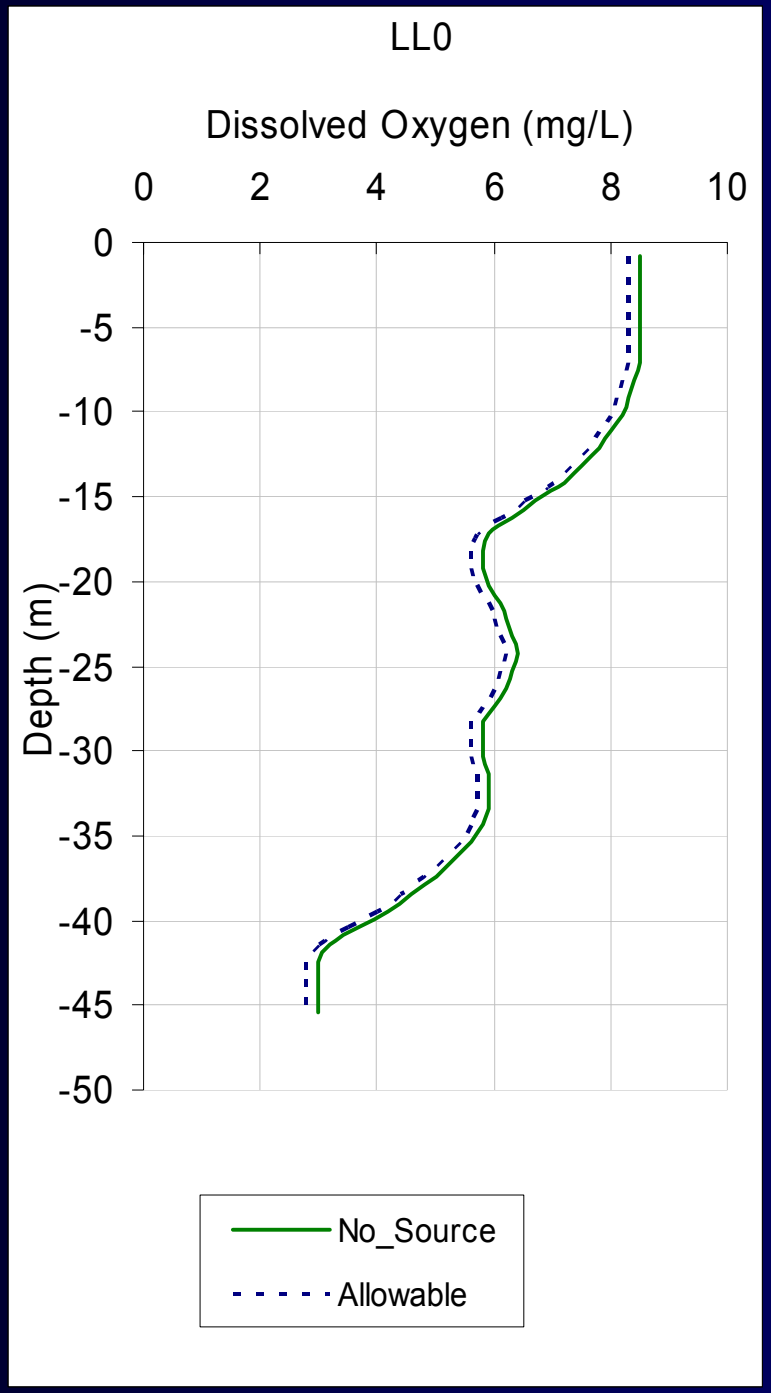
Review Comments

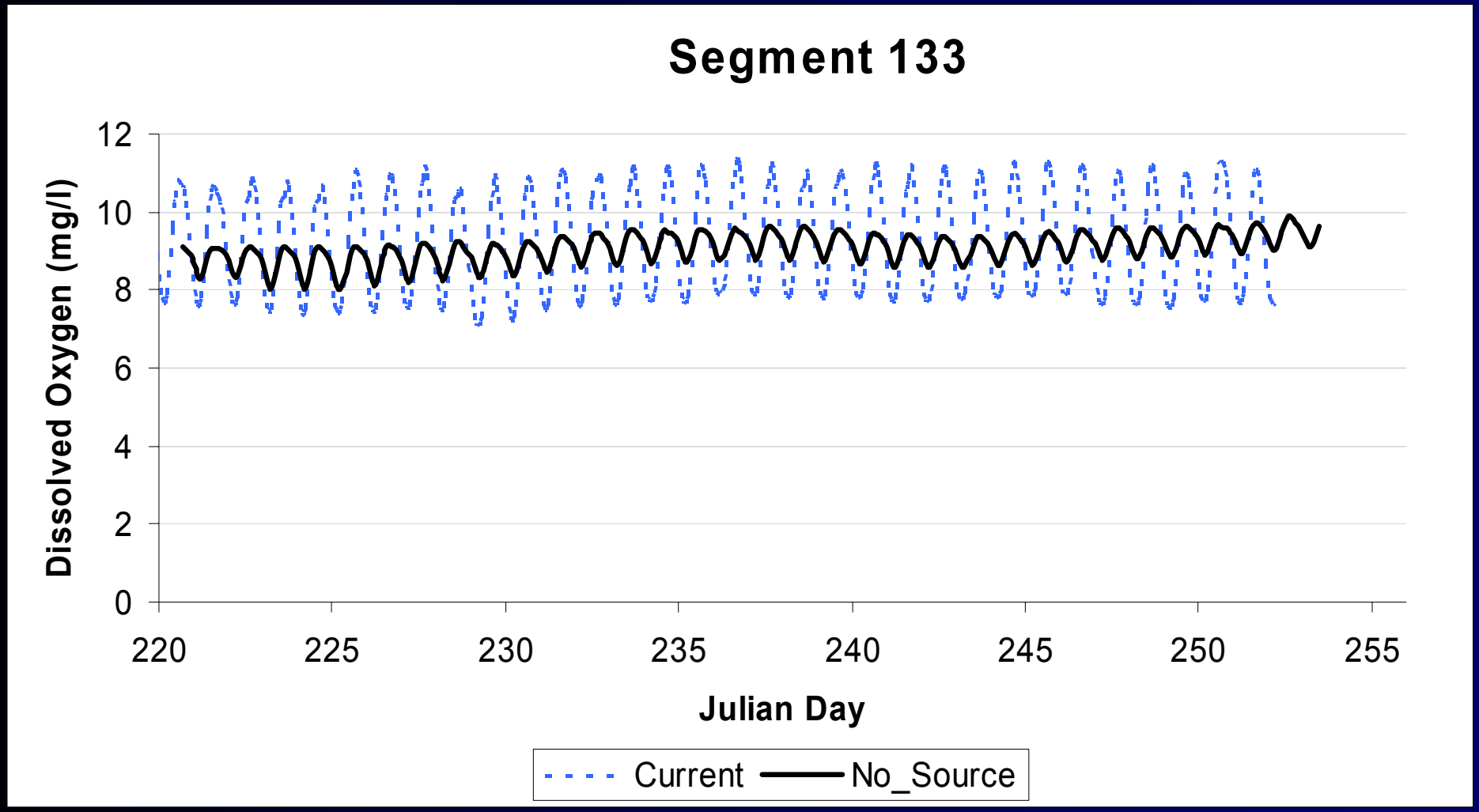
- Dissolved Oxygen Criteria
- Use Attainability Analysis
- Dissolved Oxygen and Algal Blooms
- Model Calibration

  - CBODU, ratios, *k*
  - SOD
- Critical Conditions
- Margin of Safety
- Draft Report and Model Scenarios

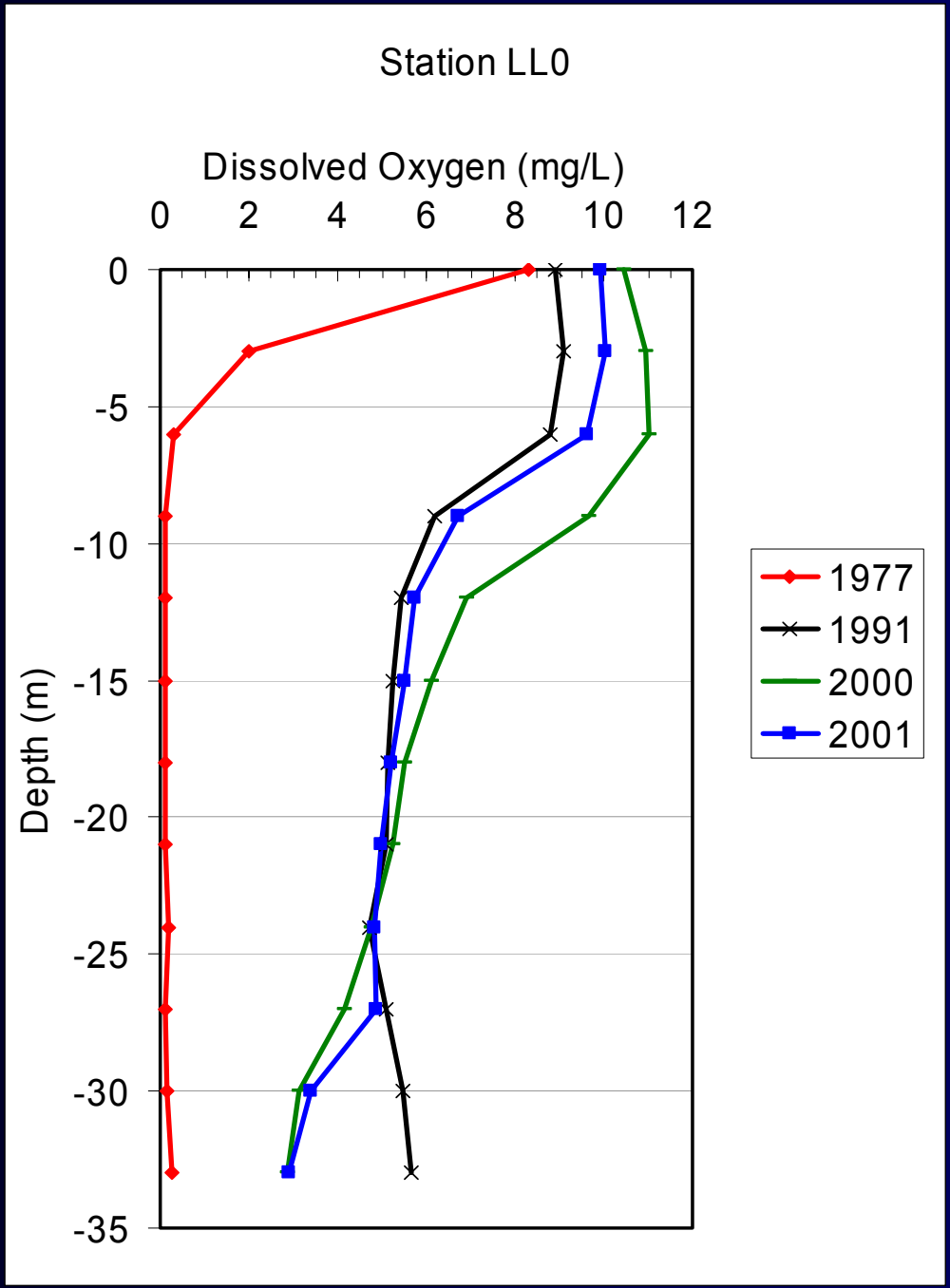
Dissolved Oxygen Criteria

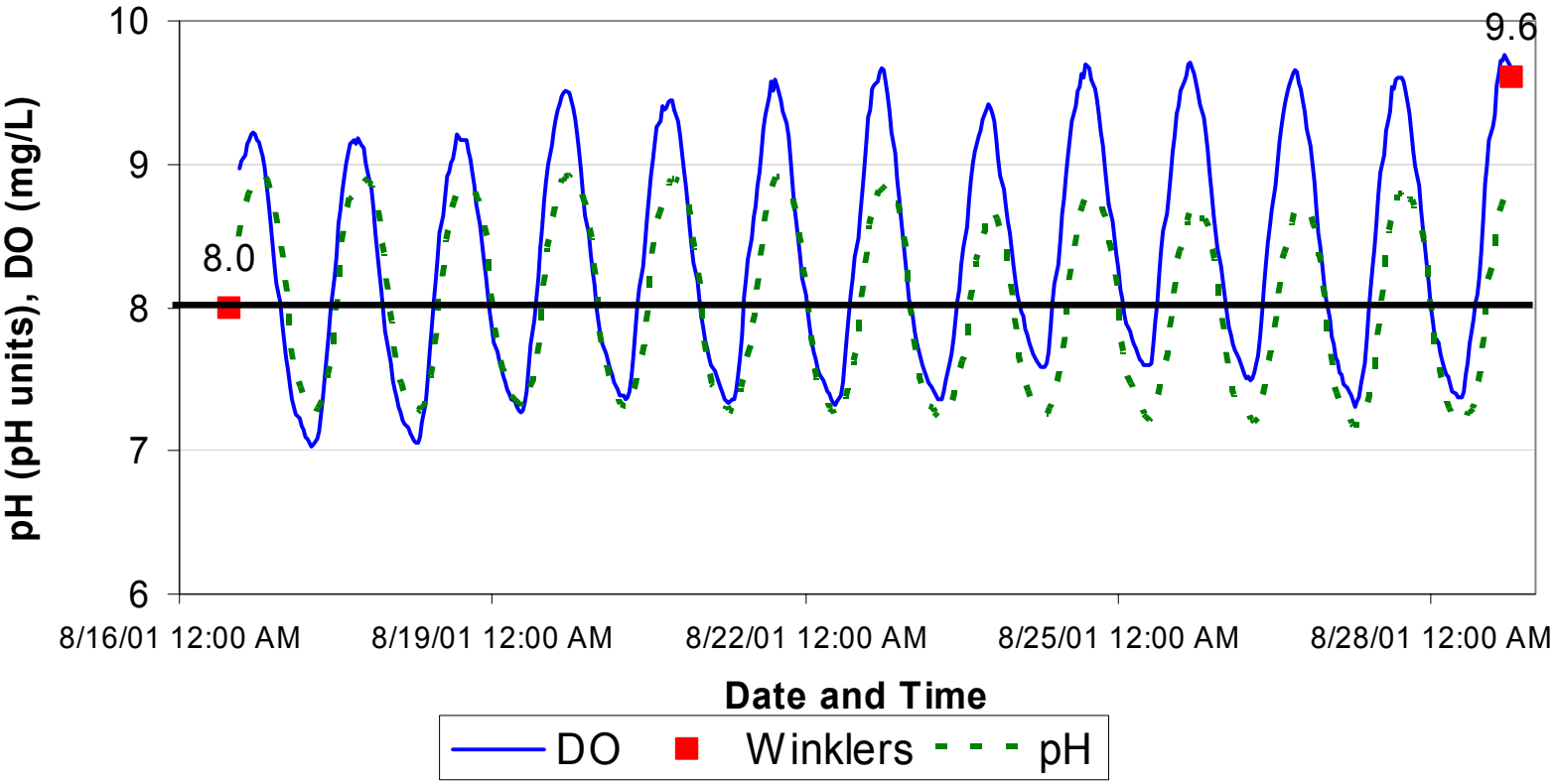
- LAKE SPOKANE (LONG LAKE):
  - No Measurable Decrease from Natural Conditions
- SPOKANE RIVER:
  - Shall Exceed 8.0 mg/L

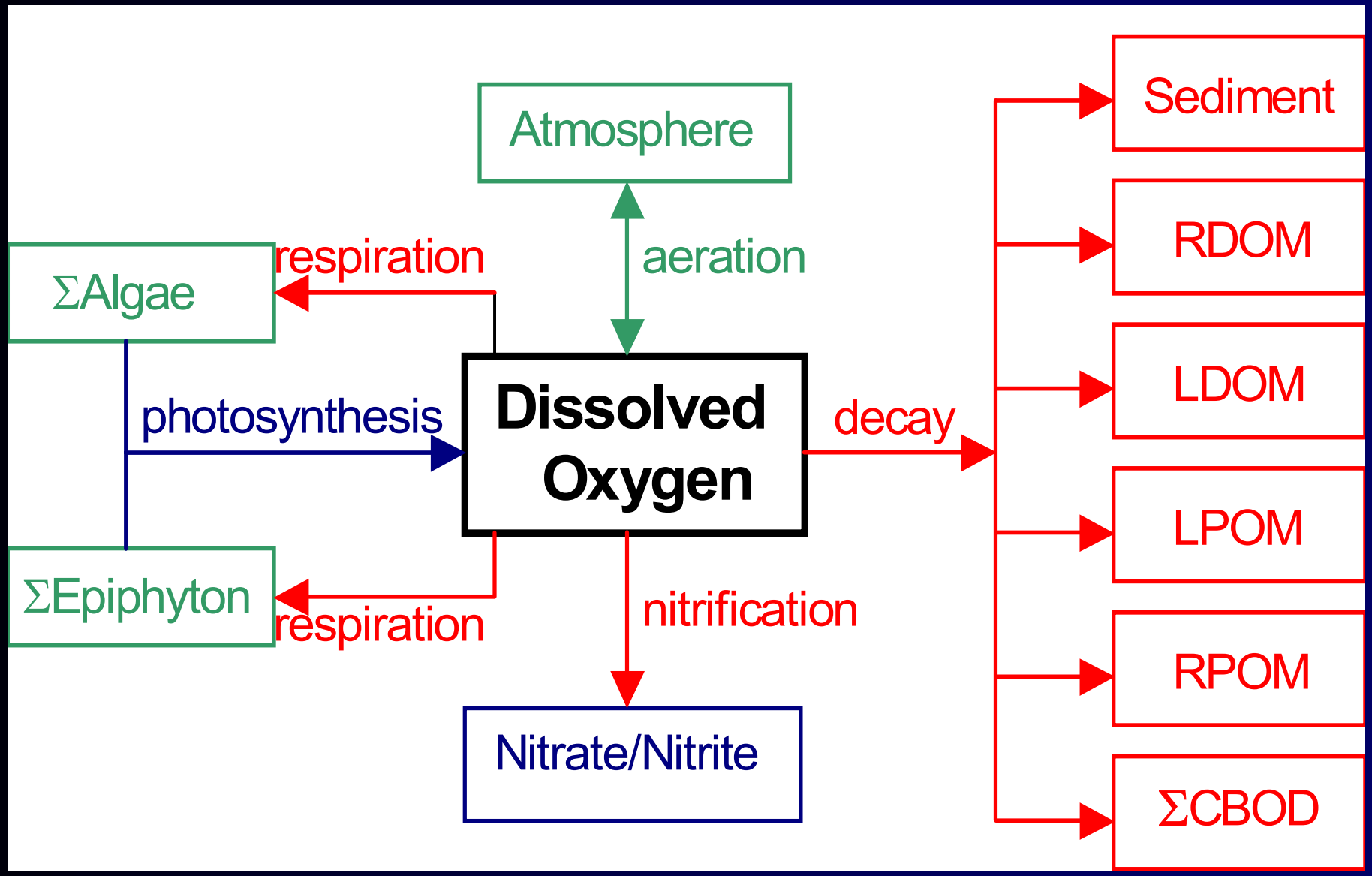

LL0
Dissolved Oxygen (mg/L)
0
2
4
6
8
10
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
-50
Depth (m)
No_Source
Allowable


Segment 133
Dissolved Oxygen (mg/l)
12
10
8
6
4
2
0
220
225
230
235
240
245
250
255
Julian Day
Current
No_Source

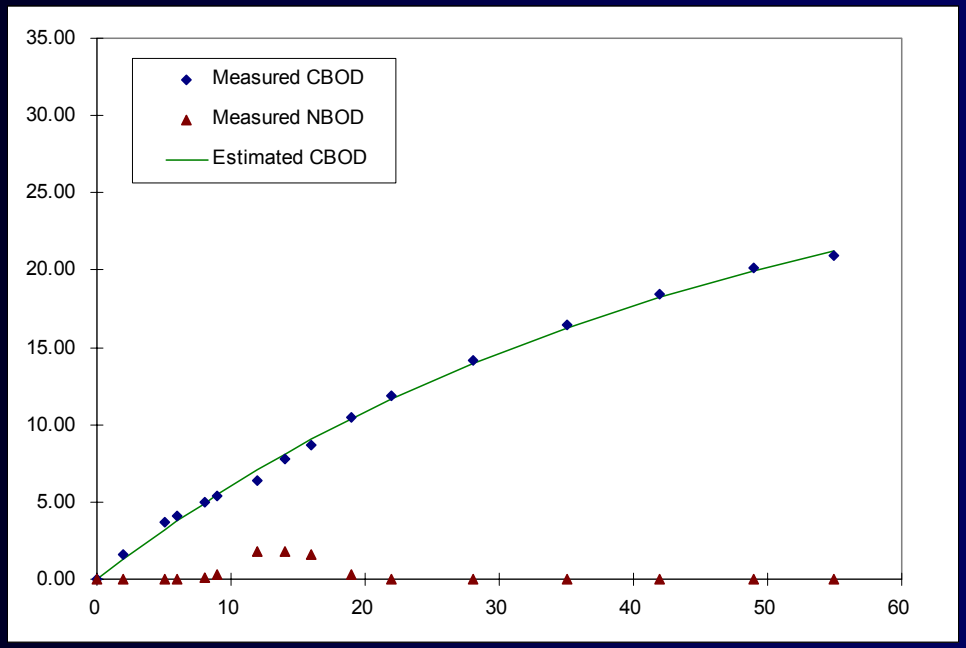
Dissolved Oxygen and Algae

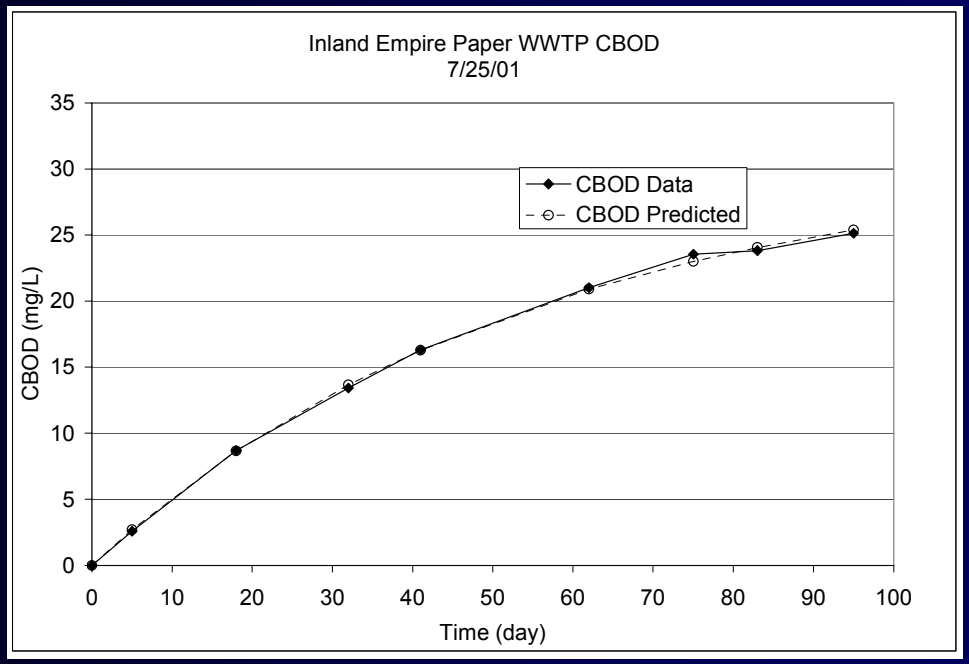

Station LL0
Dissolved Oxygen (mg/L)
0
2
4
6
8
10
12
0
-5
-10
-15
-20
-25
-30
-35
Depth (m)
1977
1991
2000
2001


STATELINE (RM 96.0)
pH (pH units), DO (mg/L)
10
9
8
7
6
8.0
9.6
8/16/01 12:00 AM
8/19/01 12:00 AM
8/22/01 12:00 AM
8/25/01 12:00 AM
8/28/01 12:00 AM
Date and Time
DO
Winklers
pH


Atmosphere
aeration
ΣAlgae
respiration
photosynthesis
Dissolved Oxygen
decay
ΣEpiphyton
respiration
nitrification
Nitrate/Nitrite
Sediment
RDOM
LDOM
LPOM
RPOM
ΣCBOD

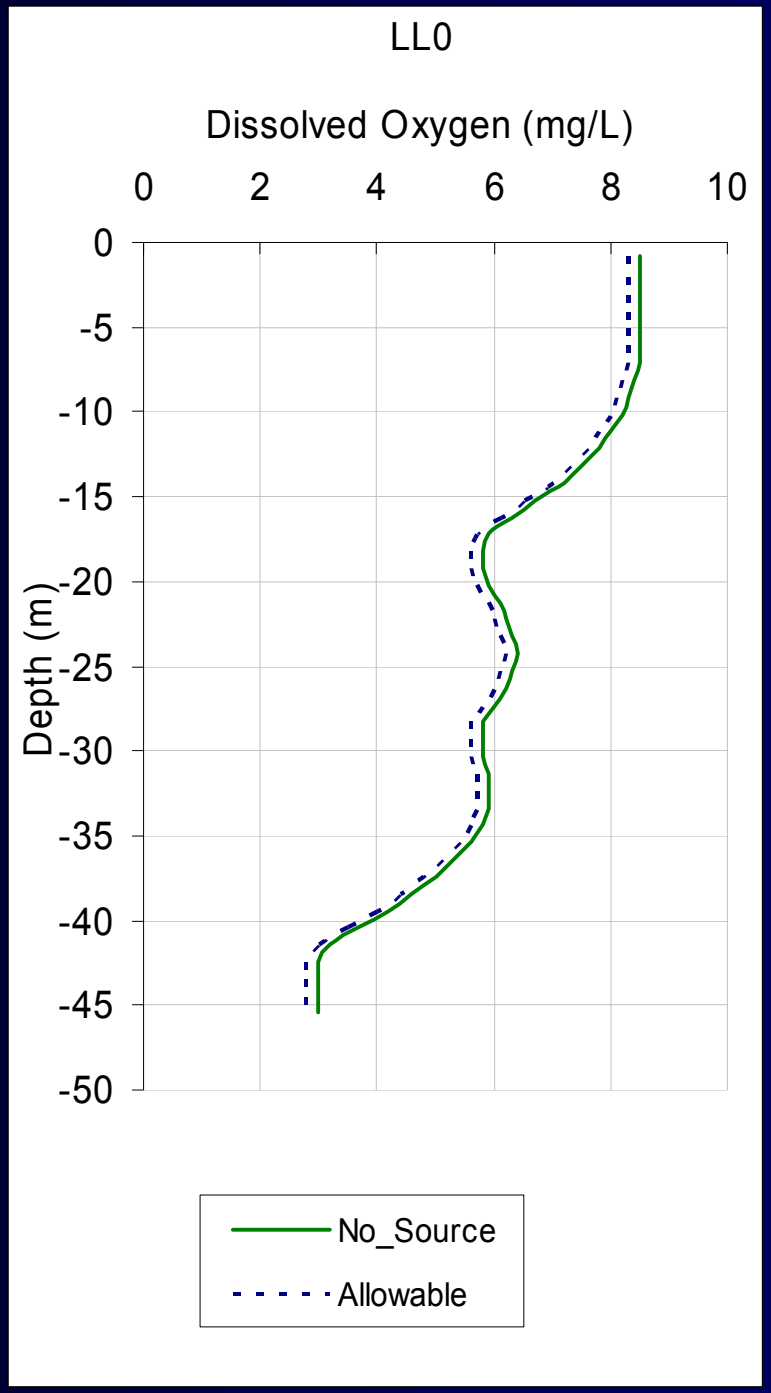
Ultimate CBOD

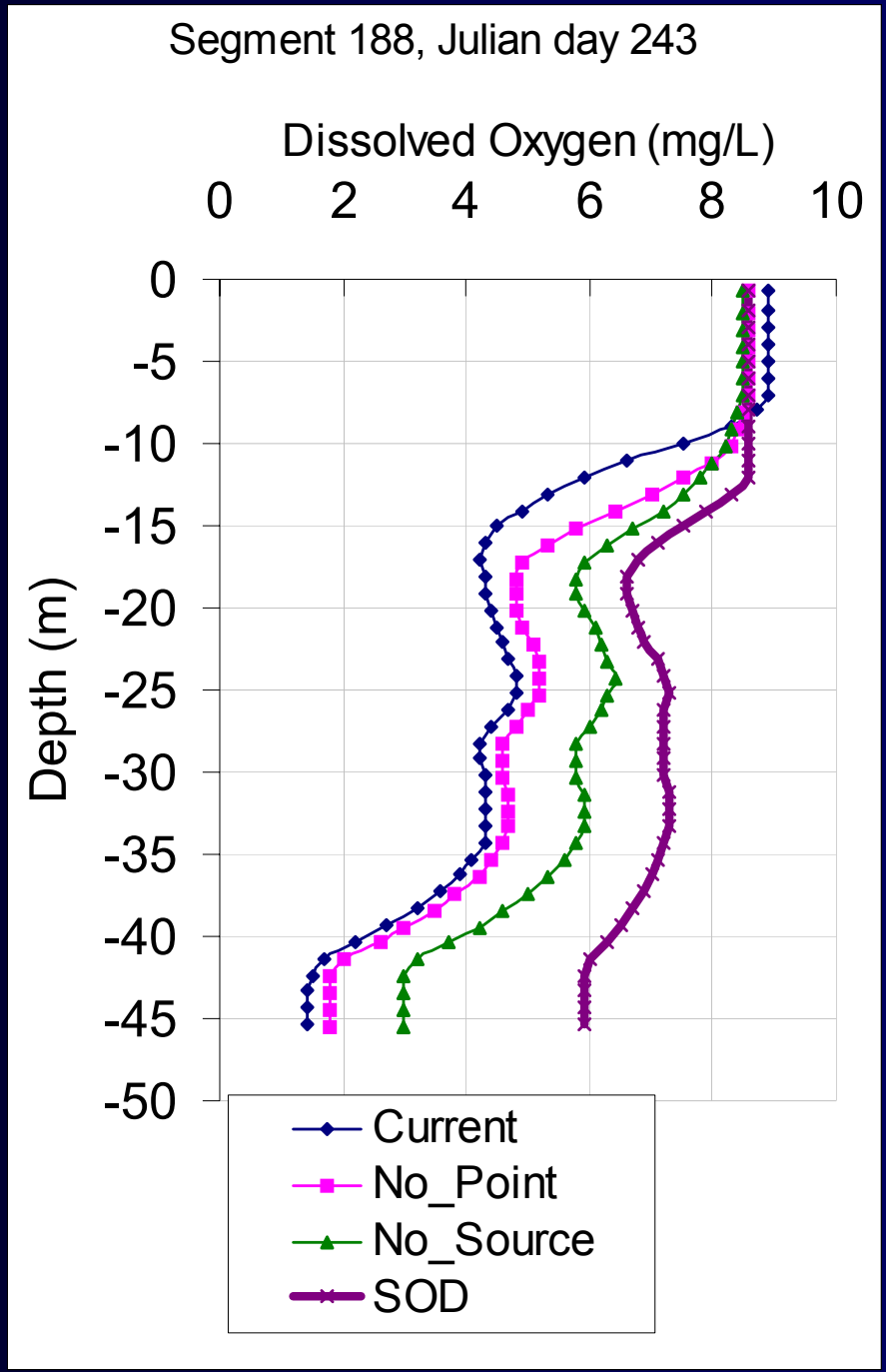

35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
0
10
20
30
40
50
60
Measured CBOD
Measured NBOD
Estimated CBOD


Inland Empire Paper WWTP CBOD
7/25/01
CBOD (mg/L)
35
30
25
20
15
10
5
0
0
10
20
30
40
50
60
70
80
90
100
Time (day)
CBOD Data
CBOD Predicted

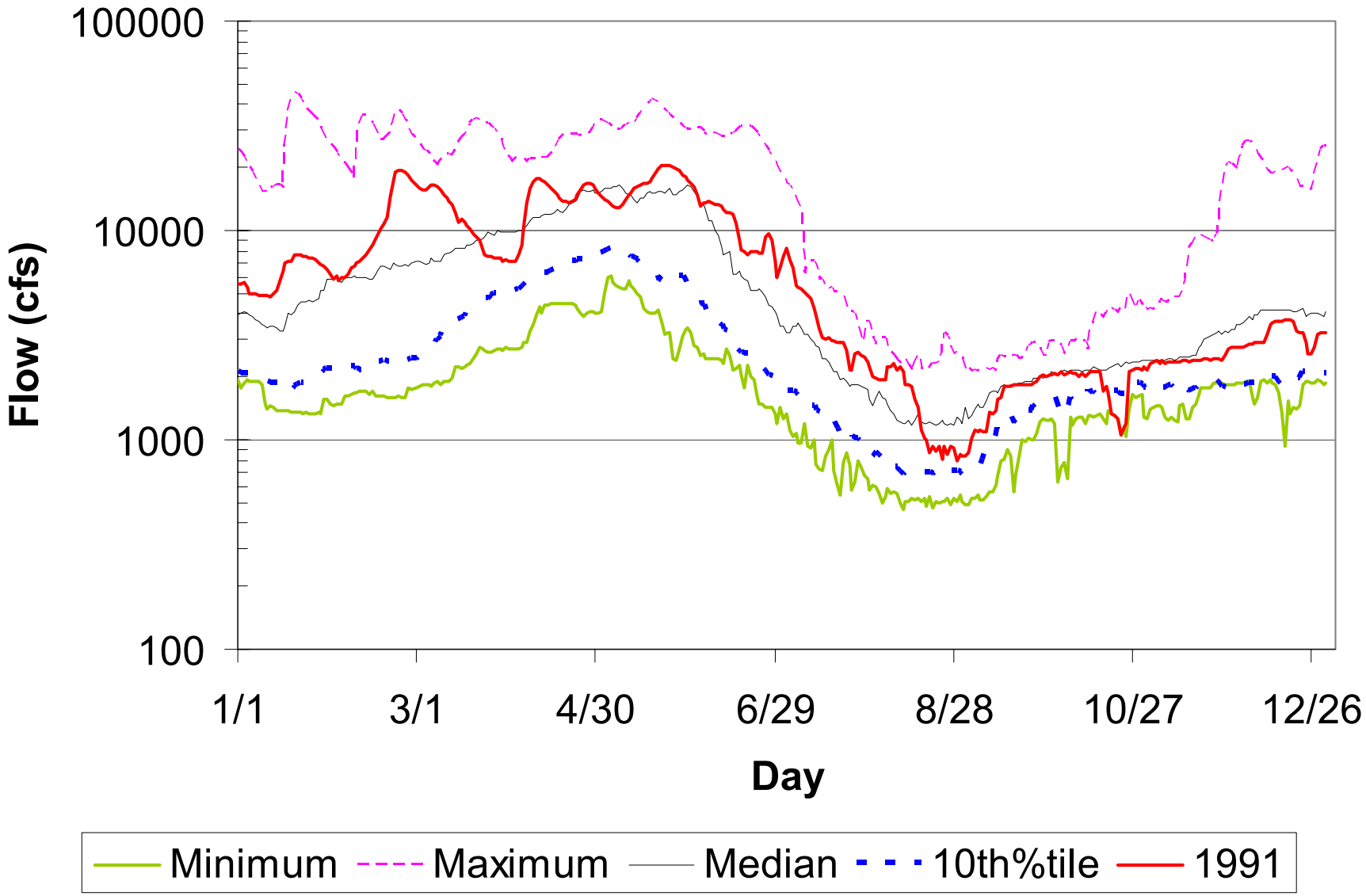
	Ecology CBODU:-BOD5 (ratio)	**Ecology** *k* (day^{-1})	**WSU** CBODU:-BOD5 (ratio)	**WSU** *k* (day^{-1})	**Avg.** CBODU:BOD5 (ratio)	**Avg.** *k* (day^{-1})
Ambient	3.36	0.0704	3.64	0.0590	3.54	0.0660
Spokane POTW	2.82	0.0880	3.46	0.0531	3.08	0.0736
Liberty Lake POTW	5.27	0.0418	4.69	0.0518	4.98	0.0456
Kaiser IWTP	2.71	0.1302	1.96	0.1232	2.22	0.1275
IEPC	13.01	0.0175	9.68	0.0204	11.72	0.0186
IEPC (1995)			6.36	0.0469		

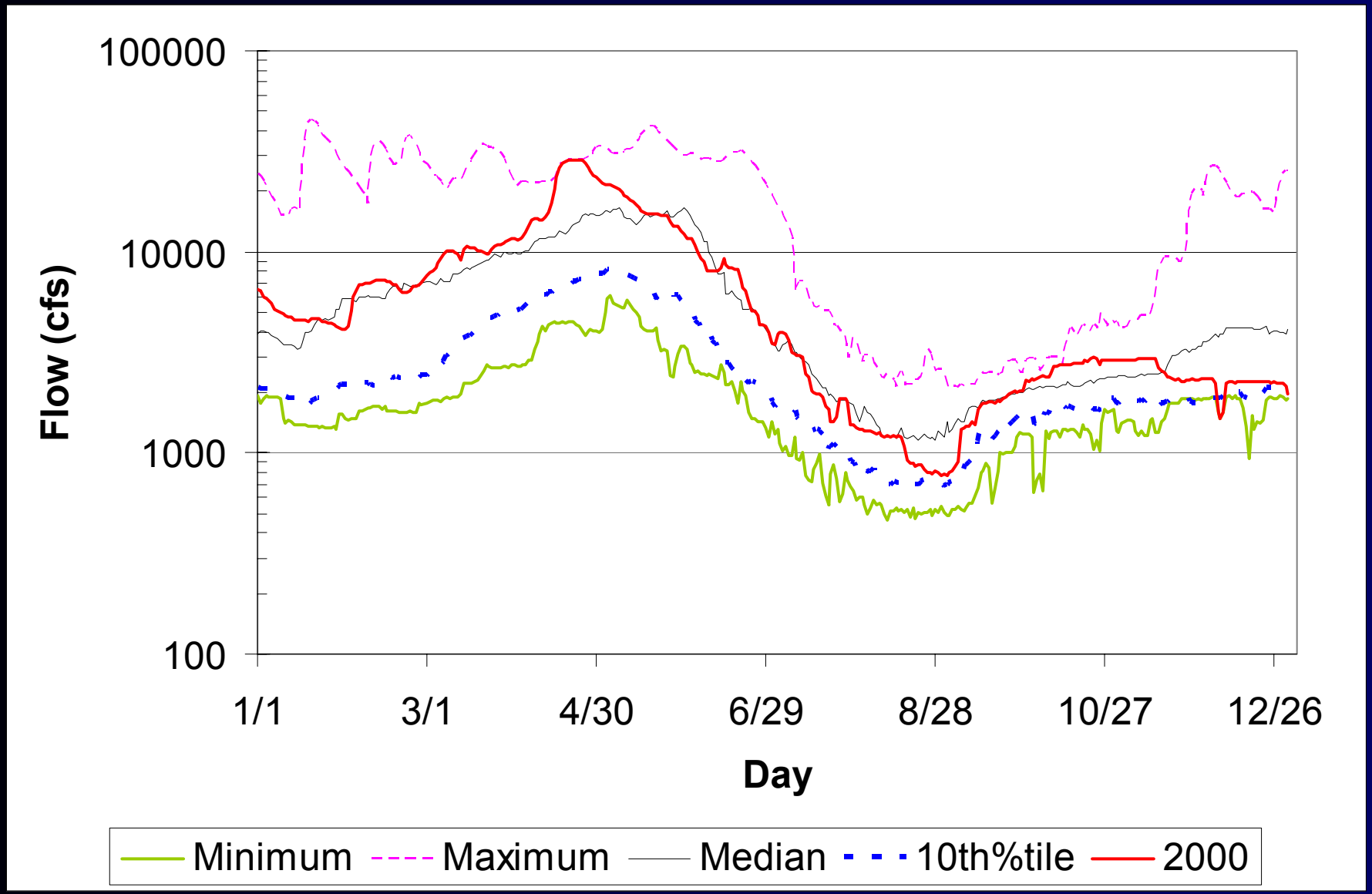
SOD

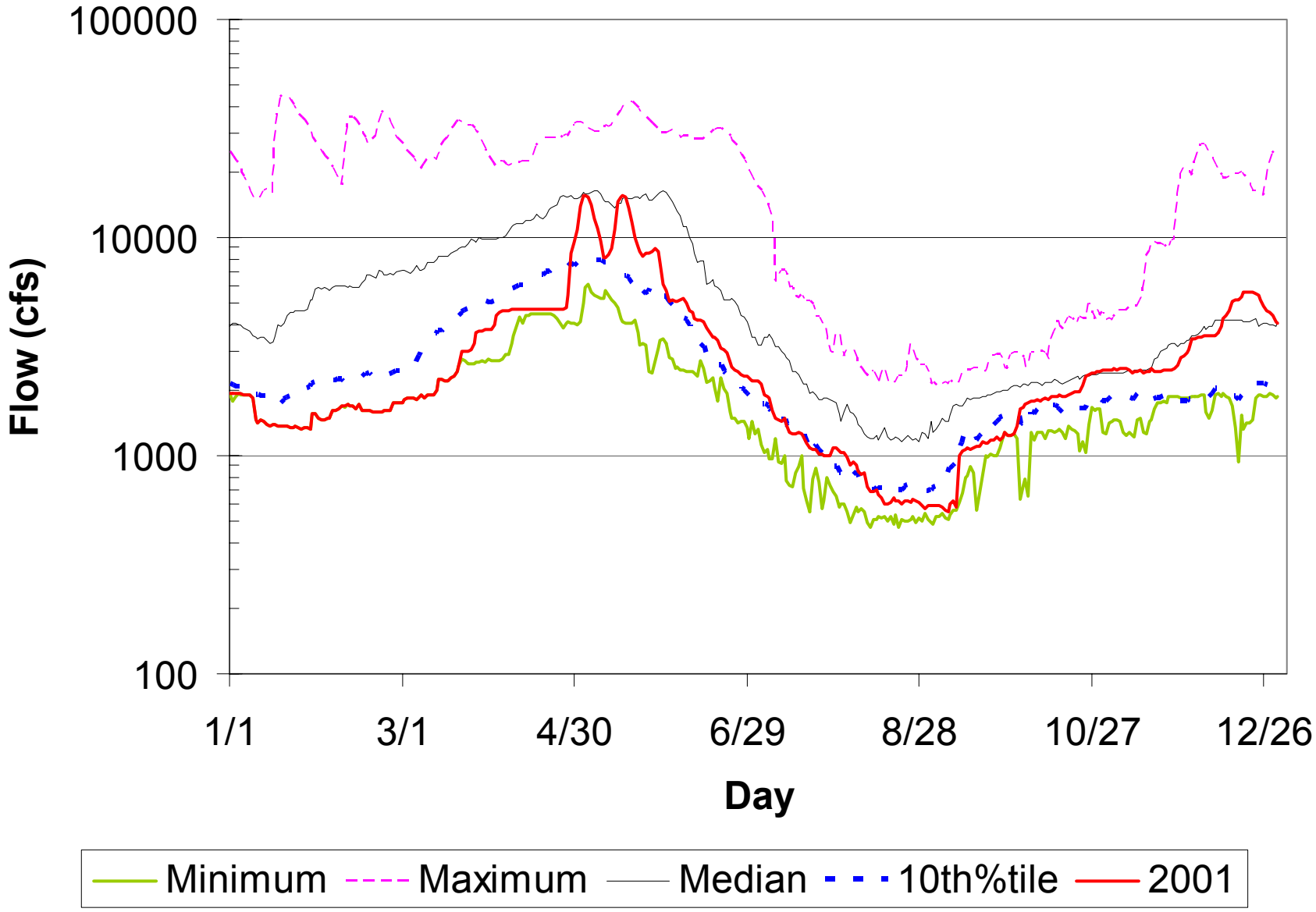

LL0
Dissolved Oxygen (mg/L)
0
2
4
6
8
10
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
-50
Depth (m)
No_Source
Allowable

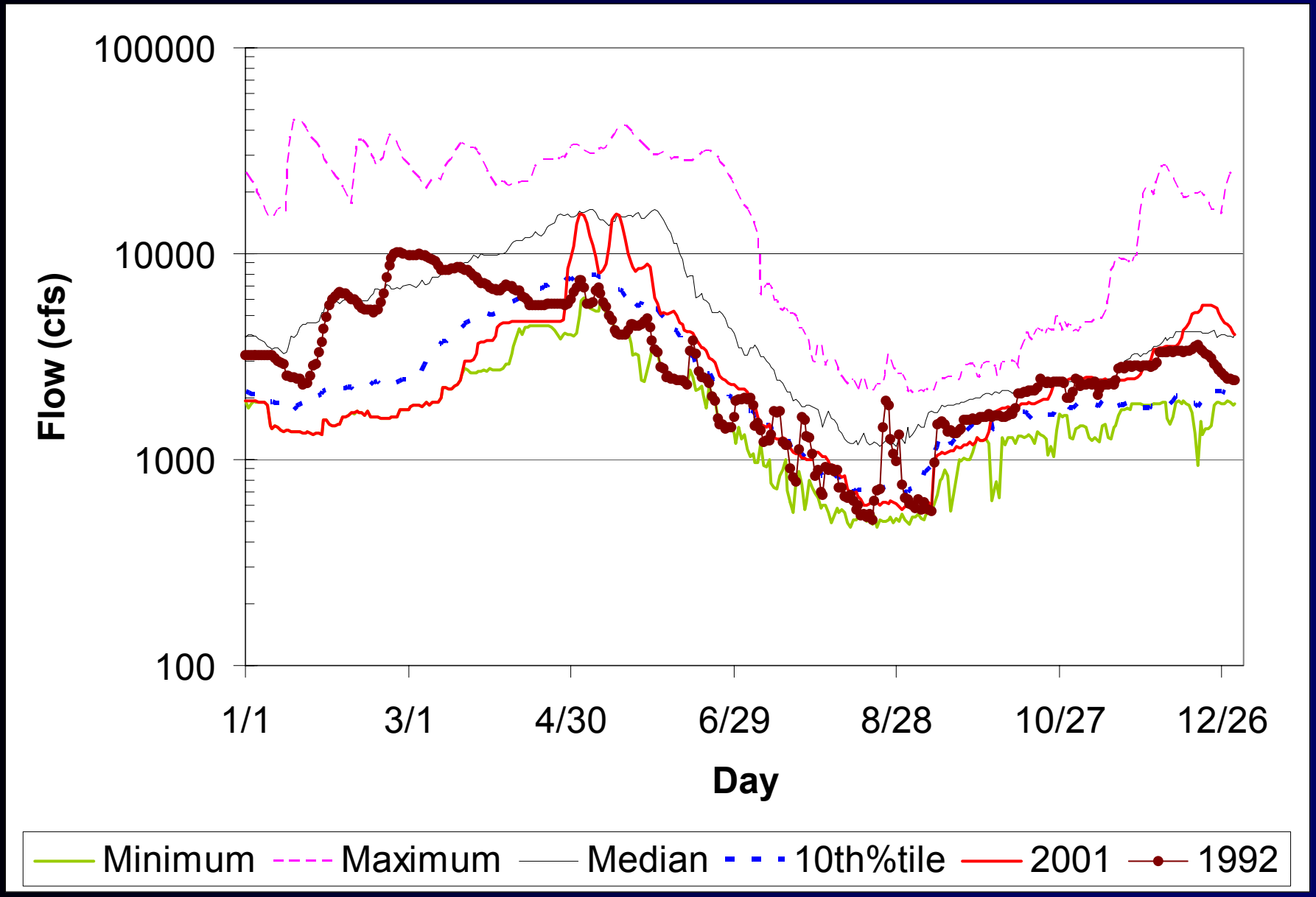

Segment 188, Julian day 243
Dissolved Oxygen (mg/L)
0
2
4
6
8
10
Depth (m)
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
-50
Current
No_Point
No_Source
SOD

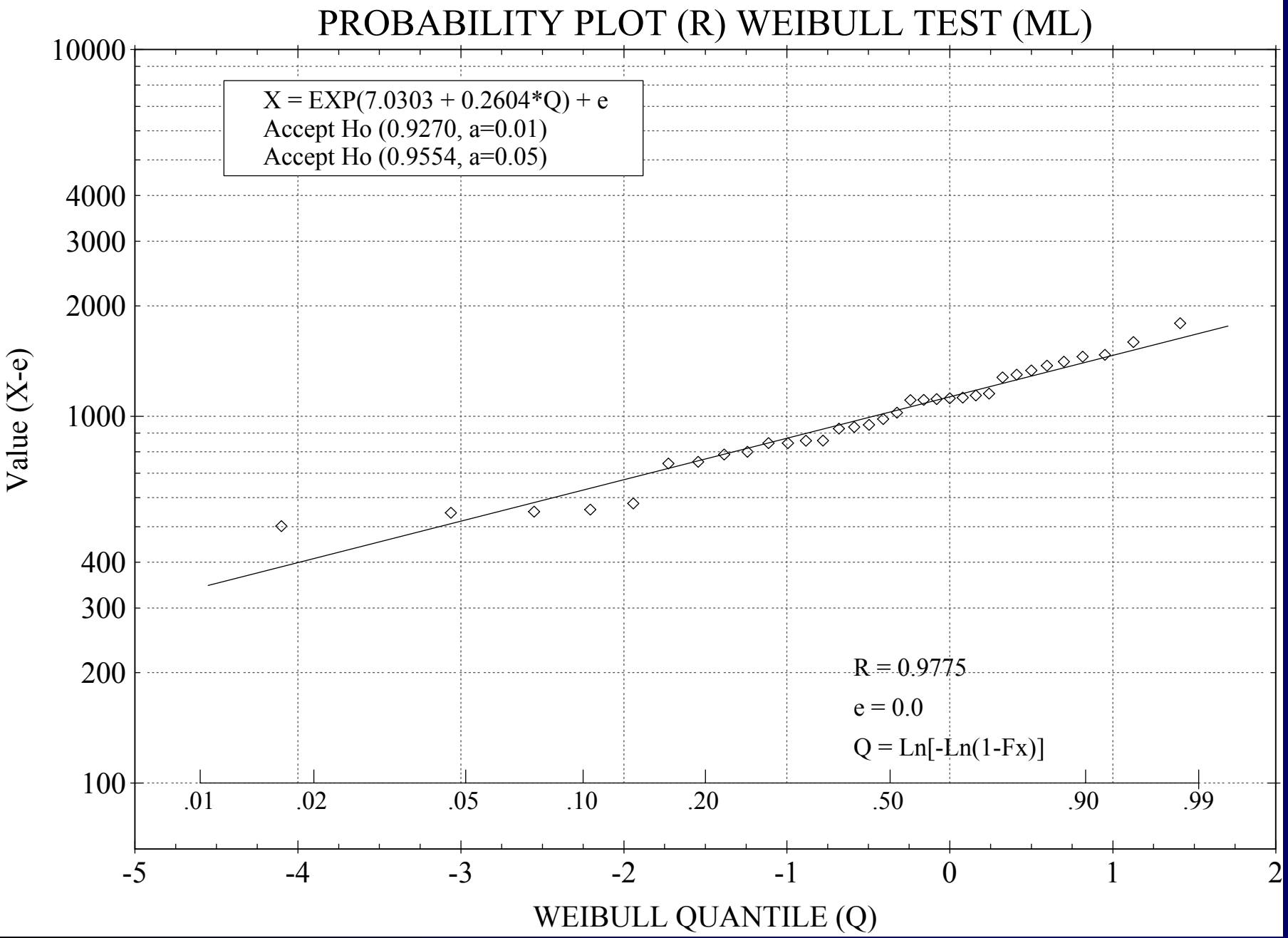
Critical Conditions


100000
10000
1000
100
Flow (cfs)
1/1
3/1
4/30
6/29
8/28
10/27
12/26
Day
Minimum
Maximum
Median
10th%tile
1991


100000
10000
1000
100
Flow (cfs)
1/1
3/1
4/30
6/29
8/28
10/27
12/26
Day
Minimum
Maximum
Median
10th%tile
2000

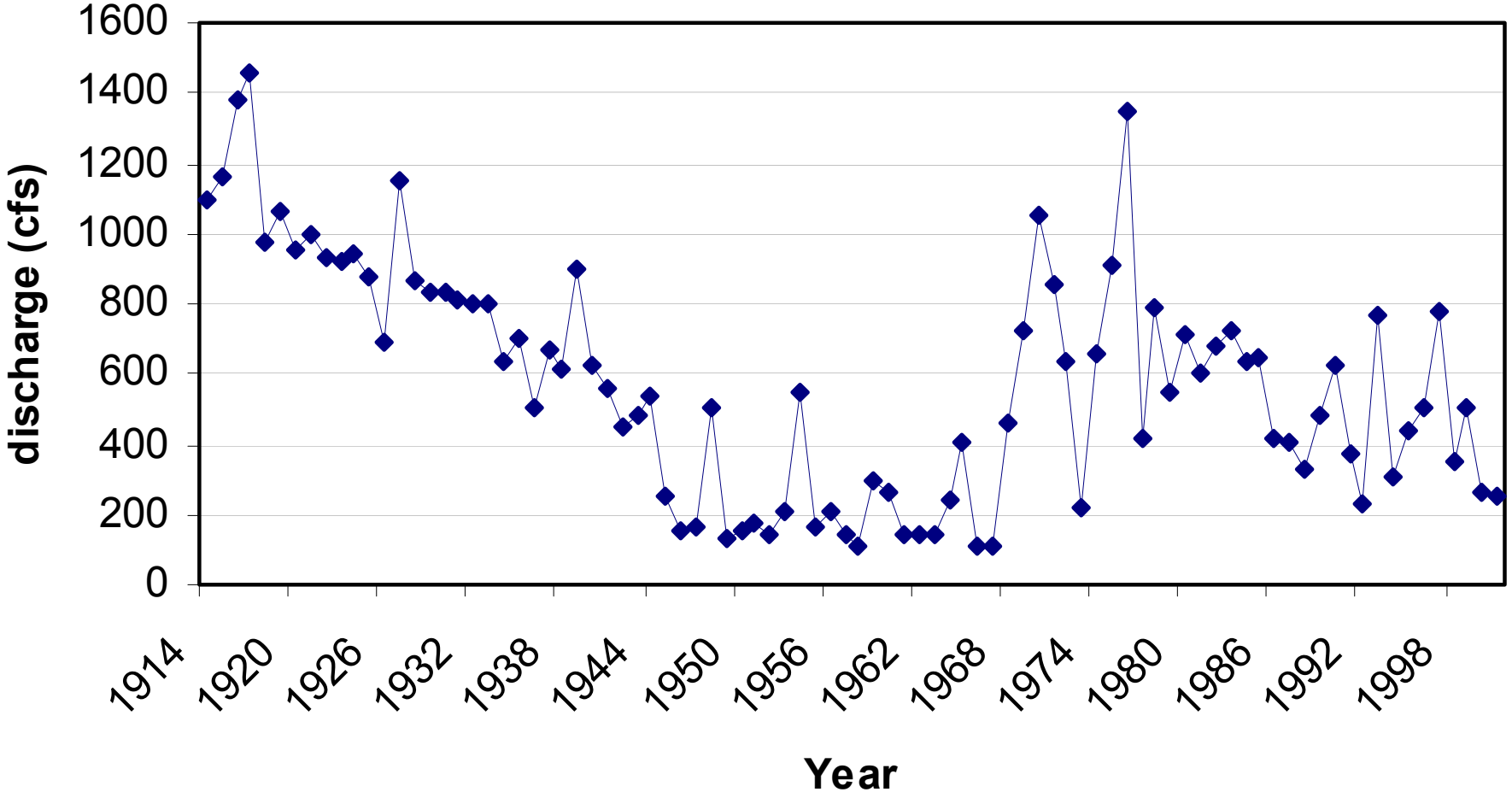

100000
10000
1000
100
Flow (cfs)
1/1
3/1
4/30
6/29
8/28
10/27
12/26
Day
Minimum
Maximum
Median
10th%tile
2001

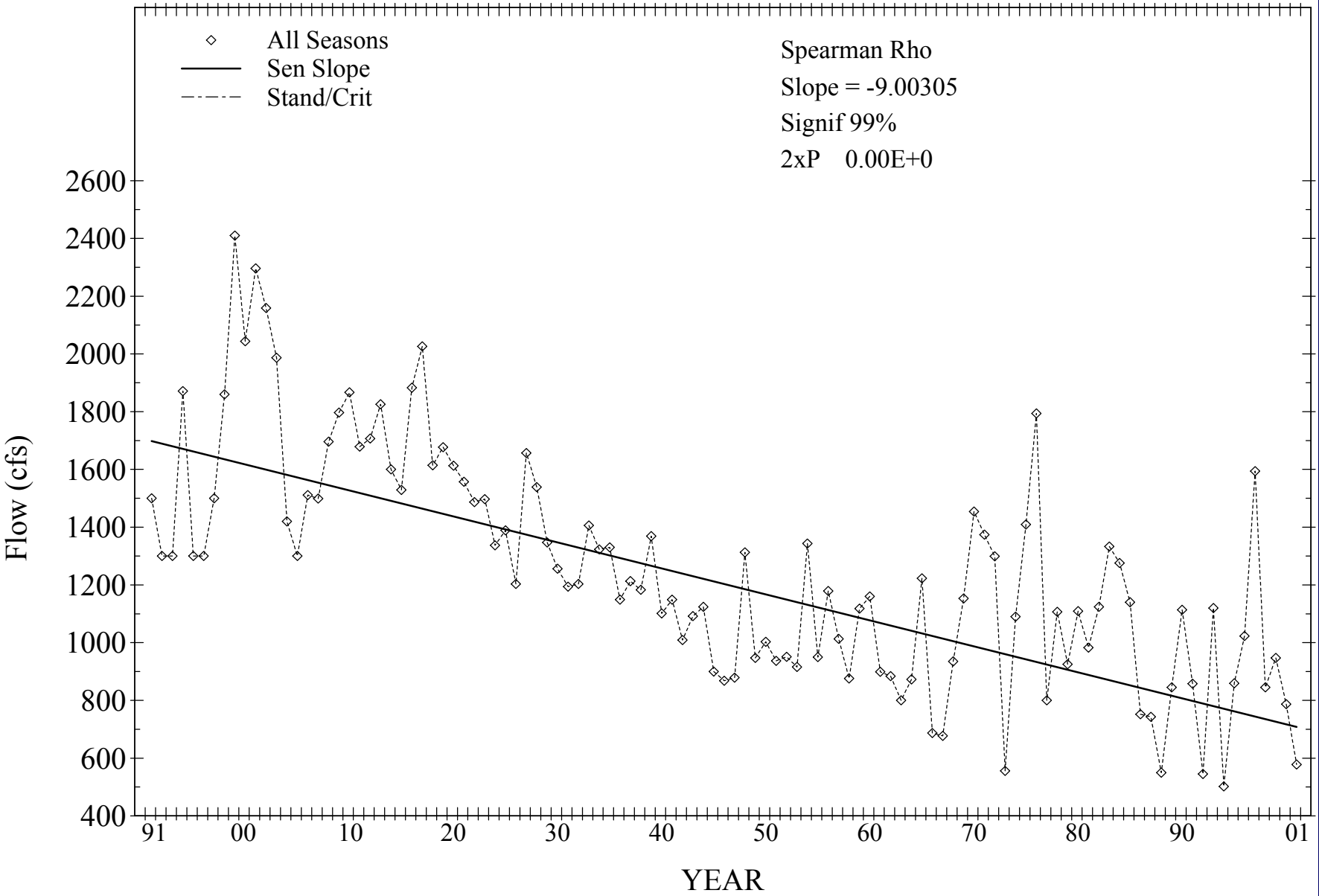

100000
10000
1000
100
Flow (cfs)
1/1
3/1
4/30
6/29
8/28
10/27
12/26
Day
Minimum
Maximum
Median
10th%tile
2001
1992

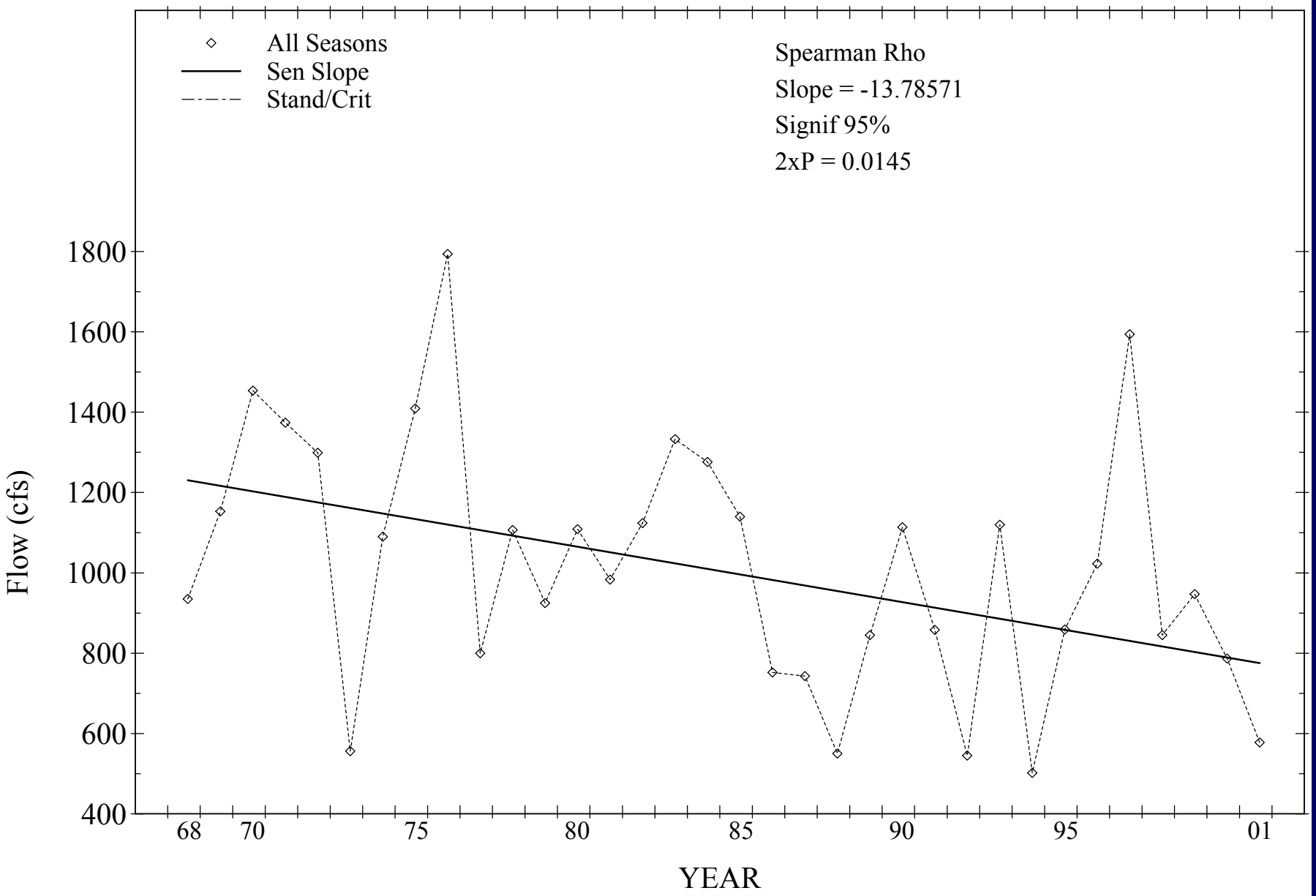

PROBABILITY PLOT (R) WEIBULL TEST (ML)
X = EXP(7.0303 + 0.2604*Q) + e
Accept Ho (0.9270, a=0.01)
Accept Ho (0.9554, a=0.05)
R = 0.9775
e = 0.0
Q = Ln[-Ln(1-Fx)]
Value (X-e)
10000
4000
3000
2000
1000
400
300
200
100
.01
.02
.05
.10
.20
.50
.90
.99
-5
-4
-3
-2
-1
0
1
2
WEIBULL QUANTILE (Q)

		1973	1977	1987	1988	1992	1994	2001
Jun-Oct	**(cfs)**	1513	1621	1404	1404	1387	1144	1431
	(%) EXP	89.8	87.2	92.0	92.0	92.4	95.9	91.5
Jul	**(cfs)**	1167	1233	1371	1481	1318	998	1348
	(%) EXP	90.7	89.7	87.3	85.1	88.3	93.0	87.7
Aug	**(cfs)**	739	912	828	646	793	530	715
	(%) EXP	91.2	83.3	87.5	94.1	89.1	96.6	92.4
Sep	**(cfs)**	1517	1576	1341	988	1085	963	916
	(%) EXP	65.3	59.2	80.8	96.6	94.1	97.1	97.9
Apr-May	**(cfs)**	5759	4681	8614	9961	5571	6827	7221
	(%) EXP	93.6	95.8	83.7	76.7	94.1	90.7	89.4
7-day	**(cfs)**	556	800	550	743	545	502	578
	(%) EXP	95.8	73.3	96.1	81.2	96.4	98.3	94.4
Average	**(%) EXP**	87.7	81.4	87.9	87.6	92.4	95.3	92.2
Stdev		11.2	13.2	5.5	7.9	3.1	2.9	3.6

7day low flow at Postfalls




All Seasons
Sen Slope
Stand/Crit
Spearman Rho
Slope = -9.00305
Signif 99%
2xP 0.00E+0
Flow (cfs)
2600
2400
2200
2000
1800
1600
1400
1200
1000
800
600
400
91
00
10
20
30
40
50
60
70
80
90
01
YEAR

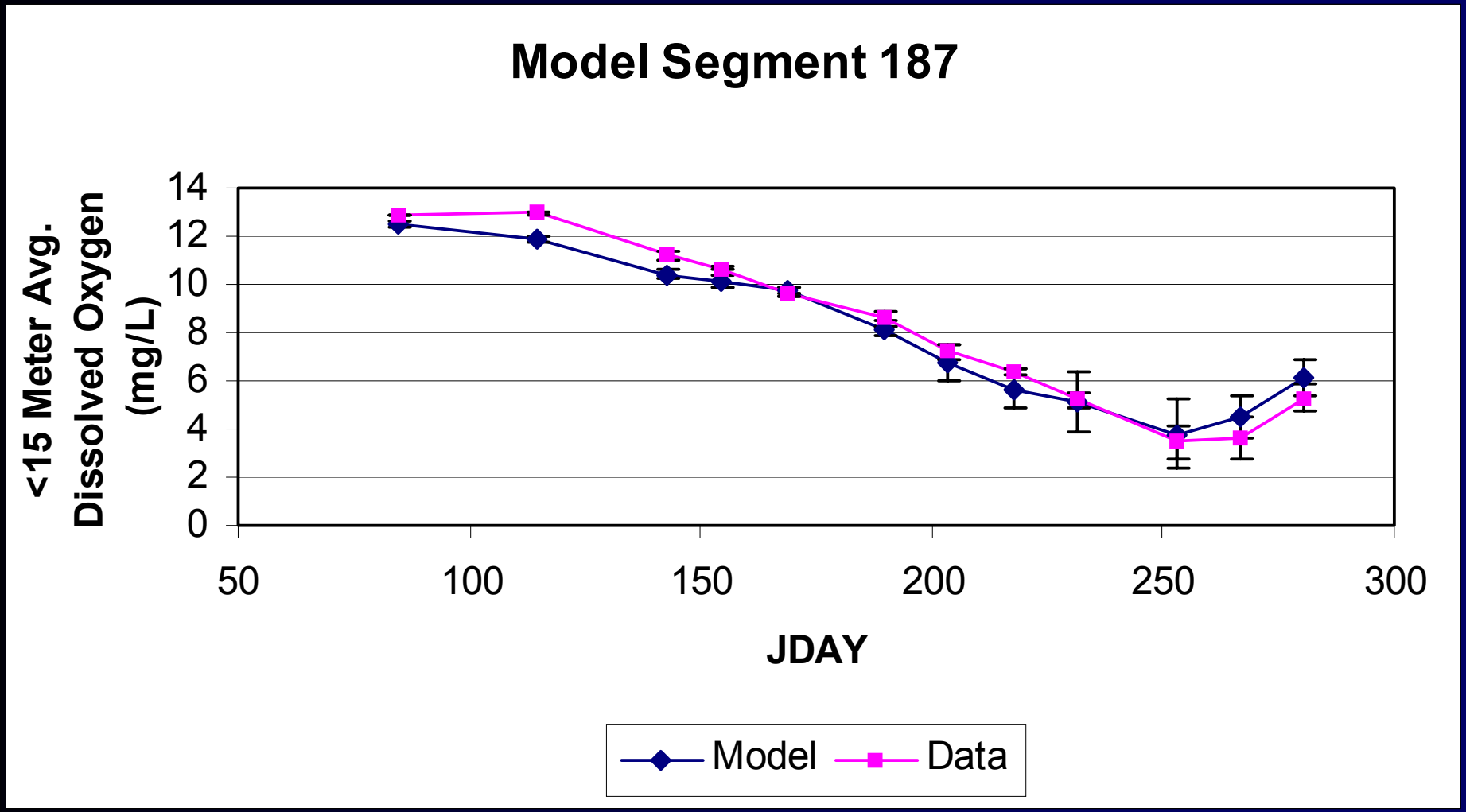

All Seasons
Sen Slope
Stand/Crit
Spearman Rho
Slope = -13.78571
Signif 95%
2xP = 0.0145
Flow (cfs)
1800
1600
1400
1200
1000
800
600
400
68
70
75
80
85
90
95
01
YEAR

Margin of Safety

TMDL = WLA + LA + MOS

Draft Report and Model Scenarios

- 2001 conditions
- No point source loads
- No point or nonpoint source loads
- BOD5 monthly average permit limits
- Oligotrophic SOD
- ?


Model Segment 187
<15 Meter Avg. Dissolved Oxygen (mg/L)
14
12
10
8
6
4
2
0
50
100
150
200
250
300
JDAY
Model
Data