APPENDIX B

WATER QUALITY/MIXING ZONE ANALYSIS WORKSHEETS

AMBIENT MONITORING DATA

Station 27C080
Six Year Water Quality Data Summary

Last updated 26-May-1998

Station name	Class	Latitude	Longitude	Elevation (ft)	River mile	Watershed(s)	External mapping links	
Lewis R @ Co Rd 16	A	45 54 21.0	122 44 10.0	10	6.62	Columbia Go	Tiger Mapping Service	MapBlast®

Years-monitored history *Note: Data for years not presented here are available on request. See*
Requesting additional data

98	97	96	95	94	93	92	91	90	89	88	87	86	85	84	83

1992 (27C080)	Time	Flow (CFS)	Temperature (C)	Conductivity (umhos/25c)	Oxygen (mg/L)	Oxygen Saturation (%)	pH	Fecal Coliforms (colonies/100ml)	Suspended Solids (mg/L)	Total Persulfate Nitrogen (mg/L)	Ammonia Nitrogen (mg/L)	Total Phosphorus (mg/L)	Dissolved Soluble Phosphorus (mg/L)	Turbidity (NTU)	Nitrate-Nitrite (mg/L)
9/29/92	940	1200	14.2	45	9.4	91	7.4	11x	2		0.012	0.010k	0.010k	1.1	
8/25/92	1200	1300	13.8	44	9.9	94.4	7.4	12	4		0.012	0.010k	0.010k	1.5	
7/28/92	1320	1300	14	47	10.2	98.3	7.3	2	4		0.02	0.017	0.010k	2.2	
6/23/92	1125	1700	11.4	39	10.3	94.5	7.5	8	3		0.014	0.010k	0.010k	0.6	
5/26/92	1205	1800	10.4	39	10.9	95.9	7.4	3	3		0.010k	0.019	0.010k	0.8	0.1
4/28/92	1150	3300	8.2	40	11.5	96.5	7.5	5	5		0.010k	0.01	0.010k	1.3	0.1
3/24/92	1220	2800	7	35	12.3	99.7	7.6	3	3		0.010k	0.010k	0.010k	1.9	0.1
2/25/92	1215	9900	6.6	39	12.6	100.9	7.3	2	1		0.010k	0.010k	0.010k	1.5	0.2
1/28/92	1230	9000	8.5	52	12.1	101.8	6.9	40s	4		0.011	0.02	0.010k	2.9	0.3

result fails water quality criteria

Data qualifiers: u, j - estimated value k - actual value known to be less s - spreader x - high background count

1991 (27C080)	Time	Flow (CFS)	Temperature (C)	Conductivity (umhos/25c)	Oxygen (mg/L)	Oxygen Saturation (%)	pH	Fecal Coliforms (colonies/100ml)	Suspended Solids (mg/L)	Total Persulfate Nitrogen (mg/L)	Ammonia Nitrogen (mg/L)	Total Phosphorus (mg/L)	Dissolved Soluble Phosphorus (mg/L)	Turbidity (NTU)	Nitrate-Nitrite (mg/L)
12/17/91	1055	10600	8	56	11.1	93	7.1	4	2		0.011	0.011	0.010k	1	0.2
11/19/91	1005	8600	11.3	47	9.9	89.1	7.4	10	2		0.010k	0.012	0.010k	1	0.1
10/29/91	1135	4400	14.1	37	9.9	94	7.5	11	9		0.013	0.017	0.010k	1.4	

result fails water quality criteria

Data qualifiers: u, j - estimated value k - actual value known to be less s - spreader x - high background count

Feb 12, 1999, 12:32: 1 WED PROGRAM PLUMES, Ed 3.1, 8/7/95 Case: 5 of 8

Title ^ZS Existing Conditions

tot flow	# ports	port flow	spacing	effl sal	effl temp	far inc	nonlinear far dis
0.04030	1	0.04030	1.829	0.0	22	3.048	92.20

ort dep	port dia	plume dia	total vel	horiz vel	vertl vel	asp coeff	print frq
33.53	0.3592	0.3592	0.3977	0.3977	0.000	0.10	50

port elev	ver angle	cont coef	effl den	poll conc	decay	Froude #	Roberts F
0.1270	0	1.0	-2.16673	100	0	5.517	84.82

hor angle	red space	p amb den	p current	far dif	far vel	K:vel/cur	Stratif #
68	1.696	-0.694791	0.3078	0.0003	0.3078	1.292	0.000

depth	current	density	salinity	temp	amb conc	N (freq)	red grav.
0.0	0.3078	-0.694791	0	14.025	0	0.000	0.01447
67.06	0.3078	-0.694791	0	14.025	0	buoy flux	puff-ther
						0.0003438	1.127
						jet-plume	jet-cross
						1.866	0.4113
						plu-cross	jet-strat
						0.01999	
						plu-strat	

hor dis =

ORMIX1 flow category algorithm is turned off.

lp: F1. Quit: <esc>. Configuration:NTNOO. FILE: WOODLAND.VAR; to range

M INITIAL DILUTION CALCULATION (nonlinear mode)

lume dep	plume dia	poll conc	dilution	hor dis	
m	m			m	
33.53	0.3592	100.0	1.000	0.000	
33.53	0.3604	99.31	1.007	0.02755	-> bottom hit
33.50	0.4413	70.71	1.413	0.8487	-> bottom hit
33.44	0.5380	50.00	1.998	1.649	-> bottom hit
33.37	0.6518	35.36	2.825	2.503	-> bottom hit
33.27	0.7859	25.00	3.995	3.500	-> bottom hit
33.16	0.9442	17.68	5.650	4.720	
33.02	1.131	12.50	7.989	6.251	
32.85	1.353	8.839	11.30	8.202	
32.65	1.615 ←1.5M	6.250	15.98 ←13.1	10.71	←9.14M max. acute plume length
32.59	1.703	5.633	17.73	11.59	-> surface reflection begi
32.40	1.991	4.420	22.59	14.14	
32.04	2.623	3.125	31.95	19.26	
31.53	3.577	2.210	45.19	26.71	
30.81	4.967	1.563	63.90	37.42	
29.78	6.963	1.105	90.37	52.68	
28.34	9.806	0.7813	127.8	74.35	
26.28	13.84 ←12.0	0.5524	180.7 ←157.1	105.1	←91.4 max. chronic plume length
23.38	19.56	0.3906	255.6	148.5	
19.27	27.65	0.2762	361.5	210.0	
16.50	33.11	0.2307	432.9	251.5	-> bank(s) reached

FIELD CALCULATION (based on Brooks, 1960, see guide)

rfield dispersion based on wastefield width of 33.11m

--4/3 Power Law--			--Const Eddy Diff--					
conc	dilution	width	conc	dilution	width	distance	time	
		m			m	m	sec	hrs
0.230	435	33.2	0.230	435	33.2	253	4.75	0.0013

```
'eb 12, 1999,  12:33:11  WED PROGRAM PLUMES, Ed 3.1, 8/7/95   Case:   6 of   8
'itle   ^ZS Future Conditions Phase I                                  nonlinear
 tot flow   # ports port flow   spacing  effl sal effl temp   far inc   far dis
  0.06878         1   0.06878     1.829       0.0        22     3.048     92.20
 ort dep  port dia plume dia total vel horiz vel vertl vel asp coeff print frq
    33.53    0.3592    0.3592    0.6787    0.6787     0.000      0.10        50
port elev ver angle cont coef  effl den poll conc     decay  Froude # Roberts F
   0.1270         0       1.0  -2.16673       100         0     9.416     49.70
hor angle red space p amb den p current   far dif   far vel K:vel/cur Stratif #
        68     1.696 -0.694791    0.3078    0.0003    0.3078     2.205     0.000
    depth   current   density  salinity      temp  amb conc  N (freq) red grav.
      0.0    0.3078 -0.694791         0    14.025         0     0.000   0.01447
    67.06    0.3078 -0.694791         0    14.025         0 buoy flux puff-ther
                                                             0.0005867     1.923
                                                             jet-plume jet-cross
                                                                 3.184    0.7020
                                                             plu-cross jet-strat
                                                               0.03412
                                                             plu-strat

                                                               hor dis =

ORMIX1 flow category algorithm is turned off.
                                                                        to   range
lp: F1.  Quit: <esc>.  Configuration:NTNO0.  FILE: WOODLAND.VAR;
M INITIAL DILUTION CALCULATION (nonlinear mode)
 lume dep plume dia poll conc  dilution   hor dis
       m         m                             m
    33.53    0.3592     100.0     1.000     0.000

    33.53    0.3604     99.31     1.007   0.01137 -> bottom hit
    33.53    0.4652     70.71     1.413    0.4496 -> bottom hit
    33.51    0.5948     50.00     1.998     1.094 -> bottom hit
    33.48    0.7497     35.36     2.825     2.057 -> bottom hit
    33.41    0.9331     25.00     3.995     3.440 -> bottom hit
    33.30     1.149     17.68     5.650     5.173 -> bottom hit
    33.15     1.403     12.50     7.989     7.268 -> bottom hit
    32.96     1.701     8.839     11.30     9.818 -> bottom hit
    32.95     1.708     8.778     11.38     9.876 -> bottom hit
-> surface reflection begins
    32.68     2.188     6.250     15.98     13.41 -> bottom hit
    32.27     2.971     4.420     22.59     18.59 -> bottom hit
    31.68     4.136     3.125     31.95     25.89 -> bottom hit
    30.82     5.824     2.210     45.19     36.16 -> bottom hit
    29.60     8.237     1.563     63.90     50.61 -> bottom hit
    27.87     11.67     1.105     90.37     70.96 -> bottom hit
    25.41     16.54    0.7813     127.8     99.64
    21.92     23.43    0.5524     180.7     140.1
    16.97     33.18    0.3906     255.6     197.2
    16.74     33.65    0.3853     259.2     200.0 -> bank(s) reached
 FIELD CALCULATION (based on Brooks, 1960, see guide)
rfield dispersion based on wastefield width of      33.65m
     --4/3 Power Law--          --Const Eddy Diff--
   conc dilution    width     conc dilution    width   distance     time
                      m                          m        m       sec     hrs
  0.383      260     33.7    0.383      260     33.7     201      3.90  0.0011
```

←1.6M ←10.4 ←9.14M max acute plume length

←15.1 ←117.0 91.4m max. chronic plume length

Feb 12, 1999, 12:34:18 WED PROGRAM PLUMES, Ed 3.1, 8/7/95 Case: 7 of 8
Title ^ZS Future Conditions Phase II nonlinear

tot flow	# ports	port flow	spacing	effl sal	effl temp	far inc	far dis
0.1376	1	0.1376	1.652	0.0	22	3.048	92.20
port dep	port dia	plume dia	total vel	horiz vel	vertl vel	asp coeff	print frq
33.53	0.3592	0.3592	1.358	1.358	0.000	0.10	50
port elev	ver angle	cont coef	effl den	poll conc	decay	Froude #	Roberts F
0.03871	0	1.0	-2.16673	100	0	18.84	22.44
hor angle	red space	p amb den	p current	far dif	far vel	K:vel/cur	Stratif #
68	1.532	-0.694791	0.3078	0.0003	0.3078	4.412	0.000
depth	current	density	salinity	temp	amb conc	N (freq)	red grav.
0.0	0.3078	-0.694791	0	14.025	0	0.000	0.01447
67.06	0.3078	-0.694791	0	14.025	0	buoy flux	puff-ther
						0.001300	3.848
						jet-plume	jet-cross
						6.370	1.404
						plu-cross	jet-strat
						0.06826	
						plu-strat	

hor dis =

CORMIX1 flow category algorithm is turned off.

to range

elp: F1. Quit: <esc>. Configuration:NTNO0. FILE: WOODLAND.VAR;

JM INITIAL DILUTION CALCULATION (nonlinear mode)

plume dep	plume dia	poll conc	dilution	hor dis	
m	m			m	
33.53	0.3592	100.0	1.000	0.000	
33.53	0.3604	99.31	1.007	0.008022	-> bottom hit
33.53	0.4844	70.71	1.413	0.3815	-> bottom hit
33.53	0.6469	50.00	1.998	0.9087	-> bottom hit
33.52	0.8522	35.36	2.825	1.648	-> bottom hit
33.50	1.106	25.00	3.995	2.702	-> bottom hit
33.47	1.414	17.68	5.650	4.234	-> bottom hit
33.44	1.540	15.60	6.400	4.952	-> bottom hit
> surface reflection begins					
33.37	1.862	12.50	7.989	6.961	-> bottom hit
33.10	2.663	8.839	11.30	12.09	-> bottom hit
32.57	3.901	6.250	15.98	19.18	-> bottom hit
31.74	5.726	4.420	22.59	28.46	-> bottom hit
30.48	8.359	3.125	31.95	40.74	-> bottom hit
28.63	12.12	2.210	45.19	57.31	-> bottom hit
25.98	17.47	1.563	63.90	80.01	-> bottom hit
22.17	25.06	1.105	90.37	111.4	-> bottom hit
17.25	34.80	0.8032	124.3	151.2	-> bank(s) reached
> bottom hit					

← 2.2m ← 9.4 ← 9.14 max acute plume length

← 20.2 ← 73.5 ← 91.4 max chronic plume length

ARFIELD CALCULATION (based on Brooks, 1960, see guide)

rfield dispersion based on wastefield width of 34.80m

--4/3 Power Law--			--Const Eddy Diff--					
conc	dilution	width	conc	dilution	width	distance	time	
		m			m	m	sec	hrs
0.800	125	34.8	0.800	125	34.8	152	3.95	0.0011

Oct 19, 1999, 14:51:29 WED PROGRAM PLUMES, Ed 3.1, 8/7/95 Case: 13 of 13
Title ^ZSWoodland WWTP Future Conditions Max. SBR Decant Rate Base nonlinear

tot flow	# ports	port flow	spacing	effl sal	effl temp	far inc	far dis
0.4206	1	0.4206	1.829	0.0	22	3.048	92.20
port dep	port dia	plume dia	total vel	horiz vel	vertl vel	asp coeff	print frq
33.53	0.5747	0.5747	1.621	1.621	0.000	0.10	50
port elev	ver angle	cont coef	effl den	poll conc	decay	Froude #	Roberts F
0.1270	0	1.0	-2.16673	100	0	17.78	8.127
hor angle	red space	p amb den	p current	far dif	far vel	K:vel/cur	Stratif #
68	1.696	-0.694791	0.3078	0.0003	0.3078	5.268	0.000
depth	current	density	salinity	temp	amb conc	N (freq)	red grav.
0.0	0.3078	-0.694791	0	14.025	0	0.000	0.01447
67.06	0.3078	-0.694791	0	14.025	0	buoy flux	puff-ther
						0.003588	6.286
						jet-plume	jet-cross
						9.621	2.683
						plu-cross	jet-strat
						0.2087	
						plu-strat	

hor dis =

CORMIX1 flow category algorithm is turned off.
33.53 m, 110.0 ft, 1320 in. 0 to 200 m range
Help: F1. Quit: <esc>. Configuration:NTNO0. FILE: WOODLAND.VAR;
UM INITIAL DILUTION CALCULATION (nonlinear mode)

plume dep	plume dia	poll conc	dilution	hor dis	
m	m			m	
33.53	0.5747	100.0	1.000	0.000	
33.53	0.5767	99.31	1.007	0.01225	-> bottom hit
33.53	0.7803	70.71	1.413	0.6030	-> bottom hit
33.52	1.051	50.00	1.998	1.435	-> bottom hit
33.51	1.397	35.36	2.825	2.596	-> bottom hit
33.49	1.709	27.36	3.651	3.751	-> bottom hit
-> surface reflection begins					
33.48	1.855 ←2.53	25.00	3.995 ←5.24	4.338	-> bottom hit ←7.23
33.34	2.752	17.68	5.650	8.179	-> bottom hit
32.89	4.256	12.50	7.989	15.19	-> bottom hit
31.91	6.574	8.839	11.30	25.10	-> bottom hit
30.26	10.01	6.250	15.98	37.62	-> bottom hit
27.76	15.01 ←21.4	4.420	22.59 ←30.92	53.63	-> bottom hit ←72.34
24.10	22.19	3.125	31.95	74.65	-> bottom hit
18.81	32.43	2.210	45.19	102.9	-> bottom hit
17.23	35.47	2.033	49.11	111.0	-> bank(s) reached

-> bottom hit

plume width restricted.

ARFIELD CALCULATION (based on Brooks, 1960, see guide)
arfield dispersion based on wastefield width of 35.47m

--4/3 Power Law--			--Const Eddy Diff--					
conc	dilution	width	conc	dilution	width	distance	time	
		m			m	m	sec	hrs
2.02	49.3	35.5	2.02	49.3	35.5	113	5.64	0.0016

Freshwater un-ionized ammonia criteria based on EPA Gold Book (EPA 440/5-86-001) as revised by Heber and Ballentine (1992).

Based on Lotus File NH3FRES2.WK1 Revised 12-Dec-94

INPUT

1. Temperature (deg C; 0<T<30):	14.0
2. pH (6.5<pH<9.0):	7.42
3. Total Ammonia (ug N/L):	20.0
4. Acute TCAP (Salmonids present- 20; absent- 25):	20
5. Chronic TCAP (Salmonids present- 15; absent- 20):	15

OUTPUT

1. Intermediate Calculations:

Acute FT:	1.5136
Chronic FT:	1.5136
FPH:	1.5640
RATIO:	19.7369
pKa:	9.5955
Fraction Of Total Ammonia Present As Un-ionized:	0.6632%

2. Sample Un-ionized Ammonia Concentration (ug/L as NH3-N):	0.1

3. Un-ionized Ammonia Criteria:

Acute (1-hour) Un-ionized Ammonia Criterion (ug/L as NH3-N):	90.3
Chronic (4-day) Un-ionized Ammonia Criterion (ug/L as NH3-N):	14.1

4. Total Ammonia Criteria:

Acute Total Ammonia Criterion (ug/L as NH3-N):	13,614
Chronic Total Ammonia Criterion (ug/L as NH3-N):	2,122

most limiting

Freshwater un-ionized ammonia criteria based on EPA Gold Book (EPA 440/5-86-001) as revised by Heber and Ballentine (1992).

Based on Lotus File NH3FRES2.WK1 Revised 12-Dec-94

INPUT

1. Temperature (deg C; 0<T<30):	14.0
2. pH (6.5<pH<9.0):	7.60
3. Total Ammonia (ug N/L):	20.0
4. Acute TCAP (Salmonids present- 20; absent- 25):	20
5. Chronic TCAP (Salmonids present- 15; absent- 20):	15

OUTPUT

1. Intermediate Calculations:

Acute FT:	1.5136
Chronic FT:	1.5136
FPH:	1.3048
RATIO:	15.6308
pKa:	9.5955
Fraction Of Total Ammonia Present As Un-ionized:	1.0004%

2. Sample Un-ionized Ammonia Concentration (ug/L as NH3-N):	0.2

3. Un-ionized Ammonia Criteria:

Acute (1-hour) Un-ionized Ammonia Criterion (ug/L as NH3-N):	108.2
Chronic (4-day) Un-ionized Ammonia Criterion (ug/L as NH3-N):	21.3

4. Total Ammonia Criteria:

	most limiting
Acute Total Ammonia Criterion (ug/L as NH3-N):	10,818
Chronic Total Ammonia Criterion (ug/L as NH3-N):	2,130

Streeter-Phelps analysis of critical dissolved oxygen sag.
Based on Lotus File DOSAG2.WK1 Revised 19-Oct-93

INPUT

	Existing	Future Phase I SBC (2009)	Future Phase II SBC (2023)	Future Max. SBR Decant Rate
1. EFFLUENT CHARACTERISTICS				
Discharge (cfs):	0.712	1.22	2.43	7.43
CBOD5 (mg/L):	19	19	19	19
NBOD (mg/L):	38.7	38.7	38.7	38.7
Dissolved Oxygen (mg/L):	4.2	4.2	4.2	4.2
Temperature (deg C):	22.8	22.8	22.8	22.8
2. RECEIVING WATER CHARACTERISTICS				
Upstream Discharge (cfs):	789	789	789	789
Upstream CBOD5 (mg/L):	1.5	1.5	1.5	1.5
Upstream NBOD (mg/L):	0.06	0.06	0.06	0.06
Upstream Dissolved Oxygen (mg/L):	9.9	9.9	9.9	9.9
Upstream Temperature (deg C):	14.2	14.2	14.2	14.2
Elevation (ft NGVD):	1540	1540	1540	1540
Downstream Average Channel Slope (ft/ft):	0.0005	0.0005	0.0005	0.0005
Downstream Average Channel Depth (ft):	3	3	3	3
Downstream Average Channel Velocity (fps):	1.01	1.01	1.01	1.01
3. REAERATION RATE (Base e) AT 20 deg C (day^-1):	2.81	2.81	2.81	2.81

Reference	Applic. Vel (fps)	Applic. Dep (ft)	Suggested Values	Suggested Values	Suggested Values	Suggested Values
Churchill	1.5 - 6	2 - 50	1.86	1.86	1.86	1.86
O'Connor and Dobbins	.1 - 1.5	2 - 50	2.51	2.51	2.51	2.51
Owens	.1 - 6	1 - 2	2.85	2.85	2.85	2.85
Tsivoglou-Wallace	.1 - 6	.1 - 2	2.09	2.09	2.09	2.09

4. BOD DECAY RATE (Base e) AT 20 deg C (day^-1):	2.51	2.51	2.51	2.51

Reference	Suggested Value	Suggested Value	Suggested Value	Suggested Value
Wright and McDonnell, 1979	0.39	0.39	0.39	0.39

OUTPUT

1. INITIAL MIXED RIVER CONDITION				
CBOD5 (mg/L):	1.5	1.5	1.6	1.7
NBOD (mg/L):	0.1	0.1	0.2	0.4
Dissolved Oxygen (mg/L):	9.9	9.9	9.9	9.8
Temperature (deg C):	14.2	14.2	14.2	14.28
2. TEMPERATURE ADJUSTED RATE CONSTANTS (Base e)				
Reaeration (day^-1):	2.45	2.45	2.45	2.45
BOD Decay (day^-1):	1.92	1.92	1.93	1.93
3. CALCULATED INITIAL ULTIMATE CBODU AND TOTAL BODU				
Initial Mixed CBODU (mg/L):	2.2	2.2	2.3	2.4
Initial Mixed Total BODU (CBODU + NBOD, mg/L):	2.3	2.4	2.5	2.9
4. INITIAL DISSOLVED OXYGEN DEFICIT				
Saturation Dissolved Oxygen (mg/L):	9.698	9.697	9.694	9.682
Initial Deficit (mg/L):	-0.20	-0.19	-0.19	-0.16
5. TRAVEL TIME TO CRITICAL DO CONCENTRATION (days):	0.50	0.50	0.50	0.49
6. DISTANCE TO CRITICAL DO CONCENTRATION (miles):	8.32	8.29	8.24	8.06
7. CRITICAL DO DEFICIT (mg/L):	0.69	0.71	0.74	0.88
8. CRITICAL DO CONCENTRATION (mg/L):	9.00	8.99	8.95	8.80

Dissolved oxygen concentration following initial dilution.
References: EPA/600/6-85/002b and EPA/430/9-82-011

Based on Lotus File IDOD2.WK1 Revised 19-Oct-93

INPUT	Existing		Future Phase I SBC (2009)		Future Phase II SBC (2023)		Future Max. SBR Decant Rate	
	Acute	Chronic	Acute	Chronic	Acute	Chronic	Acute	Chronic
1. Dilution Factor at Mixing Zone Boundary:	13.1	157.1	10.4	117	9.1	73.5	3.7	27.5
2. Ambient Dissolved Oxygen Concentration (mg/L):	9.9	9.9	9.9	9.9	9.9	9.9	9.9	9.9
3. Effluent Dissolved Oxygen Concentration (mg/L):	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2
4. Effluent Immediate Dissolved Oxygen Demand (mg/L):	0	0	0	0	0	0	0	0
OUTPUT								
Dissolved Oxygen at Mixing Zone Boundary (mg/L):	9.46	9.86	9.35	9.85	9.27	9.82	8.36	9.69

Calculation of pH of a mixture of two flows. Based on the procedure in EPA's DESCON program (EPA, 1988. Technical Guidance on Supplementary Stream Design Conditions for Steady State Modeling. USEPA Office of Water, Washington D.C.)

	Existing		Future Phase I SBC (2009)		Future Phase II SBC (2023)		Future Max. SBR Decant Rate	
	Acute	Chronic	Acute	Chronic	Acute	Chronic	Acute	Chronic
INPUT								
1. DILUTION FACTOR AT MIXING ZONE BOUNDARY	13.1	157.1	10.4	117.0	9.1	73.5	3.7	27.5
1. UPSTREAM/BACKGROUND CHARACTERISTICS								
Temperature (deg C):	14.20	14.20	14.20	14.20	14.20	14.20	14.20	14.20
pH:	7.40	7.40	7.40	7.40	7.40	7.40	7.40	7.40
Alkalinity (mg $CaCO_3$/L):	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00
2. EFFLUENT CHARACTERISTICS								
Temperature (deg C):	22.80	22.80	22.80	22.80	22.80	22.80	22.80	22.80
pH:	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00
Alkalinity (mg $CaCO_3$/L):	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00
OUTPUT								
1. IONIZATION CONSTANTS								
Upstream/Background pKa:	6.43	6.43	6.43	6.43	6.43	6.43	6.43	6.43
Effluent pKa:	6.36	6.36	6.36	6.36	6.36	6.36	6.36	6.36
2. IONIZATION FRACTIONS								
Upstream/Background Ionization Fraction:	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Effluent Ionization Fraction:	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81
3. TOTAL INORGANIC CARBON								
Upstream/Background Total Inorganic Carbon (mg $CaCO_3$/L):	24.34	24.34	24.34	24.34	24.34	24.34	24.34	24.34
Effluent Total Inorganic Carbon (mg $CaCO_3$/L):	184.63	184.63	184.63	184.63	184.63	184.63	184.63	184.63
4. CONDITIONS AT MIXING ZONE BOUNDARY								
Temperature (deg C):	14.86	14.25	15.03	14.27	15.15	14.32	16.52	14.51
Alkalinity (mg $CaCO_3$/L):	31.77	22.81	34.31	23.09	36.07	23.74	56.59	26.65
Total Inorganic Carbon (mg $CaCO_3$/L):	36.57	25.36	39.75	25.71	41.95	26.52	67.66	30.17
pKa:	6.42	6.43	6.42	6.43	6.42	6.43	6.41	6.42
pH at Mixing Zone Boundary:	7.24	7.38	7.22	7.37	7.21	7.36	7.12	7.30

4.8 MGD SBR Decant Rate

Calculate the temperature of the Lewis River from effluent discharge

Key assumptions in this color				
Applicable WQ standards this color				
Key outputs in this color				
Maximum (1-hour) SBR decant rate	**4.80**	MGD	7.43 cfs	
Lewis River critical flow	**789**	cfs		
Maximum Lewis River temperature at County Road 16 during critical season	**14.2**	degrees C		
Maximum estimated WWTP temperature during the critical flow season	**22.8**	degrees C		
Actual chronic mixing zone ratio: (15:1 presumed for illustrative purposes only)	**27.5**	ratio (X:1)		
Temperature increase at edge of actual MZ boundary (degrees C)	0.30	<WQ std?	Yes	
Percentage of thermal assimilative capacity utilized at MZ boundary	22.8%	***< 70% ?***	If not - evaluate reaspot	
Lewis River chronic mixing zone flow (25% of flow)	197.25	cfs		
	127.5	MGD		
Class A Water Quality Standard	*18.0*	degrees C		
Temperature of river after complete mix under these conditions	**14.3**	degrees C		**OK**
Temperature rise upon complete mix under these conditions	0.08	< WQ std?	Yes	
Maximum allowable temperature rise at complete mix	*0.30*	degrees C	(as per WAC 173-201A)	
Max. temperature at MZ edge assuming max. mixing zone (25% of $7Q_{10}$ flow)	14.5	<WQ std?	Yes	
Max temperature rise at maximum mixing zone ratio	0.31	<WQ std?	Yes	
Maximum temperature rise at edge of mixing zone (t) when water is below 18 C	1.3	degrees C	*(t=28/[T+7])*	
Maximum effluent temp. that can still meet stds with max MZ ratio	50.6	degrees C		**OK**
Chronic mixing zone ratio needed to meet WQ standards under these conditions	6.28 : 1	***< actual chronic MZ ratio at final buildout?***		
Maximum effluent temp. that can still meet WQ stds for complete mix	46.4	degrees C		**OK**

This spreadsheet calculates the reasonable potential to exceed state water quality standards for a small number of samples. The procedure and calculations are done per the procedure in Technical Support Document for Water Quality-based Toxics Control, U.S. EPA, March, 1991 (EPA/505/2-90-001) on page 56. User input columns are shown with red headings. To view notes (cells with red dots) highlight the cell and press shift F2. Corrected formulas in col G and H on 2/97(GB)

CALCULATIONS

Wasteload Achievement Percentile Occurance Probability (in decimal)>>>>> 0.95

Parameter	Metal Criteria Translator as decimal	Ambient Concentration	State Water Quality Standard		Max concentration at edge of...		LIMIT REQ'D?	Probability		Max effluent conc. measured	Coeff Variation		# of samples	Multiplier	Acute Dil'n Factor	Chronic Dil'n Factor	COMMENTS
	Chronic	ug/L	Acute ug/L	Chronic ug/L	Acute Mixing Zone ug/L	Chronic Mixing Zone ug/L			Pn	ug/L	CV	s	n				
Existing																	
ammonia		20	10818	2122	1992	184	NO	0.95	0.47	10000	0.60	0.55	4	2.59	13.1	157.1	
chlorine		0	19	11	53	4	YES	0.95	1.00	1200	0.60	0.55	730	0.57	13.1	157.1	
Future Phase I SBC (2009)																	
ammonia		20	10818	2122	2504	241	NO	0.95	0.47	10000	0.60	0.55	4	2.59	10.4	117.0	
chlorine		0	19	11	66	6	YES	0.95	1.00	1200	0.60	0.55	730	0.57	10.4	117.0	
Future Phase II SBC (2023)																	
ammonia		20	10818	2122	2859	371	NO	0.95	0.47	10000	0.60	0.55	4	2.59	9.1	73.5	
chlorine		0	19	11	76	9	YES	0.95	1.00	1200	0.60	0.55	730	0.57	9.1	73.5	
Future (max. SBR Decant Rate)																	
ammonia		20	10818	2122	7002	959	NO	0.95	0.47	10000	0.60	0.55	4	2.59	3.7	27.5	
chlorine		0	19	11	186	25	YES	0.95	1.00	1200	0.60	0.55	730	0.57	3.7	27.5	
CASE SCENARIOS																	
Future Phase II SBC (2023)																	
ammonia		20	10818	2122	10818	1357	NO	0.95	0.47	***38016***	0.60	0.55	4	2.59	9.1	73.5	max. ammonia conc.
Future (max. SBR Decant Rate)																	
ammonia		20	10818	2122	10818	1473	NO	0.95	0.47	***15461***	0.60	0.55	4	2.59	3.7	27.5	max. ammonia conc.