Permit Rationale

Date: May 2, 2019

Permit Writer: Ann Seda

Facility Name: Boone, City of STP

Location: County: Boone
Latitude: 42 degrees 2 minutes 26.52 seconds
Longitude: 93 degrees 53 minutes 26.736 seconds

Region/ FO: **DNR FO # 5**, Des Moines

Design: Discharge from an activated sludge wastewater treatment facility to Honey Creek
Date Constructed: May 31, 1994
Flow: ADW: 2.10 MGD; AWW: 7.00 MGD; MWW: 15.10 MGD
BOD5: 4000 lbs/day
P.E.: 23952
Sources: Construction Permit No. 94-243-S dated May 31, 1994

Treatment Plant Description: The City of Boone treats their waste through the use of an activated sludge system. The city has six lift station in the collection system. The system has an automatic bar screen as preliminary treatment. There are four vertical loop reactor aeration tanks that operate in a series. All pretreated wastewater and return activated sludge enters a series of tanks equipped with brushes and blowers. The wastewater is discharged to Honey Creek which flows to the Des Moines River.

Pretreatment: The City of Boone has a Pretreatment Program. The program was approved on May 31, 1994. The DNR last audited the program on November 3, 2016.

Receiving Water Uses: Honey Creek is a designated use waterbody that flows into the Des Moines River. It is designated for secondary contact recreation (Class A2), and warm water aquatic life (Class B(WW-2)).

Wasteload allocation: WLAs dated March 25, 2019, October 14, 2013 and August 21, 2002.

Antidegradation: According to the Iowa Antidegradation Implementation Procedure, effective February 17, 2010 (IAC 567-61.2(2).e), all new or expanded regulated activities (with limited exceptions, such as unsewered communities) are subject to antidegradation review requirements. In the case of the City of Boone, less stringent ammonia nitrogen limits for certain months is the only factor that triggers an antidegradation review. In order to avoid that review, the more stringent limits between those in the current NPDES permit and those in the March 25, 2019 WLA were used in the proposed permit.

Impaired Waterbody: The following waterbodies in the discharge route are on the 2016 impaired waters list:

- Des Moines River for bacteria (indicator bacteria – *E. coli*), nutrients (nitrate), and fish kills
- Saylorville Reservoir for bacteria (indicator bacteria – *E. coli*) and turbidity
- Red Rock Reservoir for bacteria (indicator bacteria – *E. coli*) and turbidity

There are two approved TMDLs on the discharge route: a TMDL for nitrate on the Des Moines River and a TMDL for *E coli* on the Des Moines River in Polk, Warren, and Marion Counties. This facility was given nitrate-nitrogen limits in the nitrate TMDL. It was not given limits in the *E. coli* TMDL.

Additional and/or more stringent effluent limits may be given to this facility based on any future approved TMDLs for impaired waterbodies, which may provide watershed-based wasteload allocations. Information on impaired streams in Iowa and approved TMDLs can be found at the following website: http://www.iowadnr.gov/Environmental-Protection/Water-Quality/Watershed-Improvement/Impaired-Waters

Limits

Effective from permit issuance to permit expiration

Parameter	Season	7-day ave mg/L	30-day ave mg/L	daily max mg/L	min	max	7-day ave lbs/day	30-day ave lbs/day	daily max lbs/day
$CBOD_5$	yearly	40	25	---	---	---	2335	1460	---
TSS	yearly	45	30	---	---	---	2627	1751	---
pH	yearly	---	---	---	6.5 s.u.	9.0 s.u.	---	---	---
DO	yearly	---	---	---	5.0 mg/L		---	---	---
Nitrate Nitrogen	yearly	---	---	---	---	---	---	657	1075
NH3-N	January	---	3.5	15.2	---	---	---	200.6	886.7
	February	---	4.1	14.2	---	---	---	232.8	828.8
	March	---	3.5	14.7	---	---	---	176.0	857.4
	April	---	1.6	15.7	---	---	---	89.8	916.6
	May	---	1.8	15.2	---	---	---	107.1	886.7
	June	---	1.3	14.4	---	---	---	77.1	843.1
	July	---	1.0	17.6	---	---	---	59.2	1026.5
	August	---	1.0	16.2	---	---	---	56.2	947.2
	September	---	1.5	16.5	---	---	---	62.2	962.8
	October	---	1.6	15.7	---	---	---	91.6	916.6
	November	---	2.4	14.7	---	---	---	136.7	857.4
	December	---	2.5	16.0	---	---	---	145.8	931.9
Acute Toxicity (Ceriodaphnia)	yearly	No toxicity							
Acute Toxicity (Pimephales)	yearly	No toxicity							

Effective from 3/1/2023 to permit expiration

Parameter	Season	7-day ave mg/L	30-day ave mg/L	daily max mg/L	min	max	7-day ave lbs/day	30-day ave lbs/day	daily max lbs/day
E. coli (geomean)	summer	---	151 (#/100 mL)	---	---	---	---	---	---

Basis for limits:

Technology-based limits: Five-day carbonaceous biochemical oxygen demand ($CBOD_5$) limit is consistent with standard secondary treatment requirements identified in the Iowa Administrative Code (IAC) at 567 IAC 62.3(1)"a". Total suspended solids (TSS) limits are consistent with the standard secondary treatment requirements identified in Iowa Administrative Code (IAC) at 567 IAC 62.3(1)"b". $CBOD_5$ and TSS mass limits are based on the design flows.

Water Quality-based limits: The following parameters were reviewed to determine the need for water quality-based limits.

Dissolved Oxygen: A minimum DO limit of 5.0 mg/L is included in the permit based on the March 25, 2019 WLA. The average daily DO effluent result submitted as part of the NPDES permit renewal application was 9.8 mg/L. It is anticipated that the facility will be able to comply with the DO limit and therefore will be effective at permit issuance. The monitoring frequency was based on best professional judgment. Twice per week is consistent with the ammonia nitrogen monitoring frequency. It remains the same as the current permit.

pH: Iowa Water Quality Standards require pH in Class A and Class B waters "Shall not be less than 6.5 nor greater than 9.0". The pH requirement in the March 25, 2019 WLA is between 6.5 and 9.0. This remains consistent with the current NPDES permit.

Ammonia: The Department reviewed discharge monitoring report (DMR) data for ammonia available for the City of Boone wastewater treatment facility back to August 2016. The data indicates the facility is able to meet the limits in the proposed NPDES permit. The ammonia limits are based on the March 25, 2019 WLA except in situations where the limits in the October 14, 2013 and August 21, 2002 WLA were more restrictive. Because the proposed permit contains the more stringent limits between those in the current permit based on previous WLAs and those in the March 25, 2019 WLA, an antidegradation review is not necessary.

E. coli: The City of Boone STP discharges into a waterbody designated for secondary contact recreation (Class A2). The water quality standard for *E. coli* in a Class (A2) water body include a geometric mean of 630 organisms/100 mL and a sample maximum of 2,880 organisms/100 mL from March 15th through November 15th, applicable at the "end-of-pipe". The nearest (A1) stream, the Des Moines River is a short distance downstream from the outfall. An A1 water body carries with it a geometric mean of 126 org/100 ml. When factoring in the 3.55 mile distance from the outfall to the Des Moines River, the E.coli limit has been set at 151 org/100 ml in the March 25, 2019 WLA. This limit will be effective March 1, 2023. March 1, 2023 was an agreed upon date in the current permit by which the City of Boone would comply with the E.coli limit of 300 org/100 ml. Because that date has not past and a more current WLA has been completed, the new limit of 151 org/100 ml will be in effect March 1, 2023. A compliance schedule was included in the current NPDES permit for the City of Boone. The remainder of the schedule that has not been met remains in effect. Due dates of required plans and progress reports are described on page 15 of the permit. The City of Boone is to achieve compliance with the final *E.coli* limit by March 1, 2023. Due to the inability of the City of Boone to disinfect until after disinfection equipment is installed, no limits or monitoring become effective until March 1, 2023.

Nitrate Nitrogen: A TMDL for nitrate was approved for the Des Moines River. The City of Boone was given nitrate-nitrogen limits in the nitrate TMDL. Those limits are reflected in the proposed permit and are the same limits that are in the current permit. The 30 day average limit for nitrate nitrogen as stated in the March 25, 2019 WLA remains 657 lb/day and a daily maximum limit of 1,075 lb/day. The mass limits are outlined in the December 14, 2010 memo: "Deriving effluent limitations from the Des Moines River Nitrate TMDL". The monitoring frequency is based on best professional judgment and is consistent with TKN requirements from Chapter 63 Iowa Administrative Code (IAC), Table II. The frequency is the same as the current permit.

Chloride and Sulfate: The City of Boone's NPDES permit renewal application included chloride and sulfate effluent sample results of 140 mg/L and 84 mg/L, respectively. These results are below the 30-day average limits for chloride (391 mg/L) and sulfate (1,515 mg/L) calculated in the March 25, 2019 WLA. Therefore, there is no reasonable potential for the discharge to violate the chloride or sulfate limits calculated in the WLA, and no chloride or sulfate limits are included in the permit.

Total Residual Chlorine: The permit does not include limits for total residual chlorine since the City of Boone wastewater treatment facility does not currently use chlorine or employ chlorine disinfection. If the facility was to choose to install a chlorination/dechlorination disinfection system in the future, the permit would have to be reopened and TRC monitoring and limits added.

Total Kjeldahl Nitrogen, and Nitrate + Nitrite Nitrogen: The Department received an effluent sample result for total kjeldahl nitrogen (TKN) (1.8 mg/L) and nitrate + nitrite nitrogen (14 mg/L) as part of the City of Boone's NPDES permit renewal application. There are no applicable numeric water quality criteria for total kjeldahl nitrogen. The numeric water quality criterion for nitrate + nitrite nitrogen (10 mg/L) only applies to Class "C" (drinking water supply) waters.

Oil and Grease: The oil and grease result included in the city's NPDES permit renewal application was reported as 5.0 mg/L. Iowa's WQS only include a narrative standard for oil and grease at 567 IAC 61.3(2). In most cases if oil and grease is below 10 mg/L, there should not be a visible sheen.

Total Phosphorus and Nitrogen: A phosphorus result of 3.1 mg/L was included in the City of Boone's NPDES permit renewal application. There are no Water Quality Standards (WQS) for phosphorus. Based on information currently available, the Department cannot make a reasonable potential determination for the narrative WQS in IAC 567-61.2(3) specific to phosphorus. However, NPDES permits are protective of Iowa's narrative standards that apply at all times to all surface waters regardless of whether or not the standards are specifically included in the permit. The Department is addressing nitrogen and phosphorus discharges from point sources through the Iowa Nutrient Reduction Strategy. Therefore, monitoring of phosphorus and nitrogen remains in the proposed permit.

Part B Pollutants: The City of Boone's NPDES permit renewal application included three effluent sampling results for each of the metal and toxic pollutants identified on Part B of the application. The Department compared these results with the concentration limits calculated in the WLA dated March 25, 2019 to determine if there was reasonable potential for Boone to exceed the limits. In all cases besides zinc, the reported result was equivalent to the minimum detection level (MDL). Therefore, reasonable potential to exceed the limit could not be determined. The result for zinc was greater than the MDL, but still less than 50% of the limit in the WLA. No additional monitoring or limits are required for zinc at this time.

A review was conducted of the Part B results to determine if any pollutants had MDL greater than the limit in the March 25, 2019 WLA. Hexachlorobenzene had a MDL greater than the limit calculated in the WLA. The MDL was 0.005 microgram/L. A determination was made that a more sensitive testing method likely does not exist, therefore no limits are required in the permit at this time.

Backsliding/Anti-Backsliding: The limits in the proposed permit are identical or more stringent than the limits in the previous permit. Therefore, backsliding is not occurring.

Effluent toxicity: The Department is incorporating acute toxicity limits and testing into the permit as per IAC 567-63.4. The dilution percentages for effluent toxicity testing specified in the WLA are: 99.9% of the effluent and 0.1% of dilution water for the acute WET test. An annual monitoring frequency is specified in the permit.

Monitoring Basis: Compliance monitoring is based on 567 IAC Chapter 63, Table II for population equivalent (P.E.) category 15,001 – 30,000.

Special Monitoring: Special monitoring language for total nitrogen and *E. coli* is included in the "Special Monitoring Requirements" page(s) of the permit.

Sludge: Sludge will be land applied according to 567 IAC 67 land application rules, or otherwise disposed of in accordance with federal regulations specified in 40 CFR Part 503. No adverse environmental impacts have been identified.

Compliance Schedule:

E.coli

Per Subrule 567 IAC 64.7(4) the Department is authorized to include schedules of compliance in NPDES permits. This permit includes a schedule for E.coli. March 1, 2023 is the date by which the City of Boone needs to demonstrate final compliance with the limit of 151 org/100 ml.

Nutrient Reduction Strategy: The monitoring requirements as a result of the Iowa Nutrient Reduction Strategy remain in the proposed permit. Nitrogen and phosphorus shall both be monitored in the raw and final effluent after disinfection stage. A final report that evaluates the feasibility and reasonableness of reducing nitrogen and phosphorus shall be submitted to the State no later than August 1, 2021.

City of Boone

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This Package Contains

WASTELOAD ALLOCATION CALCULATIONS & NOTES

Please Do Not Separate

ENVIRONMENTAL SERVICES DIVISION
WATER QUALITY BASED PERMIT LIMITS

SECTION VI: WATER QUALITY-BASED PERMIT LIMITS

Facility Name: Boone, City of STP — Sewage File Number: 6-08-19-0-01

Parameters	Ave. Conc. (mg/l)	Max. Conc. (mg/l)	Ave. Mass (lbs/d)	Max. Mass (lbs/d)
Outfall No. 001	**ADW = 2.1 mgd & AWW = 7.0 mgd**			
CBOD5	Secondary Treatment Levels Will Not Violate WQS			
Total D.O.	Minimum Concentration (mg/l)			
January - December	5.0			
Ammonia - Nitrogen				
January	3.5	15.2	200.6	886.9
February	4.1	14.2	232.8	829.1
March	3.5	14.7	200.6	857.6
April	1.6	15.7	89.8	916.8
May	1.8	15.2	102.4	886.9
June	1.3	14.5	77.1	843.2
July	1.0	17.6	59.2	1026.8
August	1.0	16.2	56.2	947.4
September	1.1	16.5	62.2	963.0
October	1.6	15.7	91.6	916.8
November	2.4	14.7	136.7	857.6
December	2.5	16.0	145.8	932.0
Bacteria	Geometric Mean (#org./100 ml)		March 15th – November 15th	
E. coli	151			
Chloride	391	629	22,737	36,720
Sulfate	1,515	1,515	88,389	88,389
TRC[1]	0.0079	0.019	0.46	1.11
Nitrate Nitrogen[2]	--	--	657	1,075
pH	6.5-9.0 Standard Units			

Major Facility Acute WET Testing Ratio: Use 99.9% of effluent and 0.1% of dilution water for the testing

Stream Network/Classification of Receiving Stream: Honey Creek (A2, B(WW-2))

Annual critical low flows in Honey Creek at the outfall:
1Q10 flow 0.1 cfs, 7Q10 flow 0.1 cfs, 30Q10 flow 0.1 cfs, 30Q5 flow 0.1 cfs, harmonic mean flow 0.1 cfs
Annual critical low flows in Des Moines River at the mouth of Honey Creek:
1Q10 flow 60.3 cfs, 7Q10 flow 68.1 cfs, 30Q10 flow 85.9 cfs, 30Q5 flow 135 cfs, harmonic mean flow 504 cfs
Annual critical low flows in Des Moines River at the Des Moines Water Works intake:
1Q10 flow 137 cfs, 7Q10 flow 149 cfs, 30Q10 flow 161 cfs, 30Q5 flow 216 cfs, harmonic mean flow 799 cfs

Excel spreadsheet calculations [X] Qual II E model [ ] Qual II E modeling date [ ]

Performed by: Alex Martin

1: Only required if chlorine is used for disinfection.
2: TMDL limits converted to average monthly and maximum daily mass limits according to "Deriving effluent limitations from the Des Moines River Nitrate TMDL" memo from December 14, 2010.

Antidegradation Review Requirement

Less stringent ammonia nitrogen limits for certain months is the only factor that triggers an antidegradation review. See Section 2 for details.
Please note that the antidegradation review conducted in this wasteload allocation is based on the current information available. Antidegradation could also be triggered during the NPDES permitting process based on new information.

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Outfall No. 001	**ADW = 2.1 mgd & AWW = 7.0 mgd**			
Toxics				
1,1,1-Trichloroethane	1.350E+01	2.642E+01	2.446E+02	1.542E+03
1,1,2-Trichloroethane	1.482E+00	1.482E+00	2.620E+01	2.620E+01
1,1-Dichloroethylene	5.404E+01	5.404E+01	1.441E+03	3.153E+03
1,2,4-Trichlorobenzene	4.724E+00	4.724E+00	8.560E+01	8.560E+01
1,2-Dichloroethane	9.384E-01	5.905E+01	1.659E+01	3.445E+03
1,2-Dichloropropane	1.235E+00	1.235E+00	2.183E+01	2.183E+01
2,3,7,8-TCDD (Dioxin)	2.029E-09	2.029E-09	3.762E-08	3.762E-08
2,4,5-TP (Silvex)	6.749E-01	6.749E-01	1.223E+01	1.223E+01
2,4-D	6.744E+00	6.744E+00	1.222E+02	1.222E+02
3,3-Dichlorobenzidine	1.114E-02	1.114E-02	2.065E-01	2.065E-01
4,4' DDT	1.008E-06	1.101E-03	5.851E-05	6.423E-02
Alachlor	1.317E-01	1.317E-01	2.387E+00	2.387E+00
Aldrin	1.989E-05	3.002E-03	3.688E-04	1.752E-01
Aluminum	8.767E-02	7.506E-01	5.091E+00	4.380E+01
Antimony	3.779E-01	1.101E+01	6.848E+00	6.423E+02
Arsenic (III)	4.445E-02	3.403E-01	7.859E-01	1.985E+01
Asbestos	4.724E-01	4.724E-01	8.560E+00	8.560E+00
Atrazine	1.962E-01	1.962E-01	3.559E+00	3.559E+00
Barium	6.124E+01	2.052E+02	1.113E+03	1.197E+04
Benzene	5.433E+00	1.651E+01	9.605E+01	9.635E+02
Benzo(a)Pyrene	7.161E-03	7.161E-03	1.328E-01	1.328E-01
Beryllium	2.700E-01	5.004E-01	4.891E+00	2.920E+01
Bis(2-ethylhexyl)phthalate	8.753E-01	8.753E-01	1.623E+01	1.623E+01
Bromoform	1.062E+01	1.062E+01	1.877E+02	1.877E+02
Cadmium	4.558E-04	4.319E-03	2.646E-02	2.520E-01
Carbofuran	2.700E+00	2.700E+00	4.891E+01	4.891E+01
Carbon Tetrachloride	5.680E-01	2.157E+01	1.004E+01	1.258E+03
Chlordane	4.333E-06	2.402E-03	2.516E-04	1.401E-01
Chlorobenzene	6.749E+00	1.611E+01	1.223E+02	9.401E+02
Chlorodibromomethane	9.878E-01	9.878E-01	1.746E+01	1.746E+01
Chloroform	1.408E+01	1.408E+01	2.489E+02	2.489E+02
Chloropyrifos	4.132E-05	8.306E-05	2.399E-03	4.847E-03
Chromium (VI)	1.108E-02	1.601E-02	6.437E-01	9.343E-01
cis-1,2-Dichloroethylene	4.724E+00	4.724E+00	8.560E+01	8.560E+01
Copper	1.700E-02	2.692E-02	9.870E-01	1.571E+00
Cyanide	5.240E-03	2.202E-02	3.043E-01	1.285E+00

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Outfall No. 001	**ADW = 2.1 mgd & AWW = 7.0 mgd**			
Toxics				
Dalapon	1.350E+01	1.350E+01	2.446E+02	2.446E+02
Di(2-ethylhexyl)adipate	2.700E+01	2.700E+01	4.891E+02	4.891E+02
Dibromochloropropane	1.350E-02	1.350E-02	2.446E-01	2.446E-01
Dichlorobromomethane	1.358E+00	1.358E+00	2.401E+01	2.401E+01
Dichloromethane	3.374E-01	3.374E-01	6.114E+00	6.114E+00
Dieldrin	2.148E-05	2.402E-04	3.983E-04	1.401E-02
Dinoseb	4.724E-01	4.724E-01	8.560E+00	8.560E+00
Diquat	1.350E+00	1.350E+00	2.446E+01	2.446E+01
Endosulfan	5.643E-05	2.202E-04	3.277E-03	1.285E-02
Endothall	6.749E+00	6.749E+00	1.223E+02	1.223E+02
Endrin	3.628E-05	8.607E-05	2.107E-03	5.022E-03
Ethylbenzene	2.267E+01	2.267E+01	5.047E+02	1.323E+03
Ethylene dibromide	3.374E-03	3.374E-03	6.114E-02	6.114E-02
Fluoride	8.083E+00	8.083E+00	4.716E+02	4.716E+02
gamma-Hexachlorocyclohexane (Lindane)	9.507E-04	9.507E-04	5.547E-02	5.547E-02
Glyphosate	4.724E+01	4.724E+01	8.560E+02	8.560E+02
Heptachlor	3.829E-06	5.204E-04	2.224E-04	3.036E-02
Heptachlor epoxide	3.829E-06	5.204E-04	2.224E-04	3.036E-02
Hexachlorobenzene	1.154E-04	1.154E-04	2.139E-03	2.139E-03
Hexachlorocyclopentadiene	2.700E+00	2.700E+00	4.891E+01	4.891E+01
Iron	1.001E+00	1.001E+00	5.839E+01	5.839E+01
Lead	7.752E-03	1.976E-01	4.501E-01	1.153E+01
Mercury (II)	9.069E-04	1.641E-03	3.605E-02	9.577E-02
Methoxychlor	6.749E+00	6.749E+00	1.223E+02	1.223E+02
Nickel	9.449E-02	8.440E-01	5.487E+00	4.925E+01
Nitrate as N*	3.202E+02	3.202E+02	1.223E+04	1.869E+04
Nitrate+Nitrite as N*	3.202E+02	3.202E+02	1.223E+04	1.869E+04
Nitrite as N	6.749E+01	6.749E+01	1.223E+03	1.223E+03
o-Dichlorobenzene	4.049E+01	4.049E+01	7.337E+02	7.337E+02
Oxamyl (Vydate)	1.350E+01	1.350E+01	2.446E+02	2.446E+02
para-Dichlorobenzene	2.002E+00	2.002E+00	4.566E+01	1.168E+02
Parathion	1.310E-05	6.505E-05	7.607E-04	3.796E-03
Pentachlorophenol (PCP)	2.253E-02	2.916E-02	1.308E+00	1.701E+00
Phenols	5.038E-02	2.502E+00	2.926E+00	1.460E+02
Picloram	3.374E+01	3.374E+01	6.114E+02	6.114E+02

* The TMDL based limits shown on Page 1 govern.

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Outfall No. 001	**ADW = 2.1 mgd & AWW = 7.0 mgd**			
Toxics				
Polychlorinated Biphenyls (PCBs)	1.411E-05	2.002E-03	4.721E-04	1.168E-01
Polynuclear Aromatic Hydrocarbons (PAHs)	1.872E-04	3.002E-02	4.505E-03	1.752E+00
Selenium	5.038E-03	1.931E-02	2.926E-01	1.127E+00
Silver	3.803E-03	3.803E-03	2.219E-01	2.219E-01
Simazine	2.700E-01	2.700E-01	4.891E+00	4.891E+00
Styrene	6.749E+00	6.749E+00	1.223E+02	1.223E+02
Tetrachloroethlyene	1.313E+00	1.313E+00	2.434E+01	2.434E+01
Thallium	5.353E-03	5.985E-01	1.130E-01	3.492E+01
Toluene	1.512E-01	3.660E+00	7.508E+00	1.663E+02
Toxaphene	2.015E-06	7.306E-04	1.170E-04	4.263E-02
trans-1,2-Dichloroethylene	1.594E+00	1.594E+00	3.365E+01	3.365E+01
Trichloroethylene (TCE)	8.062E-02	4.003E+00	4.681E+00	2.336E+02
Trihalomethanes (total)	5.399E+00	5.399E+00	9.783E+01	9.783E+01
Vinyl Chloride	6.174E-02	6.174E-02	1.091E+00	1.091E+00
Xylenes (Total)	6.749E+02	6.749E+02	1.223E+04	1.223E+04
Zinc	2.157E-01	2.157E-01	1.259E+01	1.259E+01

WLAs/Permit Limits for the City of Boone's Mechanical Plant

These wasteload allocations and water quality based permit limitations are for the City of Boone's wastewater discharge. The wasteload allocations/permit limits are based on the Water Quality Standards (IAC 567.61) and 'Iowa Wasteload Allocation (WLA) Procedure', February 21, 2018. The chloride allocation/permit limits are based on the criteria that became effective on November 11, 2009.

The water quality based limits in this WLA are calculated to meet the surface water quality criteria to protect downstream uses. There could be technology based limits applicable to this facility that are more stringent than the water quality based limits shown in this WLA. The technology based limits could be derived from either federal guidelines based on different industrial categories or permit writer's judgment.

1. BACKGROUND:

The City of Boone discharges treated domestic wastewater from a mechanical wastewater treatment facility (activated sludge) into Honey Creek (at 42° 2' 26.52" N, 93° 53' 26.736" W).

Route of flow and use designations:

Honey Creek is an A2, B(WW-2) designated use waterbody. It flows into the Des Moines River (A1, B(WW-1), HH), which has a Class C designated use at the Des Moines Water Works intake. The designations have been adopted in Iowa's state rule described in the rule referenced document of Surface Water Classification effective on June 17, 2015. Based on the pollutants of concern, the use designations of waterbodies further downstream will not impact the resulting limits for this facility.

Critical low flow determination:

The annual critical low flows in Honey Creek at the outfall are estimated based on the Regional Regression Equations (RRE) from 'Methods for estimating selected low-flow frequency statistics and harmonic mean flows for streams in Iowa', 2012 (revised 2013).

The annual critical low flows in the Des Moines River at the mouth of Honey Creek are estimated based on the Drainage Area Ratio (DAR) from 'Methods for estimating selected low-flow frequency statistics and harmonic mean flows for streams in Iowa', 2012 (revised 2013) and flow statistics obtained at USGS gage station 05481300, located on the Des Moines River at Stratford, Iowa.

The annual critical low flows in the Des Moines River at the Des Moines Water Works intake are estimated based on the Drainage Area Ratio (DAR) and flow statistics obtained at USGS gage station 05481650, located on the Des Moines River at Saylorville, Iowa.

Table 1: Annual Critical Low Flows

Location	D.A. (mi^2)	1Q10 (cfs)	7Q10 (cfs)	30Q10 (cfs)	30Q5 (cfs)	Harmonic Mean (cfs)
Honey Creek at the Outfall	5.04	0.1[@]	0.1[@]	0.1[@]	0.1[@]	0.1[@]
Des Moines River at the Mouth of Honey Creek	5,580	60.3[#]	68.1[#]	85.9[#]	135[#]	504[#]
Des Moines River at the Des Moines Water Works Intake	6,250	137[#]	149[#]	161[#]	216[#]	799[#]
Des Moines River at USGS Gage 05481300	5,452	58.9[$]	66.5[$]	83.9[$]	132[$]	492[$]
Des Moines River at USGS Gage 05481650	5,841	128[$]	139[$]	150[$]	202[$]	747[$]

[@]: Based on the RRE method

[#]: Based on the DAR method

[$]: Based on USGS gage statistics

2. ANTIDEGRADATION REVIEW:

According to the Iowa Antidegradation Implementation Procedure, effective February 17, 2010 (IAC 567-61.2(2).e), all new or expanded regulated activities (with limited exceptions, such as unsewered communities) are subject to antidegradation review requirements.

Table 2: Antidegradation Review Analysis

Item #	Factor or Scenario	Antidegradation Determination	Analysis/Comments
1	Design Capacity Increase	Yes ☐, No ☒, or Not Applicable ☐	
2	Significant Industrial Users (SIU) Contributing New Pollutant of Concern (POC)	Yes ☐, No ☐, or Not Applicable ☒	
3	New Process Contributing New Pollutant of Concern (POC)	Yes ☐, No ☐, or Not Applicable ☒	
4	Less Stringent Water Quality Based Limits?	Yes ☒, No ☐, or Not Applicable ☐	1: Less stringent ammonia nitrogen limits will trigger an antidegradation review.
5	Outfall Location Change	Yes ☐, No ☒, or Not Applicable ☐	

Conclusion and discussion:

Due to Item 4, less stringent ammonia nitrogen limits for certain months is the only factor that triggers an antidegradation review. If the more stringent limits between those in the current NPDES permits and those in this report are to be used in the renewal NPDES permit, the antidegradation review is not necessary.

Please note that the antidegradation review conducted in this WLA is based on the current information available. Antidegradation could also be triggered during the NPDES permitting process based on new information.

3. TOTAL MAXIMUM DAILY LOAD (TMDL) LIMITATIONS:

The following waterbodies in the discharge route are on the 2016 impaired waters list:

- Des Moines River for bacteria (indicator bacteria – *E. coli*), nutrients (nitrate), and fish kills
- Saylorville Reservoir for bacteria (indicator bacteria – *E. coli*) and turbidity
- Red Rock Reservoir for bacteria (indicator bacteria – *E. coli*) and turbidity

There are two approved TMDLs on the discharge route: a TMDL for nitrate on the Des Moines River and a TMDL for *E coli* on the Des Moines River in Polk, Warren, and Marion Counties. This facility was given nitrate-nitrogen limits in the nitrate TMDL. It was not given limits in the *E. coli* TMDL. See Section 4 for more details.

Please note that the results presented in this report are wasteload allocations based on meeting the State's current water quality standards in the receiving waterbody. Additional and/or more stringent effluent limits may be applicable to this discharge based on approved TMDLs for impaired waterbodies, which may provide watershed based wasteload allocations. Information on impaired streams in Iowa and approved TMDLs can be found at the following website: http://www.iowadnr.gov/Environmental-Protection/Water-Quality/Watershed-Improvement/Impaired-Waters.

4. CALCULATIONS:

The WLAs/permit limits for this outfall are calculated based on the facility's Average Dry Weather (ADW) design flow of 2.1 mgd and its Average Wet Weather (AWW) design flow of 7.0 mgd.

Please note that only wasteload allocations/permit limits (water quality based effluent limits) calculated using DNR approved design flows can be applied in NPDES permits. Water quality based effluent limits calculated using proposed flows that have not been approved by the DNR for permitting and compliance may be used for informational purposes only.

The water quality based permit concentration limits are derived using the allowed stream flow and the ADW design flow, while the loading limits are derived using the allowed stream flow and the AWW design flow.

Toxics:
The toxics wasteload allocations will consider the procedures included in the 2000 revised WQS and the 2007 chemical criteria.

To protect the aquatic life use:
Important to toxics is the use of the 1Q10 stream flow in association with the acute wasteload allocation calculation. The chronic WLA will continue to use the 7Q10 stream flow in its calculations. In this case, 25% of the 7Q10 flow and 2.5% of the 1Q10 flow in Honey Creek at the outfall are used as the Mixing Zone (MZ) and the Zone of Initial Dilution (ZID), respectively.

To protect the human health (HH) use:
For pollutants that are non-carcinogenic and have criteria for human health protection, the criteria apply at the end of the MZ, which in this case is 25% of the 30Q5 flow in the Des Moines River at the mouth of Honey Creek.

For pollutants that are carcinogenic and have criteria for human health protection, the criteria apply at the end of the MZ, which in this case is 25% of the harmonic mean flow in the Des Moines River at the mouth of Honey Creek.

To protect the downstream class C use of the Des Moines River:
It is expected that the effluent will be 100% mixed with the stream flow at the Des Moines Water Works intake.

For pollutants that are non-carcinogenic and have criteria for drinking water protection, the criteria apply at the end of the MZ, which in this case is 100% of the 30Q5 flow in the receiving stream at the water intake.

For pollutants that are carcinogenic and have criteria for drinking water protection, the criteria apply at the end of the MZ, which in this case is 100% of the harmonic mean flow in the receiving stream at the water intake.

Final limits:
The maximum limits are those calculated for the protection of the aquatic life use and the average limits are the more stringent between those for the protection of the aquatic life use, the HH use, and the Class C use.

Please note that the TRC limits are based on a sampling frequency of 5/week, based on a design population equivalent (PE) of 23,952; the limits for other toxics are based on a sampling frequency of 1/week.

Ammonia Nitrogen:
Standard stream background pH, temperatures, and concentrations of NH3-N are mixed with the discharge from the facility's effluent pH and temperature values to calculate the applicable instream criteria for the protection of Honey Creek.

Based on the ratio of the stream flow to the discharge flow, 5% of the 1Q10 flow and 100% of the 30Q10 flow in Honey Creek at the outfall are used as the ZID and the MZ, respectively. Honey Creek is a B(WW-2) stream; therefore, early life protection will begin in April and run through September.

The monthly background pH, temperatures, and NH3-N concentrations shown in Table 3 are used for the wasteload allocation/permit limits calculations based on the Year 2000 ammonia nitrogen criteria. Table 4 shows the statewide monthly effluent pH and temperature values for mechanical facilities. Table 5 shows the calculated ammonia nitrogen wasteload allocations for this facility.

Table 3: Background pH, Temperatures, and NH3-N Concentrations
For Use with Year 2000 Ammonia Nitrogen Criteria

Months	pH	Temperature (°C)	NH_3-N (mg/l)
January	8.1	0.3	0.02
February	8.0	0.1	0.08
March	8.1	1.5	0.12
April	8.3	9.3	0.03
May	8.2	15.0	0.03
June	8.2	19.4	0.02
July	8.2	23.5	0.02
August	8.2	24.3	0.02
September	8.3	20.2	0.02
October	8.3	14.2	0.02
November	8.3	8.0	0.02
December	8.3	0.8	0.03

Table 4: Standard Effluent pH & Temperature Values for Mechanical Facilities

Months	pH	Temperature (°C)
January	7.67	12.4
February	7.71	11.3
March	7.69	13.1
April	7.65	16.2
May	7.67	19.3
June	7.70	22.1
July	7.58	24.1
August	7.63	24.4
September	7.62	22.8
October	7.65	20.2
November	7.69	17.1
December	7.64	14.1

Table 5: Wasteload Allocations for Ammonia Nitrogen for the Protection of Aquatic Life

Months	ADW-Based*		AWW-Based**	
	Acute (mg/l)	Chronic (mg/l)	Acute (mg/l)	Chronic (mg/l)
January	15.2	3.5	15.2	3.4
February	14.2	4.1	14.2	4.0
March	14.7	3.5	14.7	3.4
April	15.7	1.6	15.7	1.5
May	15.2	1.8	15.2	1.8
June	14.5	1.3	14.4	1.3
July	17.6	1.0	17.6	1.0
August	16.2	1.0	16.2	1.0
September	16.5	1.1	16.5	1.1
October	15.7	1.6	15.7	1.6
November	14.7	2.4	14.7	2.3
December	16.0	2.5	16.0	2.5

*: bases for concentration limits; **: bases for mass loading limits

CBOD5/Total Dissolved Oxygen:
Streeter-Phelps DO Sag Model is used to simulate the decay of CBOD and dispersion of total Dissolved Oxygen (DO) in the receiving water downstream from the outfall. The criterion is that the discharge cannot cause the DO level in the receiving stream (warm water) to be below 5.0 mg/l.

The parameter values used in the modeling are listed below:

Background:
The temperature and ammonia nitrogen levels are shown in Table 3. The ultimate CBOD and DO levels are assumed to be 6.0 mg/l and 6.0 mg/l, respectively.

Effluent:
The temperatures are shown in Table 4. The CBOD5 level used in the modeling is 40 mg/l, which is the technology based maximum limit for standard secondary treatment. The ammonia nitrogen values used in the modeling are the calculated acute wasteload allocations shown in Table 5. Both ADW and AWW flows and the ammonia nitrogen limits associated with them are used in the modeling.

Receiving stream parameters:
There is an average water channel slope of 0.0084011 (the water channel elevation changes from 1,008 ft to 866 ft over a distance of approximately 16,900 ft, estimated based on the GIS LiDAR 2-ft contour coverage).

Field Use Attainability Assessment (UAA) had 2 sites along Honey Creek. Two observations of stream width, average depth, and velocity were made at each site. Based on these UAA data, stream width, depth, and velocity at 7Q10 + ADW and 7Q10 + AWW conditions are estimated and are shown in Table 6.

Table 6: Stream Width, Depth, and Velocity

Flow Condition	Flow (cfs)	Width (ft)	Depth (ft)	Velocity (fps)
7Q10 + ADW	3.35	14.3	0.33	0.71
7Q10 + AWW	10.9	16.4	0.56	1.18

Reaeration:
The USGS Pool-riffle model (Melching and Flores 1999) was used as pools and riffles were indicated in the UAA data.

Discussion and conclusion:
The modeling results show that the effluent, which could have an allowed maximum effluent CBOD5 level of 40 mg/l (technology based limits for secondary treatment), ammonia nitrogen levels as shown in Table 5, and a minimum DO level of 5.0 mg/l, will not cause the DO level in the receiving stream to be below 5.0 mg/l at any time.

***E. coli*:**
This facility discharges into a Class A2 waterbody. The water quality standard for *E. coli* in a Class A2 waterbody is a geometric mean of 630 org./100 ml and a sample maximum of 2,880 org./100 ml from March 15th through November 15th. The criteria apply at "end-of-pipe".

The nearest A1 stream (the Des Moines River) is approximately 3.55 miles downstream of the outfall. The water quality standard for *E. coli* in a Class A1 water body is a geometric mean of 126 org./100 ml and a sample maximum of 235 org./100 ml from March 15th through November 15th. *E. coli* decay in the 3.55 mile stream were estimated using a first order decay model with a decay rate of 1/day and a flow velocity of 1.18 fps, which is the velocity estimated at 7Q10 and AWW condition. With decay, a geometric mean of 151 org./100 ml and a sample maximum of 282 org./100 ml from March 15th through November 15th are protective of the Class A1 use. The criteria apply at "end-of-pipe".

However, 567 IAC 62.8(2) states that "the daily sample maximum criteria for *E. coli* set forth in 567 – Chapter 61 shall not be used as an end-of-pipe permit limitation." Therefore, only the geometric mean limit of 151 org./100 ml applies.

Chloride and Sulfate:
The chloride and sulfate criteria became effective on Nov. 11, 2009. The default hardness for background and effluent is 200 mg/l.

Chloride criteria are functions of hardness and sulfate concentration, shown as follows:

$$\text{Acute criteria} = 287.8*(\text{Hardness})^{0.205797} *(\text{Sulfate})^{-0.07452}$$
$$\text{Chronic criteria} = 177.87*(\text{Hardness})^{0.205797} *(\text{Sulfate})^{-0.07452}$$

The criteria apply to all Class B waters.

Sulfate criteria, shown in Table 7, are functions of hardness and chloride concentration.

Table 7: Sulfate Criteria

Hardness (mg/l as CaCO3)	Sulfate Criteria (mg/l)		
	Chloride < 5 mg/l	5 mg/l <= Chloride < 25 mg/l	25 mg/l <= Chloride < 500 mg/l
< 100	500	500	500
100<=H<=500	500	(-57.478+5.79*H+54.163*Cl)*0.65	(1276.7+5.508*H-1.457*Cl)*0.65
H> 500	500	2,000	2,000

The criteria defined in Table 7 serve as both acute and chronic criteria and apply to all Class B waters.

The acute criteria apply at the end of the ZID, and the chronic criteria apply at the end of the MZ. In this case, 25% of the 7Q10 flow and 2.5% of the 1Q10 flow in Honey Creek at the outfall are used as the MZ and the ZID, respectively.

The default chloride concentration for both background water and effluent is 34 mg/l, while the default sulfate concentration for both background water and effluent is 63 mg/l. The limits are calculated based on an assumed sampling frequency of 1/week.

Iron:
The current iron criteria are defined in the 2005 issue paper entitled "Iron Criteria and Implementation for Iowa's Surface Waters (December 5, 2005)". An iron criterion of 1 mg/l applies at the end of the ZID for both general use and designated use streams. In this case, the ZID is 2.5% of the 1Q10 flow in Honey Creek at the outfall.

pH:
Iowa Water Quality Standards (IAC 567.61.3.(3).a.(2) and IAC 567.61.3.(3).b.(2)) require that pH in Class A or Class B waters "Shall not be less than 6.5 nor greater than 9.0". The criteria apply at the end of the MZ, which is 25% of the 7Q10 flow in Honey Creek at the outfall.

TDS:
Effective Nov. 11, 2009, the site-specific TDS approach is no longer applicable; instead the new chloride and sulfate criteria became applicable. However, the TDS level should be controlled to a level such that the narrative criteria stated in IAC 567.61.3 are fulfilled.

Major Facility Acute WET Testing Ratio:
Use 99.9% of effluent and 0.1% of dilution water for the testing. The ratio is calculated using the ADW design flow and 2.5% of the 1Q10 flow in Honey Creek at the outfall as the ZID.

Nitrate-Nitrogen:
The 2009 TMDL for the nitrate impaired segments of the Des Moines River has given this facility a nitrate nitrogen allocation. The City of Boone was assigned an Average Daily Nitrate Load of 345.68 lbs nitrate/day and a Maximum Daily Nitrate Load of 1075.06 lbs Nitrate/day. However, in the Dec. 14, 2010 memo "Deriving effluent limitations from the Des Moines River Nitrate TMDL" the limits from the TMDL were converted to an average monthly limit of 657 lbs Nitrate/day and a maximum daily limit of 1,075 lbs Nitrate/day.

5. PERMIT LIMITATIONS:
- *Based on the Year 2006 Water Quality Standards & 2002 Permit Derivation Procedure.*

The acute and chronic WLAs are used as the values for input into the current permit derivation procedure. Under the 2002 permit derivation procedure, only for toxic parameters is the monitoring frequency considered in the calculation of final limits. The water quality based limits are shown on Pages 1 – 4 of this report.

City of Boone

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This Package Contains

WASTELOAD ALLOCATION CALCULATIONS & NOTES

Please Do Not Separate

ENVIRONMENTAL SERVICES DIVISION
WATER QUALITY BASED PERMIT LIMITS

SECTION VI: WATER QUALITY-BASED PERMIT LIMITS

Facility Name: Boone, City of STP — Sewage File Number: 6-08-19-0-01

Parameters	Ave. Conc. (mg/l)	Max Conc. (mg/l)	Ave. Mass (lbs/d)	Max Mass (lbs/d)	Sampling Frequency
Outfall No. 001	**ADW =2.1 mgd AWW =7.0 mgd**				
CBOD	Secondary Treatment Levels Will Not Violate WQS				
Total D.O.	Minimum Concentration (mg/l)				
January - December	5.0				
Ammonia - Nitrogen					
January	5.2	15.2	301.7	886.7	--
February	5.8	14.2	339.2	828.8	--
March	4.5	14.7	265.2	857.4	--
April	2.1	15.7	122.4	916.6	--
May	1.8	15.2	107.1	886.7	--
June	1.3	14.4	78.6	843.1	--
July	1.1	17.6	63.1	1,026.5	--
August	1.0	16.2	57.5	947.2	--
September	1.5	16.5	86.6	962.8	--
October	2.8	15.7	163.9	916.6	--
November	3.4	14.7	198.8	857.4	--
December	4.0	16.0	230.7	931.9	--
Bacteria*	Geometric Mean (#org/100ml)		March 15th – November 15th		
E. coli	300				
Chloride**	389	629	22,690	36,712	1/ month
Sulfate**	1,514	1,514	88,370	88,370	1/ month
TRC	0.008	0.019	0.458	1.109	5/week
Nitrate Nitrogen***	--	--	657	1,075	--
pH	6.5 - 9.0 Standard Units				
Major Facility Acute WET Testing Ratio: use 100% of effluent for the testing					
Priority Pollutants					
1,1,1-Trichloroethane	1.119E+01	2.640E+01	2.041E+02	1.541E+03	1/week
1,1,2-Trichloroethane	1.720E+00	1.720E+00	3.037E+01	3.037E+01	1/week
1,1-Dichloroethylene	5.400E+01	5.400E+01	1.670E+03	3.153E+03	1/week
1,2,4-Trichlorobenzene	3.916E+00	3.916E+00	7.145E+01	7.145E+01	1/week
1,2-Dichloroethane	1.089E+00	5.900E+01	1.923E+01	3.444E+03	1/week
1,2-Dichloropropane	1.433E+00	1.433E+00	2.531E+01	2.531E+01	1/week
2,3,7,8-TCDD (Dioxin)	1.201E-09	1.201E-09	2.311E-08	2.311E-08	1/week
2,4,5-TP (Silvex)	5.595E-01	5.595E-01	1.021E+01	1.021E+01	1/week
2,4-D	5.595E+00	5.595E+00	1.021E+02	1.021E+02	1/week

* Due to a recent revision to IAC567.62 (Chapter 62), sample maximum limit for bacteria is no longer required. Only geometric mean is required.

** Chloride/sulfate limits are based on the new chloride/sulfate criteria that took effective on Nov. 11, 2009. Chloride/sulfate criteria are hardness dependent and the default hardness has been changed from 100 mg/l to 200 mg/l, effective Nov. 11, 2009.

***: TMDL – based limits

By Xiaojian Gao

ENVIRONMENTAL SERVICES DIVISION
WATER QUALITY BASED PERMIT LIMITS

SECTION VI: WATER QUALITY-BASED PERMIT LIMITS

Facility Name: Boone, City of STP — Sewage File Number: 6-08-19-0-01

Parameters	Ave. Conc. (mg/l)	Max Conc. (mg/l)	Ave. Mass (lbs/d)	Max Mass (lbs/d)	Sampling Frequency
Outfall No. 001	**ADW =2.1 mgd AWW =7.0 mgd**				
Priority Pollutants					
3,3-Dichlorobenzidine	6.591E-03	6.591E-03	1.269E-01	1.269E-01	1/week
4,4' DDT	1.000E-06	1.100E-03	5.838E-05	6.422E-02	1/week
Alachlor	1.119E-01	1.119E-01	2.041E+00	2.041E+00	1/week
Aldrin	1.177E-05	3.000E-03	2.266E-04	1.751E-01	1/week
Aluminum	8.700E-02	7.500E-01	5.079E+00	4.379E+01	1/week
Antimony	3.133E-01	3.133E-01	5.716E+00	5.716E+00	1/week
Arsenic (III)	5.160E-02	3.400E-01	9.111E-01	1.985E+01	1/week
Asbestos	3.916E-01	3.916E-01	7.145E+00	7.145E+00	1/week
Atrazine	1.678E-01	1.678E-01	3.062E+00	3.062E+00	1/week
Barium	5.595E+01	5.595E+01	1.021E+03	1.021E+03	1/week
Benzene	6.307E+00	1.650E+01	1.114E+02	9.633E+02	1/week
Benzo(a)Pyrene	4.237E-03	4.237E-03	8.157E-02	8.157E-02	1/week
Beryllium	2.238E-01	2.238E-01	4.083E+00	4.083E+00	1/week
Bromoform	1.233E+01	1.233E+01	2.177E+02	2.177E+02	1/week
Cadmium	4.523E-04	4.316E-03	2.640E-02	2.520E-01	1/week
Carbofuran	2.238E+00	2.238E+00	4.083E+01	4.083E+01	1/week
Carbon Tetrachloride	3.766E-01	2.155E+01	7.250E+00	1.258E+03	1/week
Chlordane	4.300E-06	2.400E-03	2.510E-04	1.401E-01	1/week
Chlorobenzene	5.595E+00	1.610E+01	1.021E+02	9.399E+02	1/week
Chlorodibromomethane	1.147E+00	1.147E+00	2.025E+01	2.025E+01	1/week
Chloroform	1.634E+01	1.634E+01	2.885E+02	2.885E+02	1/week
Chloropyrifos	4.100E-05	8.300E-05	2.394E-03	4.846E-03	1/week
Chromium (VI)	1.100E-02	1.600E-02	6.422E-01	9.341E-01	1/week
cis-1,2-Dichloroethylene	3.916E+00	3.916E+00	7.145E+01	7.145E+01	1/week
Copper	1.687E-02	2.690E-02	9.847E-01	1.570E+00	1/week
Cyanide	5.200E-03	2.200E-02	3.036E-01	1.284E+00	1/week
Dalapon	1.119E+01	1.119E+01	2.041E+02	2.041E+02	1/week
Di(2-ethylhexyl)adipate	2.238E+01	2.238E+01	4.083E+02	4.083E+02	1/week
Bis(2-ethylhexyl)phthalate	9.090E-02	9.090E-02	9.969E+00	9.969E+00	1/week
Dibromochloropropane	1.119E-02	1.119E-02	2.041E-01	2.041E-01	1/week
Dichlorobromomethane	1.577E+00	1.577E+00	2.784E+01	2.784E+01	1/week
Dichloromethane	2.797E-01	2.797E-01	5.103E+00	5.103E+00	1/week
Dieldrin	1.271E-05	2.400E-04	2.447E-04	1.401E-02	1/week
Dinoseb	3.916E-01	3.916E-01	7.145E+00	7.145E+00	1/week
Diquat	1.119E+00	1.119E+00	2.041E+01	2.041E+01	1/week
Endosulfan	5.600E-05	2.200E-04	3.269E-03	1.284E-02	1/week
Endothall	5.595E+00	5.595E+00	1.021E+02	1.021E+02	1/week
Endrin	3.600E-05	8.600E-05	2.102E-03	5.021E-03	1/week

ENVIRONMENTAL SERVICES DIVISION
WATER QUALITY BASED PERMIT LIMITS

SECTION VI: WATER QUALITY-BASED PERMIT LIMITS

Facility Name: Boone, City of STP — Sewage File Number: 6-08-19-0-01

Parameters	Ave. Conc. (mg/l)	Max Conc. (mg/l)	Ave. Mass (lbs/d)	Max Mass (lbs/d)	Sampling Frequency
Outfall No. 001	**ADW =2.1 mgd AWW =7.0 mgd**				
Priority Pollutants					
Ethylbenzene	8.677E+00	2.265E+01	2.378E+02	1.322E+03	1/week
Ethylene dibromide	2.797E-03	2.797E-03	5.103E-02	5.103E-02	1/week
Fluoride	2.238E+02	2.238E+02	4.083E+03	4.083E+03	1/week
gamma-Hexachlorocyclohexane (Lindane)	9.500E-04	9.500E-04	5.546E-02	5.546E-02	1/week
Glyphosate	3.916E+01	3.916E+01	7.145E+02	7.145E+02	1/week
Heptachlor	3.800E-06	5.200E-04	2.218E-04	3.036E-02	1/week
Heptachlor epoxide	3.800E-06	5.200E-04	1.767E-04	3.036E-02	1/week
Hexachlorobenzene	6.827E-05	6.827E-05	1.314E-03	1.314E-03	1/week
Hexachlorocyclopentadiene	2.238E+00	2.238E+00	4.083E+01	4.083E+01	1/week
Lead	7.693E-03	1.974E-01	4.491E-01	1.152E+01	1/week
Mercury (II)	6.198E-04	1.640E-03	1.699E-02	9.574E-02	1/week
Methoxychlor	5.595E+00	5.595E+00	1.021E+02	1.021E+02	1/week
Nickel	9.376E-02	8.433E-01	5.474E+00	4.923E+01	1/week
Nitrate as N	3.200E+02	3.200E+02	1.021E+04	1.868E+04	1/week
Nitrate+Nitrite as N	3.200E+02	3.200E+02	1.021E+04	1.868E+04	1/week
Nitrite as N	5.595E+01	5.595E+01	1.021E+03	1.021E+03	1/week
o-Dichlorobenzene	3.357E+01	3.357E+01	6.124E+02	6.124E+02	1/week
Oxamyl (Vydate)	1.119E+01	1.119E+01	2.041E+02	2.041E+02	1/week
para-Dichlorobenzene	7.851E-01	2.000E+00	2.151E+01	1.168E+02	1/week
Parathion	1.300E-05	6.500E-05	7.589E-04	3.795E-03	1/week
Pentachlorophenol (PCP)	1.828E-02	2.383E-02	1.067E+00	1.391E+00	1/week
Phenols	5.000E-02	2.500E+00	2.919E+00	1.460E+02	1/week
Picloram	2.797E+01	2.797E+01	5.103E+02	5.103E+02	1/week
Polychlorinated Biphenyls (PCBs)	1.400E-05	2.000E-03	2.900E-04	1.168E-01	1/week
Polynuclear Aromatic Hydrocarbons (PAHs)	1.240E-04	3.000E-02	3.397E-03	1.751E+00	1/week
Selenium	5.000E-03	1.930E-02	2.919E-01	1.127E+00	1/week
Silver	3.800E-03	3.800E-03	2.218E-01	2.218E-01	1/week
Simazine	2.238E-01	2.238E-01	4.083E+00	4.083E+00	1/week
Styrene	5.595E+00	5.595E+00	1.021E+02	1.021E+02	1/week
Tetrachloroethlyene	7.768E-01	7.768E-01	1.495E+01	1.495E+01	1/week
Thallium	1.942E-03	1.942E-03	5.322E-02	5.322E-02	1/week
Toluene	1.500E-01	3.166E+00	5.662E+00	1.576E+02	1/week
Toxaphene	2.000E-06	7.300E-04	1.168E-04	4.262E-02	1/week

ENVIRONMENTAL SERVICES DIVISION
WATER QUALITY BASED PERMIT LIMITS

SECTION VI: WATER QUALITY-BASED PERMIT LIMITS

Facility Name: Boone, City of STP — Sewage File Number: 6-08-19-0-01

Parameters	Ave. Conc. (mg/l)	Max Conc. (mg/l)	Ave. Mass (lbs/d)	Max Mass (lbs/d)	Sampling Frequency
Outfall No. 001	**ADW =2.1 mgd AWW =7.0 mgd**				
Priority Pollutants					
trans-1,2-Dichloroethylene	5.785E-01	5.785E-01	1.585E+01	1.585E+01	1/week
Trichloroethylene (TCE)	8.000E-02	4.000E+00	4.670E+00	2.335E+02	1/week
Trihalomethanes (total)	4.476E+00	4.476E+00	8.166E+01	8.166E+01	1/week
Vinyl Chloride	7.167E-02	7.167E-02	1.265E+00	1.265E+00	1/week
Xylenes (Total)	5.595E+02	5.595E+02	1.021E+04	1.021E+04	1/week
Zinc	2.156E-01	2.156E-01	1.258E+01	1.258E+01	1/week
Iron	1.000E+00	1.000E+00	5.838E+01	5.838E+01	--

Stream Network/Classification of Receiving Stream:

Honey Creek (A2 and B(WW-2))
To
the Des Moines River (A1, B(WW-1) and HH) to (A1, B(WW-1), HH and C)

Date Done: Oct 14, 2013

Annual critical lows flow in Honey Creek at the discharge point
30Q10 flow 0.000 cfs, 7Q10 flow 0.000 cfs, 1Q10 flow 0.000 cfs

Annual critical low flows in the Des Moines River above the mouth of Honey Creek
30Q10 flow 52.9 cfs, 7Q10 flow 40.7 cfs, 1Q10 flow 34.6 cfs Harmonic Mean flow 292.9 cfs

Annual critical low flows in the Des Moines River near the City of Des Moines Water Works Intake
30Q10 flow 199.0 cfs, 7Q10 flow 178.5 cfs, 1Q10 flow 164.5 cfs Harmonic Mean flow 928.1 cfs

Excel Spreadsheet calculations [ ] Qual II E Model [ ] Qual II E Modeling date[ ]

Performed by: Xiaojian Gao Approved By: Connie Dou

Antidegradation Review Requirement

The average ammonia nitrogen limits (both concentration and mass loading) for the month of March are less stringent than those in the current NPDES permit; therefore a tier II antidegradation is required. However, since the less stringent limits in March are the only factor that triggers the antidegradation review, if the march average limits in the current NPDES permit were to be kept in the renewal permit, the antidegradation is not necessary.

WLA/permit limits for the City of Boone's Wastewater Treatment Plant

These wasteload allocations and water quality based permit limitations are for the City of Boone's wastewater discharge. The wasteload allocations/permit limits are based on the Water Quality Standards (IAC 567.61) and 'Supporting Document for Iowa Water Quality Management Plans,' Chapter IV, November 11, 2009. The chloride allocation/permit limits are based on the criteria that became effective on November 11, 2009.

The water quality based limits in this WLA are calculated to meet the surface water quality criteria to protect downstream uses. There could be technology based limits applicable to this facility that are more stringent than the water quality based limits shown in this WLA. The technology based limits could be derived from either federal guidelines based on different industrial categories or permit writer's judgment.

1. BACKGROUND: The City of Boone's waste water treatment plant discharges a stream of treated wastewater from an activated sludge facility into Honey Creek to the Des Moines River.

Honey Creek: the receiving segment of the stream is designated A2 and B(WW-2).

The Des Moines River: the receiving segment of the river is designated A1, B(WW-1) and HH. Farther downstream near the City of Des Moines Waterworks Intake location, the river is has an additional C (for drinking water protection) designation.

The designations described above have been adopted in Iowa's state rule described in the rule referenced document of Surface Water Classification effective on December 22, 2010.

The annual critical low flows in Honey Creek at the discharge point were estimated based on the annual 7Q10 ratio method and flow statistics obtained at USGS gage station 05481500, located on Des Moines River near Boone, Iowa.

The annual critical low flows in the Des Moines River above the mouth of Honey Creek were estimated based on the drainage area ratio method and flow statistics obtained at USGS gage station 05481500, located on Des Moines River near Boone, Iowa.

Table 1a: Annual Critical Low Flows

Location	7Q10 Coeff. in Plate_4 (cfs/mi2)	D.A. (mi2)	Harmonic Mean (cfs)	Annual 7Q10 (cfs)	Annual critical low flows (cfs)		
					1Q10	7Q10	30Q10
Outfall	0.000	5.15	--	0.000*	0.000@	0.000*	0.000@
Des Moines River above the mouth of Honey Creek	--	5605.65	292.9#	--	34.6#	40.7#	52.9#
USGS Gage (05481500)	0.000	5,511	288$	40$	34$	40$	52$

$: USGS gage station statistic data
*: Based on 7Q10 coefficient in Plate_4 and drainage area values
@: Estimated based on annual 7Q10 ratio method
#: Estimated based on the drainage area ratio method

The annual critical low flows on the Des Moines River near the City of Des Moines Waterworks Intake location were estimated based on the drainage area ratio method and flow statistics obtained at USGS gage 05481650, located on the Des Moines River near Saylorville, IA.

Table 1b: Annual Critical Low Flows

Location	D.A. (mi2)	Harmonic Mean (cfs)	Annual critical low flows (cfs)		
			1Q10	7Q10	30Q10
City of Des Moines Waterworks Intake	6281.8	928.1*	164.5*	178.5*	199.0*
USGS Gage (05481650)	5,841	863[$]	153[$]	166[$]	185[$]

[$]: USGS gage station statistic data

*: Estimated based on the drainage area ratio method

Notes on the stream critical flows:

1. In the past few years, the minimum release flow of 270 cfs from the Saylorville Reservoir were used in lieu of the 1Q10 flow and 7Q10 flows in the Des Moines River below the Saylorville Dam in the calculations of WLAs for facilities discharging to the Des Moines River below the Saylorville Dam. However, the minimum release value may have changed due to the weather pattern change in recent years. For example, the Oct 9, 2012 release was 224 cfs [1]. It is the Department's decision to use the estimated annual critical low flows at the Des Moines River shown in Table 1b in the calculations of this WLA. The flow statistics at gage 05481650 were based on the regulated daily flow data (from Apr 1978 to March of 1996).

2. A different USGS gage, gage 05482000, located on the Des Moines River at 2nd Avenue, Des Moines, IA, is closer to the City of Des Moines Waterworks Intake. However, the critical low flows at the gage based on the post-regulated flows have never been published. Therefore, gage 05481650, instead of gage 05482000, was used as the reference gage to estimate the annual critical low flows at the water Intake location.

2. ANTIDEGRADATION REVIEW REQUIREMENT:

According to the Iowa Antidegradation Implementation Procedure, effective February 17, 2010 (IAC 567-61.2(2).e), all new or expanded regulated activities (with limited exceptions, such as unsewered communities) are subject to antidegradation review requirements.

The analysis of the factors that could trigger antidegradation is summarized as follows:

1. The design capacities listed in the request form for this WLA are the same as those in Construction Permit 94-243-S, issued 5/22/2007. Please note the construction permit did not specify Average Dry Weather Design Flow (ADW), however, the ADW flow of 2.1 mgd has been used in the WLA calculations since the 1990s, and has been cited in all the supporting documents to the current NPDES permit.

2. No new or existing SIU(s) contributing new pollutants of Concern (POC), as indicated in the WLA request form.

3. No new processes contributing new POC has been added since the issuance of the current NPDES permit, as indicated in the WLA request form.

4. The WLA/Limits based on the current WQS and current WLA procedures are not less stringent than those in the current permit, except for the average limits for ammonia nitrogen for the month of March (both concentration and mass loading limits).

5. The outfall location has not changes since the issuance of the current NPDES permit.

Therefore, due to the less stringent ammonia nitrogen average limits for the month of March, a tier II antidegradation review is required. However, since the less stringent limits are the only factor that triggers the antidegradation review, if the average ammonia nitrogen limits (both concentration and mass loading)

in the current NPDES permit were to be kept in the renewal permit, the tier II antidegradation review is not necessary.

3. TOTAL MAXIMUM DAILY LOAD (TMDL) LIMITATIONS:
The following stream segments in the discharge route are on the 2012 impaired waters list:

The receiving segment of the Des Moines River (IA 04-UDM-0030_1) was impaired for primary contact use due to elevated bacteria levels.

Further downstream, the Red Rock Reservoir (IA 04-LDM-0030-L_0) is impaired due to elevated turbidity.

Further downstream a segment of the Des Moines River (IA 04-LDM-0020_3) is impaired for aquatic life use due to a 2008 fish kill incident cause by a non-pollutant stressor: gas bubble trauma.

The next downstream segment (IA 04-LDM-0020_2) is impaired for primary recreational use due to elevated bacteria levels.

The next downstream segment (IA 04-LDM-0020_1) is impaired for aquatic life use due to fish kill incidents.

The next two downstream segments (IA 04-LDM-0010_4 and _3) are impaired for primary recreational use due to elevated bacteria levels and impaired for aquatic life use due to fish kill incidents.

The next two downstream segments (IA 04-LDM-0010_2 and _1) are impaired for primary recreational use due to elevated bacteria levels.

A TMDL for nitrate impaired segments of the Des Moines River (IA 04-UDM-0010_2) was developed by the IDNR and was approved by the EPA on 9/25/2009. The TMDL has given this facility a nitrate nitrogen allocation. Permit limits based on the allocation are presented in this report.

A TMDL for the bacteria impaired segments of the Des Moines River in Polk, Warren and Marion counties were developed by the DNR and approved by the EPA on 3/5/2010. Three segments of the Des Moines River in the discharge route (IA 04-LDM-0040_3, _2 and _1) were included in the TMDL. However, this facility is not in the watershed this TMDL was addressing, therefore, no allocation for this facility.

TMDLs for other above referenced impaired segments have not been scheduled. Please note that upon the completion of the future TMDLs, more stringent and/or additional limits may be given to this facility.
Information on impaired streams in Iowa and approved TMDLs can be found at the following website: http://www.iowadnr.gov/Environment/WaterQuality/WatershedImprovement/WatershedResearchData.aspx .

4. CALCULATIONS: The wasteload allocations / permit limits for this outfall were calculated based on the facility's Average Dry Weather (ADW) design flow of 2.1 mgd and its Average Wet Weather (AWW) design flow of 7.0 mgd.

Please note that only wasteload allocations/permit limits (water quality based effluent limits) calculated using DNR approved design flows can be applied in NPDES permits. Water quality based effluent limits calculated using proposed flows that have not been approved by the DNR for permitting and compliance may be used for informational purposes only.

The water quality based permit concentration limits are derived using the allowed stream flow and the ADW design flow, while loading limits are derived using the allowed stream flow and the AWW design flow.

Toxics and TRC: The Toxics and TRC wasteload allocations will consider the procedures included in the 2000 revised WQS and the 2007 chemical criteria.

To protect the B(WW-2) designated Honey Creek:
The acute criteria apply at the end of the zone of initial dilution (ZID) and the chronic criteria apply at the end of the mixing zone (MZ). In this case, since the annual critical low flows in Honey Creek at the outfall were estimated to be all zero, the criteria apply at "end-of-pipe" instead of the end of the MZ and the ZID.

To protect the B(WW-1) and HH designated receiving segment of the Des Moines River:
To protect the B(WW-1) use, the acute criteria apply at the end of the ZID and the chronic criteria apply at the end of the MZ. In this case, 2.5% of the annual 1Q10 flow and 25% of the annual 7Q10 flow in the Des Moines River above the mouth of Honey Creek were used as the ZID and the MZ, respectively.

To protect the HH use, for pollutants that have HH protection criteria and are non-carcinogenic, the HH protection criteria apply at the end of the MZ, which is 25% of the 7Q10 flow in the Des Moines River above the mouth of Honey Creek; for pollutants that have HH protection criteria and are carcinogenic, the HH protection criteria apply at the end of the MZ, which is 25% of the harmonic mean flow in the Des Moines River above the mouth of Honey Creek.

To protect this segment, the acute limits are those for the protection of the B(WW-1) use and the chronic limits are the more stringent between those for the protection of the B(WW-1) use and those for the protection of the HH use.

To protect the B(WW-1), HH and C designated segment of the Des Moines River near the City of Des Moines' Waterworks Intake
To protect the B(WW-1) use, the acute criteria apply at the end of the ZID and the chronic criteria apply at the end of the MZ. In this case, 100% of the annual 1Q10 flow and 100% of the annual 7Q10 flow in the Des Moines River at the intake location were used as the ZID and the MZ, respectively.

To protect the HH and C use, for pollutants that have HH and/or C protection criteria and are non-carcinogenic, the HH and/or C protection criteria apply at the end of the MZ, which is 100% of the 7Q10 flow in the Des Moines River at the intake location; for pollutants that have HH and/or C protection criteria and are carcinogenic, the HH and/or C protection criteria apply at the end of the MZ, which is 100% of the harmonic mean flow in the Des Moines River at the intake location.

To protect this segment, the acute limits are those for the protection of the B(WW-1) use and the chronic limits are the more stringent between those for the protection of the B(WW-1) use and those for the protection of the HH and C use.

Effluent Limits:
The final effluent limits are the most stringent among those for the protection of Honey Creek, for the protection of the receiving segment of the Des Moines River and for the protection of the segment near the City of Des Moines Waterworks Intake.

Please note that the TRC limits were based on a sampling frequency of 5/week, which was in turn based on the design population equivalent of 23,952; the limits for other priority pollutants were based on a sampling frequency of 1/week.

Ammonia: Standard stream background temperatures, pH's, and concentrations of NH3-N were mixed with the discharge from the facility's effluent pH and temperature values to calculate the applicable instream WQS criteria for the protection of Honey Creek. Since the annual critical low flows in the receiving stream are all zero, the criteria apply at "end-of-pipe" instead of the end of the MZ and the ZID. Honey Creek is a B(WW-2) stream, therefore, early life protection will begin in Apr and run through September.

Please note that the near B(WW-1) stream in the discharge route is approximately 3.58 miles below the outfall. Calculations show that due to higher stream critical low flows in the B(WW-1) stream and ammonia decay, the limits for the protection of Honey Creek are protective of the nearest B(WW-1) segment and all waters in the discharge route.

The monthly background temperatures, pH, and NH3-N concentrations shown in Table 2 were used for the wasteload allocation/permit limits calculations based on the Year 2000 ammonia criteria. Table 3 shows the statewide monthly effluent pH and temperature values for mechanical facilities. Table 4 shows the calculated ammonia nitrogen limits for this facility.

Table 2: Background Temperature, pH and NH3-N Concentrations
For Use with Year 2000 Ammonia Criteria

Months	pH	Temperature (°C)	NH_3-N (mg/l)
Jan.	7.8	0.6	0.5
Feb.	7.7	1.2	0.5
March	7.9	4.3	0.5
April	8.1	11.7	0.5
May	8.1	16.6	0.5
June	8.1	21.4	0.5
July	8.1	24.8	0.0
August	8.2	23.8	0.0
Sept.	8	22.2	0.5
October	8	12.3	0.5
November	8.1	6	0.5
December	8	1.6	0.5

Table 3: Standard Effluent pH & Temperature Values for Mechanical Facilities

Months	pH	Temperature (°C)
Jan.	7.67	12.4
Feb.	7.71	11.3
March	7.69	13.1
April	7.65	16.2
May	7.67	19.3
June	7.7	22.1
July	7.58	24.1
August	7.63	24.4
Sept.	7.62	22.8
October	7.65	20.2
November	7.69	17.1
December	7.64	14.1

Table 4: Water Quality Based Limits for Ammonia Nitrogen

Months	ADW-Based*		AWW-Based**	
	Ave. Conc. (mg/l)	Max Conc. (mg/l)	Ave. Conc. (mg/l)	Max Conc. (mg/l)
January	5.2	15.2	5.2	15.2
February	5.8	14.2	5.8	14.2
March	4.5	14.7	4.5	14.7
April	2.1	15.7	2.1	15.7
May	1.8	15.2	1.8	15.2
June	1.3	14.4	1.3	14.4
July	1.1	17.6	1.1	17.6
August	1.0	16.2	1.0	16.2
Sept.	1.5	16.5	1.5	16.5
October	2.8	15.7	2.8	15.7
November	3.4	14.7	3.4	14.7
December	4.0	16.0	4.0	16.0

*: concentration limits; **: bases for mass loading limits

CBOD5/Total Dissolved Oxygen:
Streeter-Phelps DO Sag Model was used to simulate the decay of CBOD and dispersion of total Dissolved Oxygen (DO) in the receiving water downstream from the outfall. The criterion is that the discharge cannot cause the DO level in the receiving stream below 5.0 mg/l.

The parameter values used in the modeling are listed below:

Background: the temperature and ammonia nitrogen levels are shown in Table 2. The ultimate CBOD and the DO are assumed to be 8.0 mg/l and 6.0 mg/l, respectively.

Effluent: the temperatures are shown in Table 3. CBOD5 limit of 40 mg/l is the technology based maximum limit for standard secondary treatment. The ammonia nitrogen values are the calculated maximum limits shown in Table 4. Both ADW and AWW flows and the ammonia nitrogen limits associated with them were used in the modeling.

Receiving stream parameters: an average water channel slope of 0.00935 (the water channel elevation changes from 1,010 ft to 900 ft over a distance of approximately 11,770 ft. estimated based on the USGS 7.5" topographic map).

Field Use Attainability Assessment (UAA) had two sites along the approximately 3.58 miles long Honey Creek, 74-2 is close to the outfall, 74-1 is close to the mouth. Two observations of stream width, depth and velocity were made at each site. The stream average width, depth, velocity at 7Q10 and ADW/AWW conditions were estimated based on the observed data.

Table 5: Stream Width, Depth and Velocity

Flow Condition	Flow (cfs)	Width (ft)	Depth (in)	Velocity (fps)
7Q10+ADW	3.249	13.8	3.55	0.79
7Q10+AWW	10.829	16.0	6.10	1.33

Please note that a Modified Iowa Model was used to calculate the CBOD5/DO limits in the 1990s. The modeling input, such as stream flow and effluent ammonia level, were different than the current values. Therefore, the modeling results are not considered valid. However, some of the parameters, such stream velocities at comparable conditions, can be used as reference to evaluate the estimated values at current

conditions. Comparison shows that the estimated velocities shown in Table 5 were reasonable and were consistent with values used in the modeling done in the 1990s.

Reaeration: UAA document states that "The stream was relatively shallow with riffles present throughout the reach. At least one pooled area was present (noted at site 74-1) within the reach". The stream flow on the day the UAA field work was done is comparable to the 7Q10+AWW condition. Therefore, the USGS Pool-Riffle (Melching and Flores 1999) equation was used in the estimates of reaeration rates in Honey Creek.

Conclusion: the modeling results show that the effluent, which could have an allowed maximum effluent CBOD5 level of 40 mg/l (technology based limits for secondary treatment), ammonia nitrogen levels as shown in Table 4, and a minimum DO level of 5 mg/l, will not cause the DO level in the receiving stream below 5.0 mg/l at any time.

***E. coli*:**
To protect Honey Creek:
The facility discharges into a Class (A2) water body. The water quality standard for *E. coli* in a Class (A2) water body is a Geometric Mean of 630 org./100 ml and a Sample Maximum of 2,880 org./100 ml from March 15th through November 15th. The criteria apply at "end-of-pipe".

To protect A1 designated Des Moines River:
The nearest A1 stream in the discharge route is approximately 3.58 miles below the outfall. The water quality standard for *E. coli* in a Class (A1) water body is a Geometric Mean of 126 org./100 ml and a Sample Maximum of 235 org./100 ml from March 15th through November 15th.

E. coli decay in the 3.58 miles long B(WW-2) Honey Creek were estimated using a first order decay model and a flow velocity of 1.33 fps, which is the estimated flow velocity at 7Q10 and AWW condition.

To protect the Des Moines River, the geometric mean is 300 #org/100 ml and the sample maximum is 559 #org/100 ml.

Final effluent limits:
The limits for the protection for the Des Moines River are more stringent, therefore, govern.

The recent chapter 62 revision that became effective on Oct. 14, 2009 states "…that the daily sample maximum criteria for E. coli set forth in Part E of the 'Supporting Document for Iowa Water Quality Management Plans' shall not be used as an end-of-pipe permit limitation." Therefore, only the geometric mean limit of 300 org./100 ml applies to this facility.

Chloride and Sulfate:
The new chloride and sulfate criteria became effective on Nov. 11, 2009. The default hardness for background and effluent has been changed from 100 mg/l to 200 mg/l, effective on Nov. 11, 2009.

Chloride criteria are functions of hardness and sulfate concentration, shown as follows:

$$\text{Acute criteria} = 287.8*(\text{Hardness})^{0.205797}*(\text{Sulfate})^{-0.07452}$$
$$\text{Chronic criteria} = 177.87*(\text{Hardness})^{0.205797}*(\text{Sulfate})^{-0.07452}$$

The criteria apply to all Class B waters.

Sulfate criteria, shown in Table 6, are functions of hardness and chloride concentration.

Table 6: Sulfate Criteria

Hardness (mg/l as CaCO3)	Sulfate Criteria (mg/l)		
	Chloride < 5 mg/l	5 mg/l <= Chloride < 25 mg/l	25 mg/l <= Chloride < 500 mg/l
< 100	500	500	500
100<=H<=500	500	(-57.478+5.79*H+54.163*Cl)*0.65	(1276.7+5.508*H-1.457*Cl)*0.65
H> 500	500	2,000	2,000

The criteria defined in Table 6 serve as both acute and chronic criteria and apply to all Class B waters.

The acute criteria apply at the end of the ZID, and the chronic criteria apply at the end of the MZ. In this case, since the critical low flows in Honey Creek are all zero, the criteria apply at "end-of-pipe" instead of the boundaries of the MZ and the ZID.

Please note there is a chloride criterion of 250 mg/l for the protection of the drinking water use. Calculations show that due to higher stream flows and greater MZ and ZID, the limits for the protection of (BWW-2) use for Honey Creek are more stringent that those for the protection of the downstream drinking water use.

The default chloride and sulfate concentration for both background water and effluent are 34 and 63 mg/l, respectively.

pH:
Iowa Water Quality Standards (IAC 567.61.3.(3).a.(2) and IAC 567.61.3.(3).b.(2)) require that pH in Class A or Class B waters "Shall not be less than 6.5 nor greater than 9.0". The criteria apply at the end of the ZID, which in this case is not available due to the estimated zero critical low flows in Honey Creek.

TDS:
Effective Nov. 11, 2009, the site-specific TDS approach is no longer applicable; instead the new chloride and sulfate criteria became applicable. However, the TDS level should be controlled to a level such that the narrative criteria stated in IAC 567.61.3.(2) be fulfilled.

Major Facility Acute WET testing Ratio:
Use 100% of effluent for the testing.

Nitrate-Nitrogen:
The 9/25/2009 WLA for the nitrate impaired segments of the Des Moines River has given this facility a nitrate nitrogen allocation. An average loading limit of 656.79 lbs/day and a maximum loading limit of 1,075.06 lbs/day were derived based on the allocation.

5. PERMIT LIMITATIONS: - *Based on the Year 2006 Water Quality Standards & 2002 Permit Derivation Procedure.*

The acute and chronic WLAs are used as the values for input into the current permit derivation procedure. Under the 2002 permit derivation procedure, only for toxic parameters is the monitoring frequency considered in the calculation of final limits. The water quality based limits for this facility are shown on Pages 1- 3 of this report.

Reference:

1. http://www.mvr.usace.army.mil/Media/NewsStories/tabid/6636/Article/5239/corps-lakes-providing-water-supply-and-water-quality-releases-due-to-drought.aspx

August 21, 2002

WLA/permit limits for the City of Boone

These wasteload allocations and water quality based permit limitations are for the City of Boone's wastewater treatment facility. The wasteload allocations/permit limits are based on the 2002 revised Water Quality Standards.

1. BACKGROUND: This facility discharges into Honey Creek. Honey Creek is designated as a Class B(WW) Significant Resource warm water stream. The natural $30Q_{10}$, $1Q_{10}$,, and $7Q_{10}$ flows are estimated to be less than 0.1 cfs, so a protected flow of 1 cfs has been set for Honey Creek.

The following calculations are based on the designation of t Honey Creek as a Class B(WW): **Mixing Zone (MZ)** using 100 percent of the protected flow as the flow available for the mixing zone calculations, and 50 percent of the protected flow as the flow available for the **Zone of Initial Dilution (ZID)** calculations.

2. CALCULATIONS: The wasteload allocations / permit limits for this outfall were calculated based on an Average Dry Weather (ADW) design flow of 2.100 mgd and an Average Wet Weather (AWW) design flow of 7.000 mgd.

The water quality based permit concentration limits are derived using the allowed stream flow and the ADW design flow, while loading limits are derived using the allowed stream flow and the AWW design flow.

$CBOD_5$
Initial hand calculations indicated that secondary treatment would cause a water quality violation in Honey Creek. The Modified Iowa Model was used to determine if hand calculations were correct. Model runs for all seasons under wet and dry weather flows showed that violations would occur. Modeling predicted that for discharges during dry weather flows a minimum DO concentration of 4.1 mg/l is recommended and for wet weather flows the minimum DO concentration should be 4.7 mg/l. Staff concluded that 4.7 mg/l of DO should be the annual minimum.

Ammonia:
Standard stream background temperatures, pH's and concentrations of NH3-N were mixed with the discharge from the mechanical facility's effluent pH and temperature values to calculate the applicable instream WQS criteria for the protection of Honey Creek.

Since Honey Creek is designated as Class B(WW), the Sensitive Life Stage ammonia criteria will begin in March and run through September.

The monthly background temperature, pH, and NH3-N concentrations shown in Table 1 were used for the wasteload allocation/permit limits calculations based using the Year 2000 ammonia criteria.

Table 1.
Background Temperature, pH and NH3-N Concentrations
For Use with Year 2000 Ammonia Criteria

Months	pH	Temperature (°C)	NH_3-N (mg/l)
Jan.	7.8	0.6	0.5
Feb.	7.7	1.2	0.5
March	7.9	4.3	0.5
April	8.1	11.7	0.5
May	8.1	16.6	0.5
June	8.1	21.4	0.5
July	8.1	24.8	0.0
August	8.2	23.8	0.0
Sept.	8	22.2	0.5
October	8	12.3	0.5
November	8.1	6	0.5
December	8	1.6	0.5

Table 2 shows the statewide monthly effluent pH and temperature values for a mechanical facility.

Table 2
Effluent pH & Temperature Values
for a mechanical facility

Months	pH	Temperature (°C)
Jan.	7.67	12.4
Feb.	7.71	11.3
March	7.69	13.1
April	7.65	16.2
May	7.67	19.3
June	7.7	22.1
July	7.58	24.1
August	7.63	24.4
Sept.	7.62	22.8
October	7.65	20.2
November	7.69	17.1
December	7.64	14.1

Fecal Coliform / TRC: Due to the extremely large distance from the facility to the closest Class A designation no fecal coliform and TRC limits will be used.

Toxics: The Toxics wasteload allocation will consider the procedures included in the 2000 revised WQS. Important to TRC is the use of the $1Q_{10}$ stream flow in association with the acute wasteload allocation calculation. The chronic WLA will continue to use the $7Q_{10}$ stream flow in its calculations. **The same percentages of mixing zone and zone of initial dilution were used for ADW and AWW; 25% for chronic WLA and 2.5% for acute WLA.**

3. PERMIT LIMITATIONS: - *Based on the newly adopted and EPA approved Year 2000 Ammonia Water Quality Standards & 2002 Permit Derivation Procedure (a.k.a. new/new).*

The acute and chronic WLAs and the protection of general use streams are used as the values for input into the current permit derivation procedure. Ammonia limits are based on an 8/month sampling frequency. The following table shows the Legally Enforceable permit limits for the City of Boone. These limits reflect the use of the year 2000 ammonia criteria and the 2002 Permit Derivation Procedure.

Table 3.
Year 2000 Ammonia and Proposed Permit Derivation Procedure
Permit Limits for the City of Boone

Pollutant	Average Conc. (mg/l)	Maximum Conc. (mg/l)	Average Loading (lbs/d)	Maximum Loading (lbs/d)	Sampling Frequency (months)
DO	Minimum - 4.7 mg/l (all seasons)				
Ammonia- N					
January	6.6	15.4	327	890	8
February	7.4	14.4	368	833	8
March	3.5	14.8	176	860	8
April	2.6	15.8	131	919	8
May	2.2	15.3	114	889	8
June	1.6	14.6	83	845	8
July	1.4	17.7	69	1029	8
August	1.3	16.3	63	949	8
September	1.8	16.6	92	965	8
October	3.5	15.8	176	919	8
November	4.3	14.8	214	859	8
December	5.0	16.1	249	934	8
Toxics					
Arsenic	0.054	0.36	3.0	21	4
Cadmium	0.016	0.076	0.90	4.4	4
Chromium	0.043	0.060	2.4	3.5	4
Copper	0.037	0.060	2.1	3.5	4
Lead	0.032	0.20	1.8	11.7	4
Mercury	0.00016	0.00403	0.0090	0.23	4
Nickel	0.7000	5.8	39	339	4
Zinc	0.48	0.50	27	29	4
Cyanide	0.011	0.045	0.60	2.6	4
Phenols	0.054	2.5	3.0	146	4
Beryllium	0.0000	0.0000	0.0000	0.0000	4
Silver	0.101	0.101	5.9	5.9	4
Selenium	0.13	0.18	7.5	10.2	4

STATE OF IOWA
DEPARTMENT OF NATURAL RESOURCES
HENRY A. WALLACE BUILDING
DES MOINES, IOWA 50319

CONSTRUCTION PERMIT (REPRINTED)

City of Boone
City Hall
923 Eighth Street
Boone, Iowa 50036

PERMIT NO.: 94-243-S

FILE: Boone-WW

RE: WWTF Improvements

PROJECT NO: S91-95

In accordance with the provisions of Section 455B.173.3 and 455B.174.4, Code of Iowa, and Rule 567--64.2(455B) or Rule 567--65.6(455B), or Rule 567--43.3(455B) of the Iowa Administrative Code, the Director of the Department of Natural Resources does hereby issue a permit for the construction of:

1. Screening/Grit/Generator/control Building including screening and screening compaction, grit removal and dewatering, flow measurement, generator, electrical and distribution center.
2. Vertical Loop Reactor and appurtenances.
3. 2 new 110-ft diameter final clarifiers and appurtenances.
4. Sludge pumping building including pumping for both return activated sludge and waste activated sludge, flow measurement, piping and associated work.
5. Blower Building including blowers and associated work.
6. Maintenance building and associated work.
7. Conversion of the existing final clarifiers to post aeration facility and appurtenances.
8. Remodeling of existing sludge handling building and associated work.
9. Remodelling of existing control building.
10. All control, electrical, demolition, structural, piping and earthwork as specified in the approved plans and specifications.

The wastewater treatment facility approved under this construction permit is designed to treat an organic loading of 4000 lbs/day of BOD_5 while handling an average wet weather flow of 7.00 MGD and a maximum wet weather flow of 15.10 MGD.

This facility shall meet following final effluent limits effective on July 1, 1994:

Wastewater Parameter	Effluent Limitations					
	Concentration (mg/l)			Mass (lbs/day)		
	7 day average	30 day average	daily maximum	7 day average	30 day average	daily maximum
Flow (MGD)		7.0	15.1			
$CBOD_5$*	40	25		2335.00	1460.00	
TSS*	45	30		2627.00	1751.00	
Ammonia Nitrogen (Jan-Feb)		4.8	7.9		241.00	396.00
Ammonia Nitrogen (Mar-Jun)		2.3	3.8		117.00	192.00
Ammonia Nitrogen (Jul-Aug)		1.9	3.2		96.00	158.00
Ammonia Nitrogen (Sep-Dec)		2.3	3.8		117.00	192.00
pH (std. units)	Minimum 6.0 - Maximum 9.0					

* 85 Percent removal required

This construction permit is issued under the condition that temporary final clarification shall be provided. The Department has concurred with the proposed temporary use of two of the VLR tanks as final clarifiers during the construction of the permanent final clarifiers. These temporary facilities shall include sufficient sludge draw off piping and sludge and skim coat sludge directional structure as shown in drawings TC-1 and TC-2 submitted by McClure Engineering.

The project shall be initiated within one year of issuance of this permit or this permit is no longer valid. Within thirty days after completion of construction, the permit holder shall submit a certification by a registered professional engineer that the project was completed in accordance with the approved project documents.

Pursuant to Section 455B.174.4, Code of Iowa, you have the right to appeal any condition of this permit by filing with the Director of the Department of Natural Resources a notice of appeal and request for administrative hearing within thirty days of receipt of this permit.

Contact Gabe Lee at 515/281-6253 with any questions or comments.

For the Department of Natural Resources

Larry J. Wilson, Director

By:_____
ENVIRONMENTAL PROTECTION DIVISION

Date: May 22, 2007

cc:McClure Engineering, Fort Dodge, Iowa
Field Office 5

Plan Distribution
[1] Engineer; [1] Field Office; [1] DNR File

Review of Part B from City of Boone Application								
Pollutant	30 day avg. conc (mg/L)	Limit from WLA (mg/L)	part B - max	MDL	Part B above limit?	RP?	MDL above limit?	Other Names / Notes
1,1,1-Trichloroethane	1.350E+01	13.50000			No	No	No	
1,1,2-Trichloroethane	1.482E+00	1.48200			No	No	No	
1,1-Dichloroethylene	5.404E+01	54.04000			No	No	No	
1,2,4-Trichlorobenzene	4.724E+00	4.72400			No	No	No	
1,2-Dichloroethane	9.384E-01	0.93840			No	No	No	
1,2-Dichloropropane	1.235E+00	1.23500			No	No	No	
2,3,7,8-TCDD (Dioxin)	2.029E-09	0.00000			No	No	No	
2,4,5-TP (Silvex)	6.749E-01	0.67490			No	No	No	
2,4-D	6.744E+00	6.74400			No	No	No	
3,3-Dichlorobenzidine	1.114E-02	0.01114			No	No	No	
4,4' DDT	1.008E-06	0.00000			No	No	No	
Alachlor	1.317E-01	0.13170			No	No	No	
Aldrin	1.989E-05	0.00002			No	No	No	
Aluminum	8.767E-02	0.08767			No	No	No	
Antimony	3.779E-01	0.37790		0.005	No	No	No	
Arsenic (III)	4.445E-02	0.04445		0.001	No	No	No	
Asbestos	4.724E-01	0.47240			No	No	No	
Atrazine	1.962E-01	0.19620			No	No	No	
Barium	6.124E+01	61.24000			No	No	No	
Benzene	5.433E+00	5.43300			No	No	No	
Benzo(a)Pyrene	7.161E-03	0.00716			No	No	No	
Beryllium	2.700E-01	0.27000		0.002	No	No	No	
Bis(2-ethylhexyl)phthalate	8.753E-01	0.87530			No	No	No	
Bromoform	1.062E+01	10.62000			No	No	No	
Cadmium	4.558E-04	0.00046		0.00025	No	No	No	
Carbofuran	2.700E+00	2.70000			No	No	No	
Carbon Tetrachloride	5.680E-01	0.56800			No	No	No	
Chlordane	4.333E-06	0.00000			No	No	No	
Chlorobenzene	6.749E+00	6.74900			No	No	No	
Chlorodibromomethane	9.878E-01	0.98780			No	No	No	
Chloroform	1.408E+01	14.08000			No	No	No	
Chloropyrifos	4.132E-05	0.00004			No	No	No	
Chromium (VI)	1.108E-02	0.01108		0.01	No	No	No	
cis-1,2-Dichloroethylene	4.724E+00	4.72400			No	No	No	
Copper	1.700E-02	0.01700		0.005	No	No	No	
Cyanide	5.240E-03	0.00524		0.005	No	No	No	
Dalapon	1.350E+01	13.50000			No	No	No	
Di(2-ethylhexyl)adipate	2.700E+01	27.00000			No	No	No	
Dibromochloropropane	1.350E-02	0.01350			No	No	No	
Dichlorobromomethane	1.358E+00	1.35800			No	No	No	
Dichloromethane	3.374E-01	0.33740			No	No	No	
Dieldrin	2.148E-05	0.00002			No	No	No	
Dinoseb	4.724E-01	0.47240			No	No	No	
Diquat	1.350E+00	1.35000			No	No	No	
Endosulfan	5.643E-05	0.00006			No	No	No	
Endothall	6.749E+00	6.74900			No	No	No	
Endrin	3.628E-05	0.00004			No	No	No	
Ethylbenzene	2.267E+01	22.67000			No	No	No	
Ethylene dibromide	3.374E-03	0.00337			No	No	No	
Fluoride	8.083E+00	8.08300			No	No	No	
gamma-Hexachlorocyclohexane (Lindane)	9.507E-04	0.00095			No	No	No	
Glyphosate	4.724E+01	47.24000			No	No	No	
Heptachlor	3.829E-06	0.00000			No	No	No	
Heptachlor epoxide	3.829E-06	0.00000			No	No	No	
Hexachlorobenzene	1.154E-04	0.00012		0.005	No	No		
Hexachlorocyclopentadiene	2.700E+00	2.70000			No	No	No	
Iron	1.001E+00	1.00100			No	No	No	
Lead	7.752E-03	0.00775		0.001	No	No	No	
Mercury (II)	9.069E-04	0.00091			No	No	No	
Methoxychlor	6.749E+00	6.74900			No	No	No	
Nickel	9.449E-02	0.09449		0.05	No	No	No	
Nitrate as N*	3.202E+02	320.20000			No	No	No	
Nitrate+Nitrite as N*	3.202E+02	320.20000			No	No	No	
Nitrite as N	6.75E+01	67.49000			No	No	No	
o-Dichlorobenzene	4.05E+01	40.49000			No	No	No	
Oxamyl (Vydate)	1.35E+01	13.50000			No	No	No	
para-Dichlorobenzene	2.00E+00	2.00200			No	No	No	
Parathion	1.31E-05	0.00001			No	No	No	
Pentachlorophenol (PCP)	2.25E-02	0.02253			No	No	No	
Phenols	5.04E-02	0.05038		0.035	No	No	No	
Picloram	3.37E+01	33.74000			No	No	No	
Polychlorinated Biphenyls (PCBs)	1.41E-05	0.00001			No	No	No	
Polynuclear Aromatic Hydrocarbons (PAHs)	1.87E-04	0.00019			No	No	No	
Selenium	5.04E-03	0.00504		0.005	No	No	No	
Silver	3.80E-03	0.00380		0.001	No	No	No	
Simazine	2.70E-01	0.27000			No	No	No	
Styrene	6.75E+00	6.74900			No	No	No	
Tetrachloroethlyene	1.31E+00	1.31300			No	No	No	
Thallium	5.35E-03	0.00535		0.00025	No	No	No	
Toluene	1.51E-01	0.15120			No	No	No	
Toxaphene	2.02E-06	0.00000			No	No	No	
trans-1,2-Dichloroethylene	1.59E+00	1.59400			No	No	No	
Trichloroethylene (TCE)	8.06E-02	0.08062			No	No	No	
Trihalomethanes (total)	5.40E+00	5.39900			No	No	No	
Vinyl Chloride	6.17E-02	0.06174			No	No	No	
Xylenes (Total)	6.75E+02	674.90000			No	No	No	
Zinc	2.16E-01	0.21570	0.04	0.02	No	No	No	