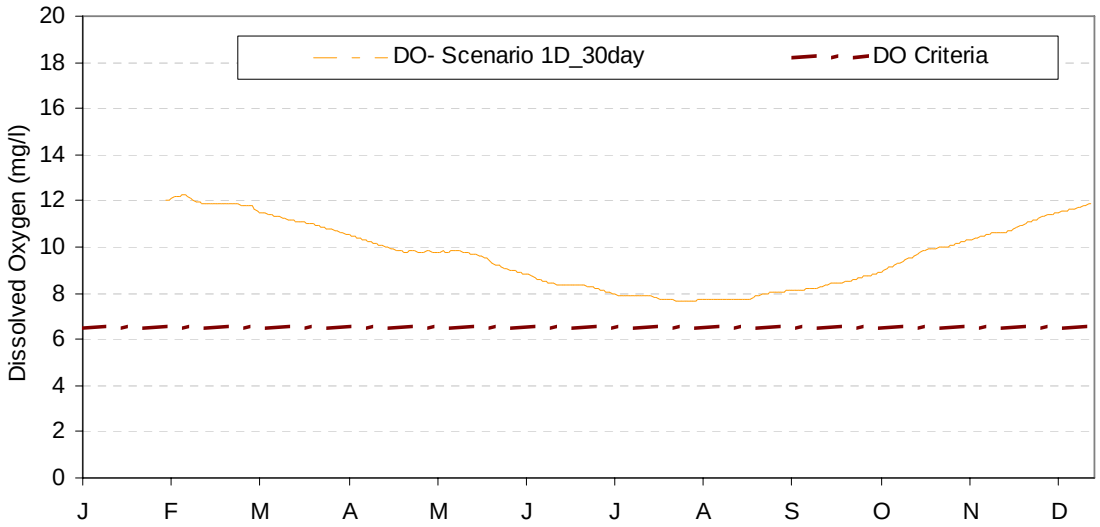
Note in the plots that chlorophyll-a also slightly exceeds the criteria at LRWRC (Wilson Dam) and LRAR (Anderson-Rose Dam). To achieve the chlorophyll-a criteria for these impoundments, a reduction **greater than 60%** will be required.

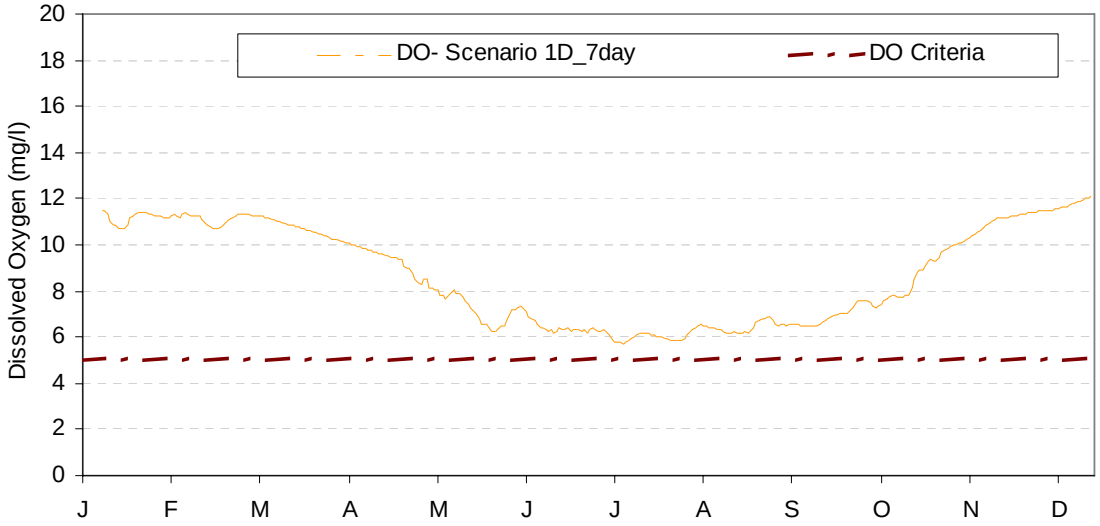
*DO Concentrations in Impoundments **Not** Meeting **All** DO Criteria*

Impoundment	Minimum Modeled DO (mg/L)			DO Criteria (mg/L)			Necessary DO Increase (mg/L)		
	Min	30-day	7-day	Min	30-day	7-day	Min	30-day	7-day
LRWRC	0.87	2.62	1.12	4.00	6.50	5.00	3.13	3.88	3.88
LRAR	2.15	6.02	3.42	4.00	6.50	5.00	1.85	0.48	1.58
KSDSR	5.2	5.75	5.36	4.00	6.50	5.00	N/A	0.75	N/A
KSDTR	4.56	5.73	4.93	4.00	6.50	5.00	N/A	0.77	0.07
KSD97	5.59	6.20	5.81	4.00	6.50	5.00	N/A	0.30	N/A
KSDM	5.56	6.17	5.79	4.00	6.50	5.00	N/A	0.33	N/A

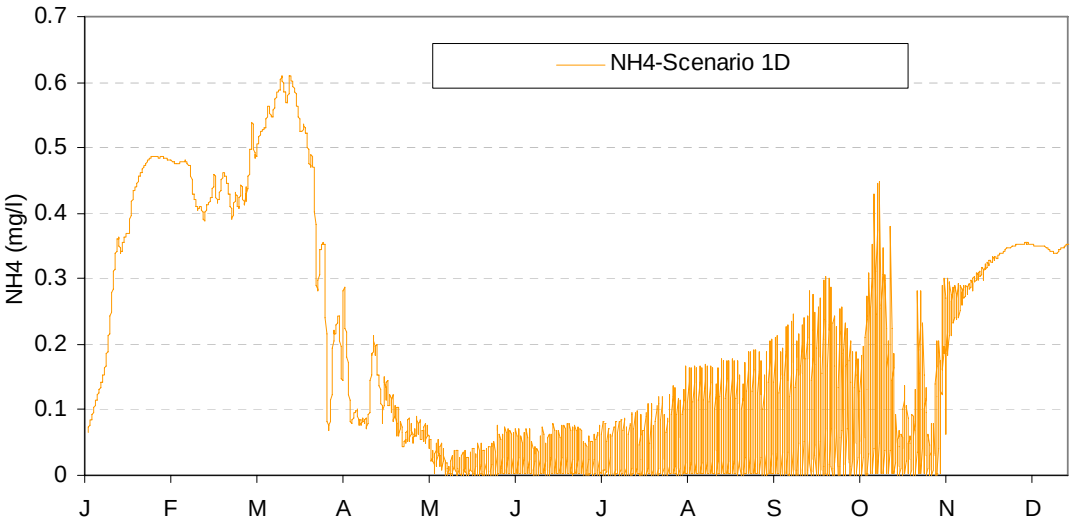


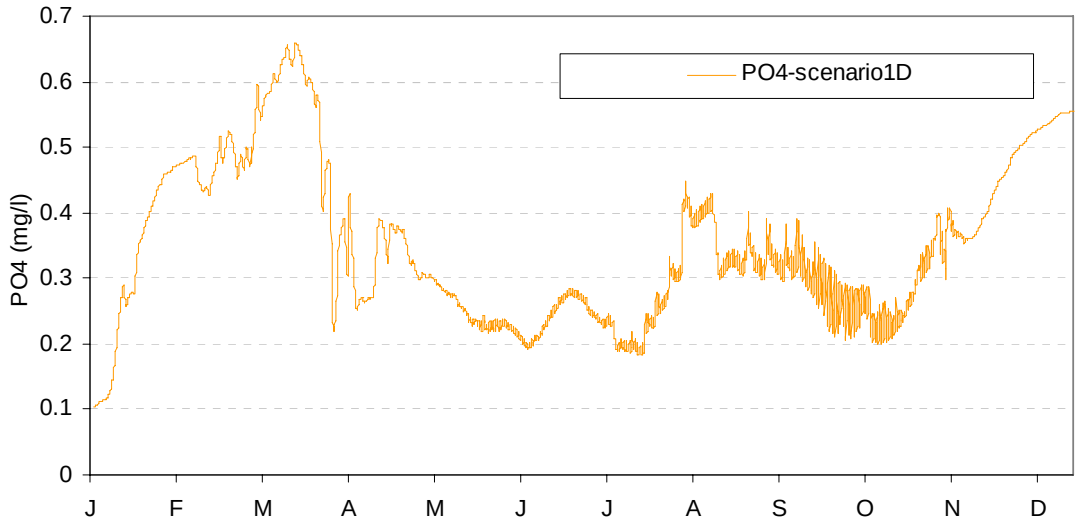

DO- Scenario 1D
DO Criteria
Dissolved Oxygen (mg/l)
20
18
16
14
12
10
8
6
4
2
0
J F M A M J J A S O N D

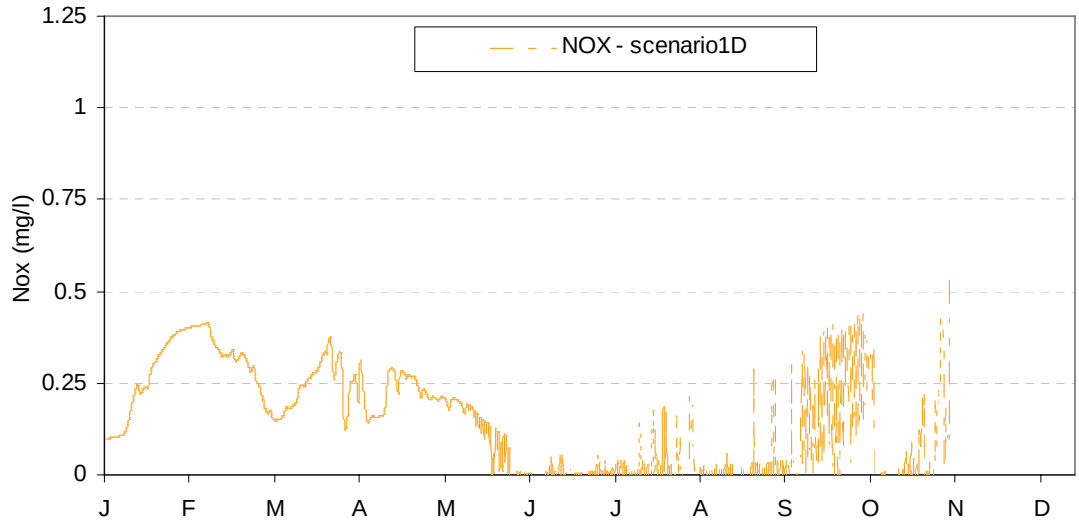

DO- Scenario 1D_30day
DO Criteria
Dissolved Oxygen (mg/l)
20
18
16
14
12
10
8
6
4
2
0
J F M A M J J A S O N D


DO- Scenario 1D_7day
DO Criteria
Dissolved Oxygen (mg/l)
20
18
16
14
12
10
8
6
4
2
0
J F M A M J J A S O N D

LRGR







LREW continued