Total Maximum Daily Load
for
Ammonia

in Bachelor Creek
near
Colman, South Dakota

developed in accordance with

Section 303(d) of the federal Clean Water Act

Prepared by

South Dakota Department of Environment and Natural Resources

2004

Copies of the TMDL can be obtained by request at the following address:

South Dakota Department of Environment and Natural Resources
Surface Water Quality Program
523 East Capitol Avenue
Pierre, SD 57501
(605) 773-3351

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INTRODUCTION

Section 303(d) of the federal Clean Water Act requires states to develop Total Maximum Daily Loads (TMDLs) for waters at levels necessary to achieve and maintain water quality standards. TMDLs are calculations of the amount of pollution a waterbody can receive and still maintain applicable water quality standards. TMDLs are necessary for waters that do not meet or are not expected to meet water quality standards with the application of technology-based controls for point sources. TMDLs address specific waterbodies, segments of waterbodies, or even entire watersheds, and are pollutant specific. TMDLs must allow for seasonal variations and a margin of safety, which accounts for any lack of knowledge concerning the relationship between pollutant loads and water quality. The TMDL calculation can be represented by Equation 1.

Equation 1:

$$TMDL = \sum WLA + \sum LA + MOS$$

where *TMDL* = The total maximum daily pollutant load of the receiving stream. This represents the allowable pollutant loading the stream can receive while maintaining applicable water quality standards. TMDLs can be expressed in terms of mass per time, toxicity, or other appropriate terms.

ΣWLA = The sum of wasteload allocations for this segment of the receiving stream. This represents the portion of the receiving stream's loading capacity that is allocated to one or more existing or future point sources dischargers.

ΣLA = The sum of load allocations for this segment of the receiving stream. This represents the portion of the stream's loading capacity that is allocated to one or more existing or future nonpoint sources or pollution or to natural background sources.

MOS = A margin of safety that accounts for the uncertainty about the relationship between the pollutant loads and the quality of the receiving stream. In the case of this TMDL, the margin of safety is not explicitly expressed, but is implicit in the conservative assumptions within the calculations or water quality models.

In accordance with the procedures and requirements outlined above, a TMDL is being developed for ammonia in Bachelor Creek near Colman, to ensure that surface water quality standards are maintained.

GEOGRAPHICAL EXTENT

Bachelor Creek is located in the Big Sioux River Basin in the eastern portion of the state. The Bachelor Creek drainage is comprised largely of cropland. Figure 1 shows Bachelor Creek in the area the TMDL is being developed.

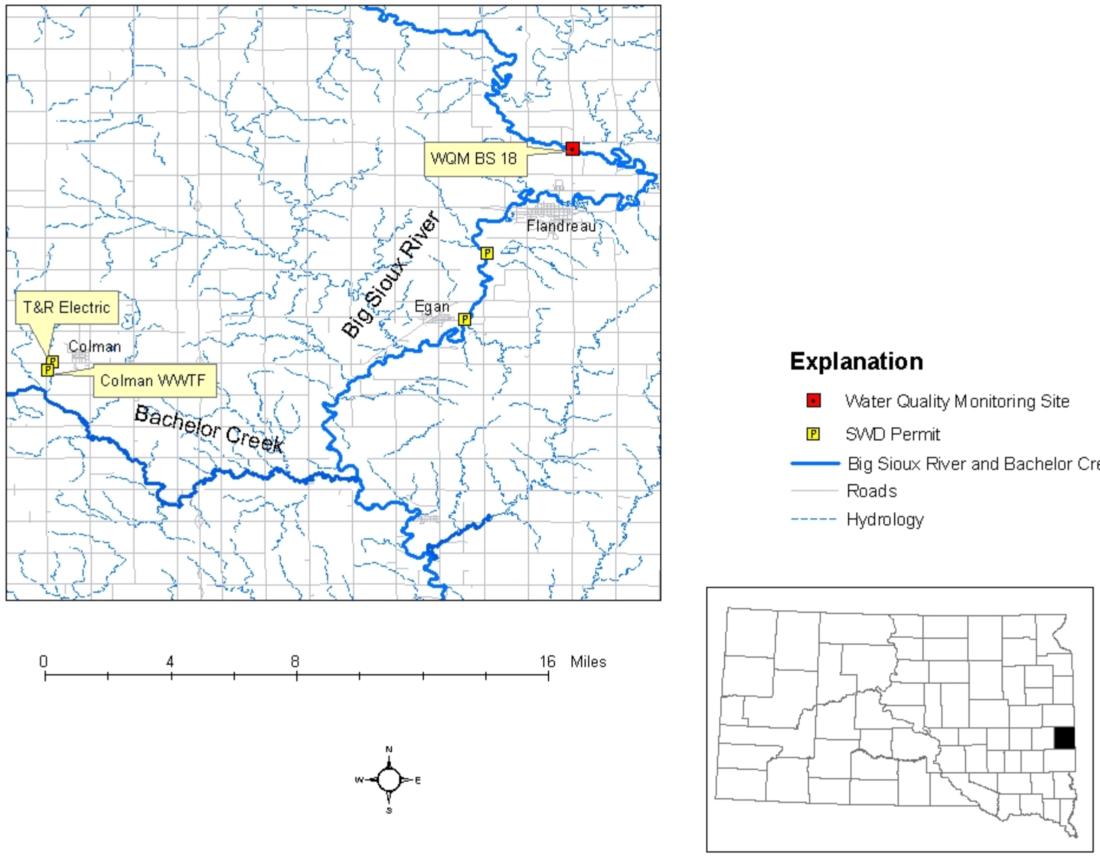

Figure 1: Bachelor Creek TMDL Area

TMDLs related to ammonia are usually relatively narrow in their spatial extent. Past experience has shown that due to the decay and transformation of organic pollutants such as ammonia, most adverse effects are generally exhibited within 10 miles of pollutant loading. While this rule of thumb can certainly vary depending on the source of the pollutant, fate and transport characteristics, hydrologic conditions, and other factors, it has generally held true in past instances.

TMDL TARGETS AND CONDITIONS

Every TMDL begins with a target, or endpoint, which is the water quality required in the stream. In this instance, the target is the surface water quality standards for ammonia. The South Dakota Surface Water Quality Standards (SDSWQS) specify the maximum allowable ammonia concentrations applicable to waters classified for fish life propagation. Also specified are the beneficial uses assigned to specific waters. Table 1 shows the beneficial uses and applicable surface water quality standards for ammonia and other parameters that apply to this segment of Bachelor Creek, as specified in the Administrative Rules of South Dakota (ARSD), Chapters 74:51:01 and 74:51:03. SDSWQS for toxic pollutants also apply.

Table 1: SDSWQS Applicable to Bachelor Creek Near Colman

Beneficial Use	Significant Parameter	Surface Water Quality Standards
Warmwater marginal fish life propagation	• Chlorine, total residual (mg/L) • Hydrogen sulfide, undisassociated (mg/L) • Nitrogen, unionized ammonia as N (mg/L) • Oxygen, dissolved (mg/L) • pH (s.u.) • Solids, suspended (mg/l) • Temperature (^oF)	• 0.019 (acute)/0.011 (chronic) • 0.002 • 0.05 (30-day ave)* • ≥4.0 • 6.0-9.0 • 150 (30-day ave)/263 (dly max) • 90
Limited-contact recreation	• Coliform, fecal (per 100mL) May 1- September 30 • Oxygen, dissolved (mg/L)	• 1,000 (geo. mean)/2,000 (1 sample) • ≥5.0
Fish and wildlife propagation, recreation, and stock watering	• Alkalinity (as $CaCO_3$) • Conductivity (µmhos/cm @25 ^oC) • Nitrogen, nitrates as N (mg/L) • pH (s.u.) • Solids, total dissolved (mg/L) • Total petroleum hydrocarbons (mg/L) • Oil and grease (mg/L)	• 750 (30-day ave)/1,313 (dly max) • 4,000 (30-day ave)/7000 (dly max) • 50 (30-day ave)/88 (dly max) • 6.0 - 9.5 • 2,500 (30-day ave)/4,375 (dly max) • 10 • 10
Irrigation	• Conductivity (µmhos/cm @25 ^oC) • Sodium adsorption ratio	• 2,500/4,375 • 10

* A daily maximum standard for ammonia also applies. This standard is 1.75 times the applicable criterion in Appendix A of ARSD §74:51:01.

Just as all TMDLs have a target, they also have specific conditions under which they are evaluated. Critical conditions are those at which the surface water quality standards are most likely to be violated. The TMDL is developed for these critical conditions to be conservative, thereby assuring water quality standards are maintained under less critical conditions. Critical conditions can be defined by several factors, including, but not limited to the following:

- stream flow (e.g. high, low)
- storm event occurrence and intensity
- ambient water quality conditions (e.g. pH, temperature, etc.)
- diurnal variations in water column conditions
- temporal occurrence of pollutant loadings from natural and human-induced activities

Due to the wide seasonal variation in the factors listed above, this TMDL is being developed on a seasonal basis, to account for these variations. Using the procedures, data, and methodologies outlined below, the critical conditions are defined for each season in order to develop the TMDL and its respective components.

DATA AND MONITORING

The department maintains a statewide network of fixed monitoring stations to gain a historic record of water quality for various streams around the state. This water quality monitoring (WQM) network consists of 136 monitoring stations, which are sampled at monthly, quarterly, or seasonal intervals. The goal of this sampling is to collect reliable water quality data that reflects actual stream conditions; to collect data to determine the effectiveness of controls on point and nonpoint sources of pollution; and to collect data to evaluate the appropriateness of current beneficial use designations.

Since there are no WQM stations on Bachelor Creek, water quality samples were collected at a WQM station on the Big Sioux River. Ambient temperature, pH, and ammonia data at WQM BS18, located near Flandreau, was obtained to represent instream conditions. A description of the station is listed below.

WQM BS 18 – located at north-south SD Hwy 13 bridge, 1.5 miles north of Flandreau

The United States Geological Survey (USGS) does not maintain a flow monitoring station in the TMDL area.

Figure 1 shows the location of the water quality monitoring station described above.

SEASON SELECTION

To account for seasonal changes in flows and water quality, this TMDL has been developed for two seasons. Season selection is based on a review of average monthly ambient temperature and pH values measured at WQM BS 18. This data is included in Attachment 1. Table 2 shows the season selection.

Table 2: Season Selection for Bachelor Creek

Season	Month	Temperature (°C)	pH (s.u.)
Winter	January	1.11	7.91
	February	1.60	8.01
	March	2.67	8.07
Summer	April	11.39	8.33
	May	17.03	8.12
	June	22.93	8.32
	July	26.18	8.09
	August	23.42	8.12
	September	20.14	8.28
	October	11.72	8.17
Winter	November	3.98	7.64
	December	1.56	7.83

TMDL DETERMINATION

Developing the TMDL for Bachelor Creek for ammonia is a matter of determining the maximum ammonia loading that can occur without causing applicable SDSWQS for ammonia to be exceeded.

40 CFR 130.2(f) defines a term called *loading capacity*. This is the maximum amount of loading a waterbody can receive without violating water quality standards, and is essentially equivalent to the TMDL. The ammonia TMDL (or loading capacity) for Bachelor Creek near Colman can be determined by Equation 2.

Equation 2:

TMDL = Loading Capacity = Allowable total ammonia in Bachelor Creek (lbs/day)
= Allowable total ammonia (mg/L) x Critical stream flow (cfs) x 5.3934 (conversion factor)

The TMDL development therefore involves determining the allowable total ammonia and the critical stream flow. Determination of these values is outlined below.

Allowable Total Ammonia
The SDSWQS specify the total ammonia concentration that will maintain the unionized ammonia standard at given pH and temperature conditions (ARSD §74:51:01, Appendix A). Using 50th percentile ambient seasonal instream water temperature and pH data collected from WQM BS 18, the allowable seasonal instream total ammonia-nitrogen concentrations were determined. 50th percentile ambient seasonal instream conditions were used instead of the more stringent 80th percentile conditions since there are no WQM sites located on Bachelor Creek. These values are summarized below.

Table 3: Allowable Seasonal Instream Total Ammonia Concentrations for Bachelor Creek

Season	Temperature (^{o}C)	pH (s.u.)	Allowable Total Ammonia 30-day Average (mg/L)	Allowable Total Ammonia Daily Maximum (mg/L)
Summer (Apr – Oct)	21.29	8.17	0.85	1.49
Winter (Nov – Mar)	1.98	8.00	5.33	9.33

Critical Flow Conditions
Ammonia loading to Bachelor Creek occurs from both point and nonpoint sources, at both high and low flows. However, critical conditions (for ammonia) presumably occur when stream flows are relatively low. This TMDL will therefore focus on low stream flow conditions. Should it be determined that water quality standards are violated at other flow conditions, a separate TMDL would be necessary for those conditions.

The SDSWQS at ARSD §74:51:01:30 specify that surface water quality standards apply to low quality fishery waters when flows meet or exceed the minimum 7-day average low flow that can be expected to occur once every five years (7Q5). The 7Q5 is therefore the minimum, or critical, flow for which the SDSWQS must be maintained (although all Surface Water Discharge permit limits remain in force below this minimum flow).

The seasonal 7Q5 flows were determined using Best Professional Judgement (BPJ). Since there was no flow data for Bachelor Creek, the critical low flow is assumed to be less than 1.0 cfs. However, 1.0 cfs was used as allowed by ARSD Section 74:51:01:30. The following table summarizes the flow data:

Table 4: Seasonal Critical Low Flow Values for Bachelor Creek

Season	Seasonal 7Q5 Low Flow (cfs)	Flow from Point Sources [2] (cfs)	Ratio of Point Source flow to 7Q5 flow	Ratio of 7Q5 allowed under Mixing Zone Procedures [3]	Critical Low Flow[4](cfs)
Summer	1.00	1.24	1.24	1.00	2.24
Winter	1.00	1.24	1.24	1.00	2.24

[1] 1.0 cfs was used for the 7Q5, as allowed by ARSD 74:51:01:30.
[2] Flows from point sources dischargers include: city of Colman WWTF – see Attachment 2
[3] See SDDENR's Mixing Zone and Dilution Implementation Procedures. Pierre, SD, August 1998.
[4] The critical low flow value is determined by multiplying the 7Q5 by the allowed dilution ratio, and adding the expected flow from the point source(s).

Loading Capacity

Having determined both the allowable total ammonia and the critical stream flow as described above, the seasonal loading capacities (or TMDLs) can be calculated. Continuing with Equation 2, the following table summarizes the seasonal ammonia loading capacities of Bachelor Creek for which applicable surface water quality standards for ammonia will be maintained. The allowable total ammonia is based on the SDSWQS for ammonia as specified in Appendix A of ARSD §74:51:01. A sample calculation is included for the spring season.

Table 5: Seasonal Ammonia Loading Capacities of Bachelor Creek

	Allowable Total Ammonia			Total Ammonia Loading Capacity	
Season	30-day Average (mg/L)	Daily Maximum (mg/L)	Critical Low Flow (cfs)	30-day Average (lbs/day)	Daily Maximum (lbs/day)
Summer	0.85	1.49	2.24	10.27	18.00
Winter	5.33	9.33	2.24	64.39	112.72

Sample calculation for summer 30-day average ammonia loading capacity:

TMDL = Loading Capacity = Allowable total ammonia x Critical stream flow x 5.3934
= 0.85 x 2.24 x 5.3934 = 10.27 pounds of total ammonia per day

LOAD ALLOCATION

At low stream flow conditions, it is assumed that there is very little nonpoint source runoff to the stream. The load allocation, which is comprised of nonpoint source loadings and natural background concentrations, is then reduced to the natural background water quality in the stream. Table 6 summarizes the calculation of the ammonia load allocation, using background 50th percentile ammonia data, upstream critical flow values, and Equation 2.

Table 6: Seasonal Total Ammonia Load Allocation for Bachelor Creek

Season	Background Total Ammonia (mg/L) *	Upstream Critical Flow (cfs) **	Total Ammonia Load Allocation (lbs/day) ***
Summer	0.02	1.00	0.11
Winter	0.02	1.00	0.11

* The background ammonia value for summer was 0.00. The value of 0.02 was used in order to be conservative and to account for detection limits.
** Critical flow values correspond to the seasonal 7Q5 flows multiplied by the mixing zone factor (see Table 4).
*** The total ammonia load allocation was computed by using Equation 2, substituting the background ammonia concentration for the allowable ammonia concentration.

WASTELOAD ALLOCATION

Having computed the loading capacity (TMDL) and load allocation of Bachelor Creek for ammonia, the determination of the wasteload allocation is simply a matter of solving the following equation:

$$TMDL = \sum WLA + \sum LA + MOS$$

Solving for *ΣWLA:*

$$\sum WLA = TMDL - \sum LA - MOS$$

Summarized in the following table are seasonal ammonia wasteload allocations for Bachelor Creek calculated using the equation presented above.

Table 7: Seasonal Total Ammonia Wasteload Allocation for Bachelor Creek

	TMDL				ΣWLA	
Season	30-day Avg (lbs/d)	Daily Max (lbs/d)	ΣLA (lbs/day)	Margin of Safety	30-day Avg (lbs/d)	Daily Max (lbs/d)
Summer (Apr-Oct)	10.27	18.00	0.11	Implicit in conservative assumptions and modeling techniques	10.16	17.89
Winter (Nov-Mar)	64.39	112.72	0.11		64.28	112.61

CONCLUSIONS

Using the data and methodologies described above, the ammonia TMDL, wasteload allocation, and load allocation for Bachelor Creek near Colman were determined. These values, specified in pounds per day, are summarized in Table 7. These values represent reasonable estimations based on procedures specified by the SDSWQS and other department guidelines. Both 30-day average and daily maximum loads have been developed, to ensure the surface water quality standards for ammonia are maintained.

TMDL Implementation
Nonpoint source ammonia loads at critical low flows are assumed to be primarily due to natural background levels of ammonia. The load allocation is based on 50th percentile ambient historical measurements of ammonia loads. Upstream conditions are meeting SDSWQS for ammonia. Unless conditions affecting ammonia loading in the watershed change, the load allocation at low flows is not expected to be exceeded. Therefore, no nonpoint source water quality controls are currently necessary to implement this TMDL.

Point source ammonia loads at critical low flow conditions are primarily due to discharges from the city of Colman's municipal wastewater treatment facility. Water quality controls on this point source loading will be required in order to meet the wasteload allocation. The implementation mechanisms for point source controls are Surface Water Discharge permits, issued by the South Dakota Department of Environment and Natural Resources. Permittees discharging to this segment of Bachelor Creek or its tributaries are summarized in Table 8.

Table 8: Surface Water Discharge permittees in Bachelor Creek Area

Permittee	Permit Number	Receiving Water	Expiration Date
City of Colman	SD0022551	Bachelor Creek	Sept. 30, 2001

The wasteload allocation will be allocated among the surface water discharge permittees. The approximate timeframe for implementation will be late 2004.

Post Monitoring and TMDL Revision
In order to assess the adequacy of the TMDL, post-implementation water quality monitoring is necessary. Bachelor Creek is a tributary of the Big Sioux River. There are no WQM sites on Bachelor Creek at this time. The department maintains 17 WQM sites on the Big Sioux River, which will show if surface water quality standards are being maintained. Effluent compliance monitoring required by the city of Colman's Surface Water Discharge permits will show if the wasteload allocation is being met.

Revisions to this TMDL could occur if the results of post-implementation monitoring consistently reveal violations of the surface water quality standards, or if monitoring shows ammonia loads consistently exceed allocated values. In addition, new point source discharges could necessitate the revision of the TMDL. All revisions would include proper public participation requirements.

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South Dakota Department of Environment and Natural Resources. *Mixing Zone and Dilution Implementation Procedures.* Pierre, SD, August 1998.

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South Dakota Department of Water and Natural Resources, Office of Water Quality. *Wasteload Allocation Procedures.* Pierre, SD, 1986.

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U.S. Environmental Protection Agency. Office of Wetlands, Oceans and Watersheds. Guidance for Water Quality-based Decisions: The TMDL Process. Publication EPA 440/4-91-001. April 1991 Washington, D.C. 58pp.

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ATTACHMENT 1 - WATER QUALITY DATA

WQM BS 18 Raw Data

	Temperature C		pH, su	Ammonia-Nitrogen, mg/L	
29-Jan-99	0	29-Jan-99	7.78	29-Jan-99	0.04
23-Feb-99	2.079	23-Feb-99	8.06	23-Feb-99	0.03
26-Apr-99	11.088	26-Apr-99	8.26	26-Apr-99	0.01
18-May-99	24.849	18-May-99	8.06	18-May-99	0
15-Jun-99	21.285	15-Jun-99	8.12	15-Jun-99	0
27-Jul-99	29.403	27-Jul-99	7.92	27-Jul-99	0
25-Aug-99	23.661	25-Aug-99	8.02	25-Aug-99	0
27-Sep-99	16.533	27-Sep-99	7.21	27-Sep-99	0
27-Oct-99	13.86	27-Oct-99	7.07	27-Oct-99	0
18-Nov-99	7.623	18-Nov-99	6.91	18-Nov-99	0
07-Dec-99	2.475	07-Dec-99	7.51	07-Dec-99	0
25-Jan-00	0.594	25-Jan-00	7.75	25-Jan-00	0.16
24-Feb-00	3.168	24-Feb-00	8.14	24-Feb-00	0.11
28-Mar-00	5.247	28-Mar-00	8.72	28-Mar-00	0
27-Apr-00	14.652	27-Apr-00	8.59	27-Apr-00	0.05
24-May-00	20.196	24-May-00	8.09	24-May-00	0.7
27-Jun-00	23.562	27-Jun-00	8.51	27-Jun-00	0
27-Jul-00	26.235	27-Jul-00	8.56	27-Jul-00	0
10-Aug-00	25.146	10-Aug-00	7.76	10-Aug-00	0
12-Sep-00	21.285	12-Sep-00	8.82	12-Sep-00	0
25-Oct-00	16.533	25-Oct-00	8.09	25-Oct-00	0.07
28-Nov-00	3.366	28-Nov-00	6.74	28-Nov-00	0.03
05-Dec-00	0.792	05-Dec-00	7.37	05-Dec-00	0
10-Jan-01	1.98	10-Jan-01	8.22	10-Jan-01	0
28-Feb-01	0.792	28-Feb-01	7.7	28-Feb-01	0.42
29-Mar-01	1.485	29-Mar-01	7.99	29-Mar-01	0.82
25-Apr-01	11.385	25-Apr-01	8.13	25-Apr-01	0
24-May-01	11.385	24-May-01	8.17	24-May-01	0
25-Jun-01	23.76	25-Jun-01	7.94	25-Jun-01	0
24-Jul-01	26.73	24-Jul-01	7.92	24-Jul-01	0.06
21-Aug-01	21.78	21-Aug-01	8.42	21-Aug-01	0
17-Sep-01	16.335	17-Sep-01	8.3	17-Sep-01	0
17-Oct-01	9.9	17-Oct-01	8.71	17-Oct-01	0
29-Oct-01	7.425	29-Oct-01	8.73	29-Oct-01	0
28-Nov-01	1.485	28-Nov-01	8.28	28-Nov-01	0.22
17-Dec-01	1.98	17-Dec-01	8.14	17-Dec-01	0.12
22-Jan-02	1.98	22-Jan-02	7.72	22-Jan-02	0.12
27-Feb-02	0.99	27-Feb-02	8.17	27-Feb-02	0
15-Mar-02	1.98	15-Mar-02	7.66	15-Mar-02	0
22-Apr-02	8.415	15-May-02	8.17	15-May-02	0
15-May-02	15.84	25-Jun-02	8.31	09-Jul-02	0
25-Jun-02	26.235	09-Jul-02	7.93	12-Aug-02	0
09-Jul-02	24.75	12-Aug-02	8.1	09-Sep-02	0
12-Aug-02	21.78	09-Sep-02	8.66	08-Oct-02	0
09-Sep-02	24.75	08-Oct-02	8.27	13-Nov-02	0
08-Oct-02	10.89	13-Nov-02	8.64	11-Dec-02	0
13-Nov-02	3.465	11-Dec-02	8.3	29-Jan-03	0

	Temperature C		pH, su	Ammonia-Nitrogen, mg/L	
11-Dec-02	0.99	29-Jan-03	8.1	18-Feb-03	0
29-Jan-03	0.99	18-Feb-03	8	19-Mar-03	1.12
18-Feb-03	0.99	19-Mar-03	7.9	11-Jun-03	0
19-Mar-03	1.98	11-Jun-03	8.7	21-Jul-03	0
14-May-03	12.87	21-Jul-03	8.1	20-Aug-03	0
11-Jun-03	19.8	20-Aug-03	8.3	03-Sep-03	0
21-Jul-03	23.76	03-Sep-03	8.4	**50%tile**	**0**
20-Aug-03	24.75	**50%tile**	**8.11**	**80%tile**	**0.056**
03-Sep-03	21.78	**80%tile**	**8.408**		
50%tile	**11.385**				
80%tile	**23.661**				

Monthly Data

pH, su		Temperature, C	
January		January	
29-Jan-99	7.78	29-Jan-99	0.00
25-Jan-00	7.75	25-Jan-00	0.59
10-Jan-01	8.22	10-Jan-01	1.98
22-Jan-02	7.72	22-Jan-02	1.98
29-Jan-03	8.1	29-Jan-03	0.99
Avg.	7.91	Avg.	1.11
February		February	
23-Feb-99	8.06	23-Feb-99	2.08
24-Feb-00	8.14	24-Feb-00	3.17
28-Feb-01	7.7	28-Feb-01	0.79
27-Feb-02	8.17	27-Feb-02	0.99
18-Feb-03	8	18-Feb-03	0.99
Avg.	8.01	Avg.	1.60
March		March	
28-Mar-00	8.72	28-Mar-00	5.25
29-Mar-01	7.99	29-Mar-01	1.49
15-Mar-02	7.66	15-Mar-02	1.98
19-Mar-03	7.9	19-Mar-03	1.98
Avg.	8.07	Avg.	2.67
April		April	
26-Apr-99	8.26	26-Apr-99	11.09
27-Apr-00	8.59	27-Apr-00	14.65
25-Apr-01	8.13	25-Apr-01	11.39
Avg.	8.33	22-Apr-02	8.42
		Avg.	11.39
May			
18-May-99	8.06	May	
24-May-00	8.09	18-May-99	24.85
24-May-01	8.17	24-May-00	20.20
15-May-02	8.17	24-May-01	11.39

pH, su		Temperature, C	
Avg.	8.12	15-May-02	15.84
		14-May-03	12.87
June		Avg.	17.03
15-Jun-99	8.12		
27-Jun-00	8.51	June	
25-Jun-01	7.94	15-Jun-99	21.29
25-Jun-02	8.31	27-Jun-00	23.56
11-Jun-03	8.7	25-Jun-01	23.76
Avg.	8.32	25-Jun-02	26.24
		11-Jun-03	19.80
July		Avg.	22.93
27-Jul-99	7.92		
27-Jul-00	8.56	July	
24-Jul-01	7.92	27-Jul-99	29.40
09-Jul-02	7.93	27-Jul-00	26.24
21-Jul-03	8.1	24-Jul-01	26.73
Avg.	8.09	09-Jul-02	24.75
		21-Jul-03	23.76
August		Avg.	26.18
25-Aug-99	8.02		
10-Aug-00	7.76	August	
21-Aug-01	8.42	25-Aug-99	23.66
12-Aug-02	8.1	10-Aug-00	25.15
20-Aug-03	8.3	21-Aug-01	21.78
Avg.	8.12	12-Aug-02	21.78
		20-Aug-03	24.75
September		Avg.	23.42
27-Sep-99	7.21		
12-Sep-00	8.82	September	
17-Sep-01	8.3	27-Sep-99	16.53
09-Sep-02	8.66	12-Sep-00	21.29
03-Sep-03	8.4	17-Sep-01	16.34
Avg.	8.28	09-Sep-02	24.75
		03-Sep-03	21.78
October		Avg.	20.14
27-Oct-99	7.07		
25-Oct-00	8.09	October	
17-Oct-01	8.71	27-Oct-99	13.86
29-Oct-01	8.73	25-Oct-00	16.53
08-Oct-02	8.27	17-Oct-01	9.90
Avg.	8.17	29-Oct-01	7.43
		08-Oct-02	10.89
November		Avg.	11.72
18-Nov-99	6.91		
28-Nov-00	6.74	November	
28-Nov-01	8.28	18-Nov-99	7.62
13-Nov-02	8.64	28-Nov-00	3.37
Avg.	7.64	28-Nov-01	1.49

pH, su		Temperature, C	
		13-Nov-02	3.47
December		Avg.	3.98
07-Dec-99	7.51		
05-Dec-00	7.37	December	
17-Dec-01	8.14	07-Dec-99	2.48
11-Dec-02	8.3	05-Dec-00	0.79
Avg.	7.83	17-Dec-01	1.98
		11-Dec-02	0.99
		Avg.	1.56

Reduced Data

pH, su				Temperature, C			
Winter (Nov-Mar)		Summer (Apr-Oct)		Winter (Nov-Mar)		Summer (Apr-Oct)	
29-Jan-99	7.78	26-Apr-99	8.26	29-Jan-99	0.00	26-Apr-99	11.09
25-Jan-00	7.75	27-Apr-00	8.59	25-Jan-00	0.59	27-Apr-00	14.65
10-Jan-01	8.22	25-Apr-01	8.13	10-Jan-01	1.98	25-Apr-01	11.39
22-Jan-02	7.72	18-May-99	8.06	22-Jan-02	1.98	22-Apr-02	8.42
29-Jan-03	8.1	24-May-00	8.09	29-Jan-03	0.99	18-May-99	24.85
23-Feb-99	8.06	24-May-01	8.17	23-Feb-99	2.08	24-May-00	20.20
24-Feb-00	8.14	15-May-02	8.17	24-Feb-00	3.17	24-May-01	11.39
28-Feb-01	7.7	15-Jun-99	8.12	28-Feb-01	0.79	15-May-02	15.84
27-Feb-02	8.17	27-Jun-00	8.51	27-Feb-02	0.99	14-May-03	12.87
18-Feb-03	8	25-Jun-01	7.94	18-Feb-03	0.99	15-Jun-99	21.29
28-Mar-00	8.72	25-Jun-02	8.31	28-Mar-00	5.25	27-Jun-00	23.56
29-Mar-01	7.99	11-Jun-03	8.7	29-Mar-01	1.49	25-Jun-01	23.76
15-Mar-02	7.66	27-Jul-99	7.92	15-Mar-02	1.98	25-Jun-02	26.24
19-Mar-03	7.9	27-Jul-00	8.56	19-Mar-03	1.98	11-Jun-03	19.80
18-Nov-99	6.91	24-Jul-01	7.92	18-Nov-99	7.62	27-Jul-99	29.40
28-Nov-00	6.74	09-Jul-02	7.93	28-Nov-00	3.37	27-Jul-00	26.24
28-Nov-01	8.28	21-Jul-03	8.1	28-Nov-01	1.49	24-Jul-01	26.73
13-Nov-02	8.64	25-Aug-99	8.02	13-Nov-02	3.47	09-Jul-02	24.75
07-Dec-99	7.51	10-Aug-00	7.76	07-Dec-99	2.48	21-Jul-03	23.76
05-Dec-00	7.37	21-Aug-01	8.42	05-Dec-00	0.79	25-Aug-99	23.66
17-Dec-01	8.14	12-Aug-02	8.1	17-Dec-01	1.98	10-Aug-00	25.15
11-Dec-02	8.3	20-Aug-03	8.3	11-Dec-02	0.99	21-Aug-01	21.78
50%tile	**7.995**	27-Sep-99	7.21	**50%tile**	**1.98**	12-Aug-02	21.78
80%tile	**8.21**	12-Sep-00	8.82	**80%tile**	**3.0294**	20-Aug-03	24.75
		17-Sep-01	8.3			27-Sep-99	16.53
		09-Sep-02	8.66			12-Sep-00	21.29
		03-Sep-03	8.4			17-Sep-01	16.34
		27-Oct-99	7.07			09-Sep-02	24.75
		25-Oct-00	8.09			03-Sep-03	21.78
		17-Oct-01	8.71			27-Oct-99	13.86
		29-Oct-01	8.73			25-Oct-00	16.53
		08-Oct-02	8.27			17-Oct-01	9.90
		50%tile	**8.17**			29-Oct-01	7.43
		80%tile	**8.55**			08-Oct-02	10.89
						50%tile	**21.285**
						80%tile	**24.75**

Ammonia-Nitrogen, mg/L							
Winter (Nov-Mar)		Summer (Apr-Oct)					
29-Jan-99	0.04	26-Apr-99	0.01				
23-Feb-99	0.03	27-Apr-00	0.05				
18-Nov-99	0	25-Apr-01	0				
07-Dec-99	0	18-May-99	0				
25-Jan-00	0.16	15-Jun-99	0				
24-Feb-00	0.11	27-Jul-99	0				
28-Mar-00	0	25-Aug-99	0				
28-Nov-00	0.03	27-Sep-99	0				
05-Dec-00	0	24-May-00	0.7				
10-Jan-01	0	27-Jun-00	0				
28-Feb-01	0.42	27-Jul-00	0				
29-Mar-01	0.82	10-Aug-00	0				
28-Nov-01	0.22	12-Sep-00	0				
17-Dec-01	0.12	24-May-01	0				
22-Jan-02	0.12	25-Jun-01	0				
27-Feb-02	0	24-Jul-01	0.06				
15-Mar-02	0	21-Aug-01	0				
13-Nov-02	0	17-Sep-01	0				
11-Dec-02	0	15-May-02	0				
29-Jan-03	0	09-Jul-02	0				
18-Feb-03	0	12-Aug-02	0				
19-Mar-03	1.12	09-Sep-02	0				
50%tile	**0.015**	27-Oct-99	0				
80%tile	**0.152**	25-Oct-00	0.07				
		17-Oct-01	0				
		29-Oct-01	0				
		08-Oct-02	0				
		50%tile	**0.0**				
		80%tile	**0.0**				

ATTACHMENT 2 – POINT SOURCE DISCHARGERS FLOW DATA

City of Colman DMR Flow Data

DMR Date	Effluent Flow Rate, 30D Avg, MGD	Effluent Flow Rate, Dly Max, MGD
31-May-98	0.8	0.8
30-Jun-98	0.8	0.8
31-Jul-98	0.8	0.8
31-Dec-98	0.82	0.82
31-May-03	0.001008	0.00108
31-Oct-03	0.001109	0.001152
50%tile	0.8	0.8
80%tile	0.8	0.8

Effluent flow conversion: $\frac{800{,}000\,gal}{day} \times \frac{0.1336806\,ft^3}{1\,gal} \times \frac{1\,day}{86{,}400\,\sec} = \frac{1.24\,ft^3}{\sec}$