

**Arkansas Department of Environmental Quality  
Water Quality Management Plan Update Summary Sheet**

Date: 10/13/2015

New Permit

Renewal Permit

Amended Permit

**Type of Discharge:** Domestic Wastewater

**Facility Name:** Arkansas Department of Corrections – North Central Unit

**Permit No.:** AR0044016

**Design Flow Rate (MGD):** 0.09

**Receiving Stream:** Moccasin Creek

**HUC + Reach Code:** 11010004+908                      **7Q10:** 0 cfs

**Planning Segment:** 4F                                      **County:** Izard

**Proposed Effluent Limits in mg/L (CBOD5/TSS/NH3-N/DO):**

No changes from current effluent limits shown below.

**Current Effluent Limits in mg/L (BOD5/TSS/DO):**

April: 10/15/3.9/5.0

May-October: 10/15/3.0/5.0

November-March: 10/15/5.0/5.0

**Justification (Sag = Minimum Modeled Value ≠ Difference in Value):**

Reach No.	Length (miles)	DO <sub>C</sub> (mg/L)	Sag <sub>C</sub> (mg/L)	Distance to Sag <sub>C</sub> (miles)	DO <sub>P</sub> (mg/L)	Sag <sub>P</sub> (mg/L)	Distance to Sag <sub>P</sub> (miles)
1	3.5	5.0 <sup>1</sup>	4.910	0.1	6.0	7.066	0.0

Values in above table are from a modeling analysis dated 10/9/2015.

**TMDL Limits:** None

**Outfall Location (Lat/Long):** 36° 10' 10.65" N; 92° 09' 29.15" W

**Remarks:** This is for the reissuance of the discharge permit for this existing facility. No changes to the 208 Plan are being made with this permit renewal. A review of permit file indicated that no dissolved oxygen model existed for this facility. Therefore, a model was prepared on 10/9/2015 and this modeling confirmed that existing permit limits meet dissolved oxygen water quality standards. A summary of model results is shown in table above.

<sup>1</sup> Critical season DO standard for Moccasin Creek at the discharge location is set by a UAA, and is more stringent than the default ecoregion standard for watershed less than 10 square miles. The watershed area at discharge location is 6.34 square miles based on USGS StreamStats.

From: Sam Gates <sgates@mcclelland-engrs.com>  
Sent: Wednesday, September 30, 2015 3:29 PM  
To: Lester, Guy  
Cc: Dan Beranek  
Subject: ADC North Central Unit Out Fall Location Permit AR0044016

Mr. Lester ,  
The ADC North Central Unit out fall location for 001:  
Latitude 36° 10' 10.65"  
Longitude 92° 9' 29.15"

Sam Gates  
Environmental Scientist

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**Ammonia Calculations**

Facility Name ADoC - N. Central Unit - Izard County  
 Major or Minor minor  
 Permit Number AR0044016  
 Receiving Stream Moccasin Creek  
 7Q10, cfs 0  
 0.25/0.67 multiplier 0.67  
 Qb, cfs 0.00  
 Qe, MGD 0.09  
 Qe, cfs 0.14  
 Cb, mg/l 0

Ecoregion or River name Ozark Highlands  
 Watershed area (mi<sup>2</sup>) 6.34  
 Regulation No. 2 Chronic Toxicity Criteria (Instream Concentration)  
 AML, mg/l DML, mg/l  
 April 3.9 3.9  
 May - October 3.9 3.9  
 November - March 10.3 10.3

Allowable Effluent Conc., mg/l

$$(Q_e * C_e) + (Q_b * C_b) = (Q_e + Q_b) * IWC$$

Qe Effluent Flow  
 Ce Allowable Effluent Concentration  
 Qb % of Low Flow of Receiving Stream  
 Cb Background Concentration  
 IWC Instream Waste Concentration Chronic Toxicity Criteria

Allowable Effluent Conc. (Ce), mg/l

$$C_e = (IWC (Q_e + Q_b) - C_b \times Q_b) / Q_e$$

	Monthly Avg.,mg/l	Daily Max, mg/l
April	3.90	3.90
May - October	3.90	3.90
November - March	10.30	10.30

**Chronic Toxicity Criteria vs. D.O. Model Limits**

Month	Monthly Average, mg/l		Permit Limits	Daily Maximum,mg/l		Permit Limits
	Toxicity limit	D.O. limit		Toxicity limit	D.O. limit	
April	3.90	5	3.90	3.90	7.5	3.90
May - October*	3.90	3	3.00	3.90	4.5	3.90
November - March	10.30	5	5.00	10.30	7.5	7.50

\*At the discharge location, Moccasin Creek has a perrenial aquatic life use(set by UAA), so aquatic toxcity standards apply during May-Oct.

### Minor Permits

Fish Early Life Stages Absent - Primary Season (November - March), mg/L

Ecoregion	Temperature	pH	4-day average	30-day average
Arkansas River	14	7.6	10.3	10.3
Arkansas River Valley	14	6.7	16.7	16.7
Boston Mountains	14	6.9	15.8	15.8
Delta	14	7.1	14.7	14.7
Gulf Coastal Plains	14	6.6	17	17
Ouachita Mountains	14	7.1	14.7	14.7
Ouachita River (L. Mo. to Mouth)	14	6.7	16.7	16.7
Ozark Highlands	14	7.6	10.3	10.3
Red River	14	7.5	11.3	11.3
White River (Dam #10 Mouth)	14	7.7	9.3	9.3

Fish Early Life Stages Present - Critical Season (April - October), mg/L

Ecoregion	Temperature	pH	4-day average	30-day average
Arkansas River	32	7.6	3.2	3.2
Arkansas River Valley	31	6.7	5.6	5.6
Boston Mountains	31	6.9	5.3	5.3
Delta	30	7.1	5.2	5.2
Gulf Coastal Plains	30	6.6	6.1	6.1
Ouachita Mountains	30	7.1	5.2	5.2
Ouachita River (L. Mo. to Mouth)	32	6.7	5.2	5.2
Ozark Highlands	29	7.6	3.9	3.9
Red River	32	7.5	3.5	3.5
White River (Dam #10 Mouth)	32	7.7	2.9	2.9

### Major Permits

Fish Early Life Stages Absent - Primary Season (November - March), mg/L

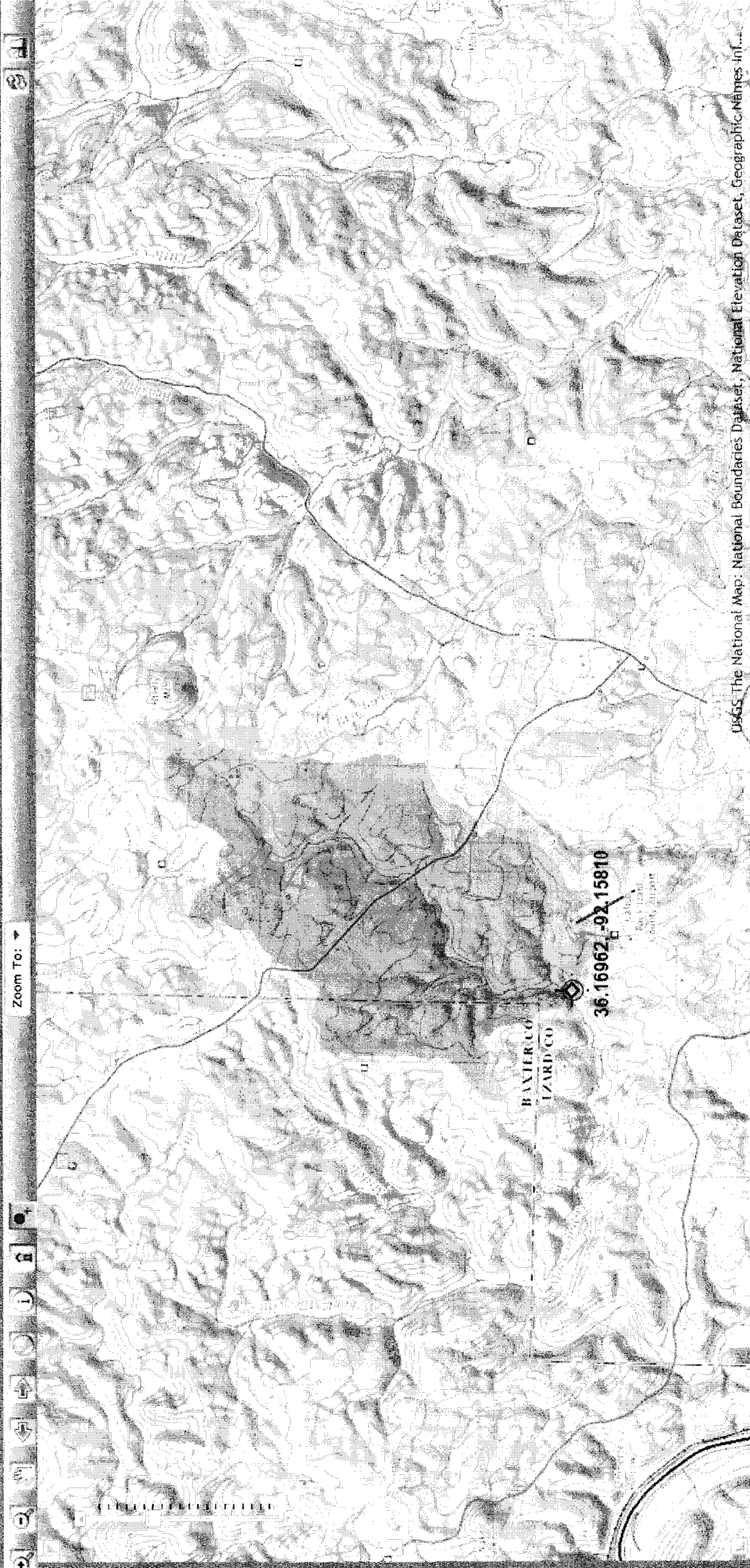
Ecoregion	Temperature	pH	4-day average	30-day average
Arkansas River	14	7.6	10.3	4.1
Arkansas River Valley	14	6.7	16.7	6.7
Boston Mountains	14	6.9	15.8	6.3
Delta	14	7.1	14.7	5.9
Gulf Coastal Plains	14	6.6	17	6.8
Ouachita Mountains	14	7.1	14.7	5.9
Ouachita River (L. Mo. to Mouth)	14	6.7	16.7	6.7
Ozark Highlands	14	7.6	10.3	4.1
Red River	14	7.5	11.3	4.5
White River (Dam #10 Mouth)	14	7.7	9.3	3.7

Fish Early Life Stages Present - Critical Season (April-October), mg/L

Ecoregion	Temperature	pH	4-day average	30-day average
Arkansas River	32	7.6	3.2	1.3
Arkansas River Valley	31	6.7	5.6	2.2
Boston Mountains	31	6.9	5.3	2.1
Delta	30	7.1	5.2	2.1
Gulf Coastal Plains	30	6.6	6.1	2.4
Ouachita Mountains	30	7.1	5.2	2.1
Ouachita River (L. Mo. to Mouth)	32	6.7	5.2	2.1
Ozark Highlands	29	7.6	3.9	1.6
Red River	32	7.5	3.5	1.4
White River (Dam #10 Mouth)	32	7.7	2.9	1.2



# StreamStats Version 3 Beta : Arkansas



Zoom To: ▾



USGS The National Map: National Boundaries Dataset, National Elevation Dataset, Geographic Names Inf...

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U.S. Department of the Interior U.S. Geological Survey

URL: <http://www.streamstats.gov/> <http://www.water.usgs.gov/arcswater/arcswater.html>

Page Contact Information: [StreamStats Help](#)

Page Last Modified: 07/23/2013 (Web5)

Drainage Area = 6.34 square miles



## Model Input Data

Facility Name: ADoC – North Central Unit – Izard County

Permit Number: AR0044016

Lat./Long. 36° 10' 10.65" N; 92° 9' 29.15" W

W.S. Drainage Area (mi<sup>2</sup>) 6.34 Ecoregion: Ozark Highlands

	Critical Season (May-Oct.)	Primary Season (Nov.-Apr.)
D.O. Standard (mg/L)	5.0 <sup>1</sup>	6.0
Temp. Standard (°C)	29	22
Q stream (cfs)	7Q10 = 0	Seasonal fishery = 1.0 – 0.14 = 0.86
Velocity stream (fps)	0.05	0.1
Depth stream (ft)	0.5	1.0

Slope = 33.3 feet/mile

Q<sub>DESIGN</sub> (MGD): 0.09 (0.14 cfs) Planning Seg. 4F

Receiving Stream: Moccasin Creek, White River

HUC + reach code: 11010004+908 Permit type: Industrial

### Input Model Coefficients

Reach 1 – 3.5 miles Slope = 33 feet/mile

Coefficient – at 20° C	Input value	Justification
BOD <sub>ult</sub> /BOD <sub>5</sub>	2.3	EPA MOA
K <sub>d</sub> (1/day)	0.4	EPA MOA
K <sub>n</sub> (1/day)	0.4	EPA MOA
SOD (g/m <sup>2</sup> /day)	C: 0.506 P: 0.337	Critical: SOD = 1.06 <sup>9</sup> *0.3 = 0.506 Primary: SOD = 1.06 <sup>2</sup> *0.3 = 0.337
K <sub>a</sub> (1/day)	C: 8.159 P: 4.079	Calculated by MultiSMP

<sup>1</sup> The critical season DO standard for Moccasin Creek at the outfall location is 5.0 mg/l as set by a UAA, which is more stringent than the default ecoregion DO standard for watershed less than 10 square miles.

Engineer: SB

Date: 10-9-2015

BVC

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*                               SIMPLIFIED METHOD PROGRAM                               *
*                               COMPLETE INPUT LISTING                               *
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44016-C.SMP

\*-\*-\*-\*-\*-\* Run Information \*-\*-\*-\*-\*-\*

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Name of receiving stream ----- Moccasin Creek
Number of discharges ----- 1
Number of reaches ----- 1
Reaeration type ----- O'Connor-Dobbins
Run title ----- ADoC NC Unit CRIT

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\*-\*-\*-\*-\*-\* Upstream Parameters \*-\*-\*-\*-\*-\*

Parameter	Value	Comment
Flow (cfs)	0.000	7Q10 = 0
Temperature (°C)	29.000	Ozark Highlands
Dissolved Oxygen (mg/l)	0.000	7Q10 = 0
5-Day BOD (mg/l)	0.000	7Q10 = 0
Ult. CBOD / 5-Day BOD	2.300	EPA MOA
pH (su)	7.000	Assumed
Ammonia (mg/l)	0.000	Assumed
Alkalinity (mg/l)	0.000	Assumed

\*-\*-\*-\*-\*-\* Effluent Parameters \*-\*-\*-\*-\*-\*

Number of Discharges = 1

For Discharge Number 1 (ADoC NC Unit)

Parameter	Value	Comment
Flow (MGD)	0.090	Design Flow
Temperature (°C)	29.000	Reg. 2.502
Dissolved Oxygen (mg/l)	5.000	Permit Limit
5-Day BOD (mg/l)	10.000	Permit Limit
Ult. CBOD / 5-Day BOD	2.300	EPA MOA
pH (su)	7.000	Assumed
Ammonia (mg/l)	3.000	Permit Limit
Alkalinity (mg/l)	0.000	Assumed
Beginning of Reach Number	1.000	

\*-\*-\*-\*-\*-\* Reach Information \*-\*-\*-\*-\*-\*

Number of Reaches = 1  
Reaeration Type is O'Connor-Dobbins

For Reach Number 1

Parameter	Value	Comment
Length (mile)	3.500	303(d) Map
Velocity (fps)	0.050	Calculated
Slope (ft/mile)	33.300	USGS QUAD MAP
Average Depth (ft)	0.500	Calculated
Temperature (°C)	29.000	Calculated

BOD Removal Rate	(1/day)	0.400	EPA MOA
NH3 Decay Rate	(1/day)	0.400	EPA MOA
Sediment Oxygen Demand	(g/m <sup>2</sup> /day)	0.506	0.3*1.06 <sup>9</sup>
Photosynthesis/respiration	(mg/L/day)	0.000	Assumed

Temperature-corrected BOD removal rate	(1/day)	0.605
Temperature-corrected NH3 decay rate	(1/day)	0.800
Calculated reaeration rate at 20° C	(1/day)	8.159
Temperature-corrected reaeration rate	(1/day)	10.109
Calculated reach-averaged width	(ft)	5.566

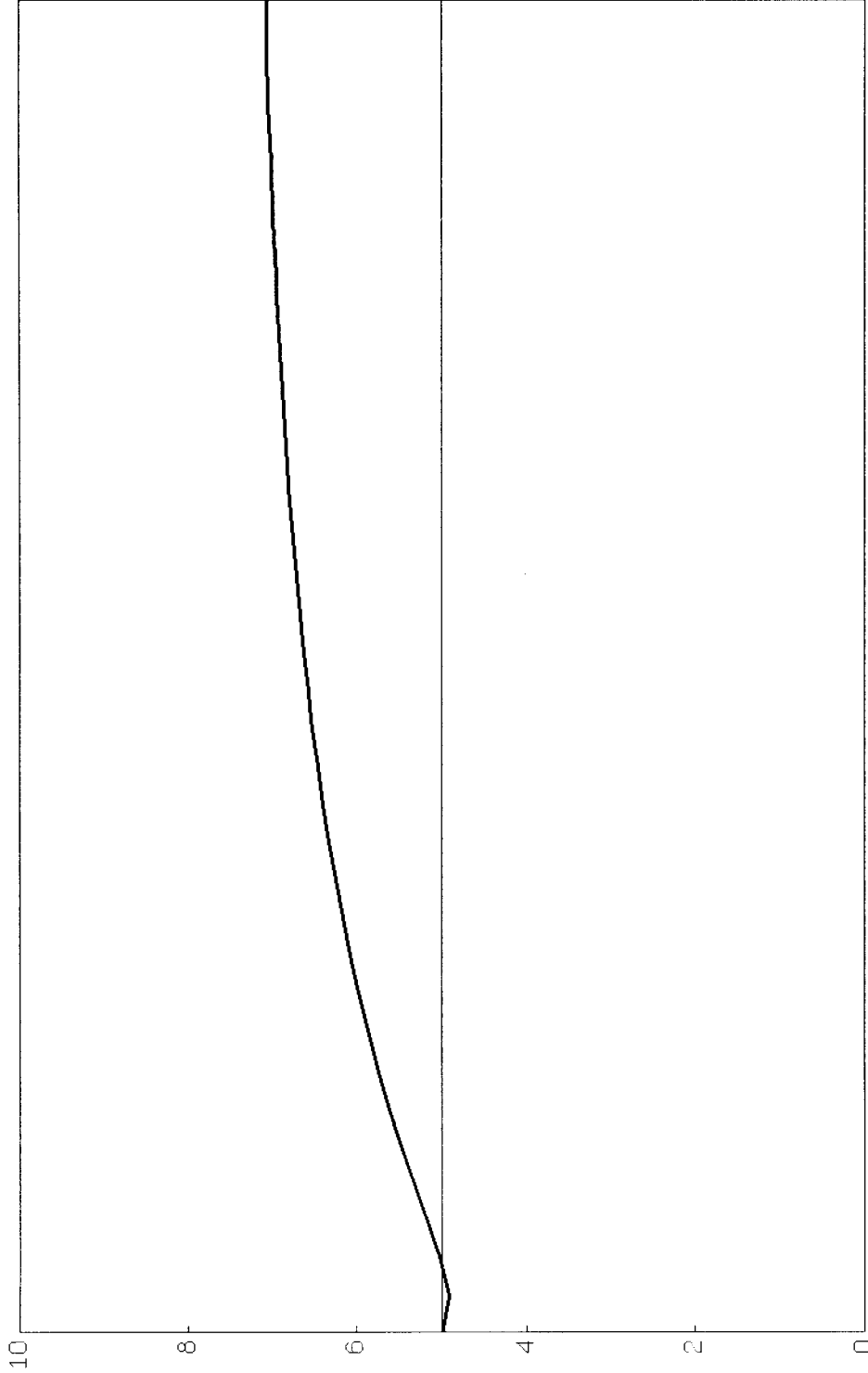
\*-\*-\*-\*-\* Results for Moccasin Creek \*-\*-\*-\*-\*

Discharge is to -- Moccasin Creek  
Run Title is -- ADoC NC Unit CRIT

River Mile	DO Predicted	DO Observed	BOD Predicted	BOD Observed	NH3 Predicted	NH3 Observed
3.500	5.000		23.000		3.000	
3.400	4.910	←	21.361		2.721	
3.300	5.018		19.839		2.467	
3.200	5.173		18.426		2.238	
3.100	5.330		17.113		2.029	
3.000	5.480		15.894		1.840	
2.900	5.619		14.761		1.669	
2.800	5.746		13.710		1.514	
2.700	5.864		12.733		1.373	
2.600	5.972		11.826		1.245	
2.500	6.071		10.983		1.129	
2.400	6.162		10.200		1.024	
2.300	6.246		9.474		0.929	
2.200	6.322		8.799		0.842	
2.100	6.393		8.172		0.764	
2.000	6.458		7.590		0.693	
1.900	6.518		7.049		0.628	
1.800	6.573		6.547		0.570	
1.700	6.623		6.080		0.517	
1.600	6.670		5.647		0.468	
1.500	6.712		5.245		0.425	
1.400	6.752		4.871		0.385	
1.300	6.788		4.524		0.349	
1.200	6.821		4.202		0.317	
1.100	6.852		3.902		0.287	
1.000	6.880		3.624		0.261	
0.900	6.906		3.366		0.236	
0.800	6.930		3.126		0.214	
0.700	6.952		2.903		0.194	
0.600	6.972		2.697		0.176	
0.500	6.991		2.504		0.160	
0.400	7.008		2.326		0.145	
0.300	7.024		2.160		0.132	
0.200	7.038		2.006		0.119	
0.100	7.052		1.863		0.108	
-0.000						
-0.000	7.064		1.731		0.098	



Dissolved Oxygen Profile  
ADOC NC Unit CRIT



Max unionized ammonia = 0.0223 mg/L

BVC

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*****
*                               SIMPLIFIED METHOD PROGRAM                               *
*                               COMPLETE INPUT LISTING                               *
*****

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44016-P.SMP

\*-\*-\*-\*-\* Run Information \*-\*-\*-\*-\*

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Name of receiving stream ----- Moccasin Creek
Number of discharges ----- 1
Number of reaches ----- 1
Reaeration type ----- O'Connor-Dobbins
Run title ----- ADoC NC Unit PRIMARY

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\*-\*-\*-\*-\* Upstream Parameters \*-\*-\*-\*-\*

Parameter	Value	Comment
Flow (cfs)	0.860	1.0 - DF (cfs)
Temperature (°C)	22.000	Reg. 2.505(A)
Dissolved Oxygen (mg/l)	7.400	85%sat ER Study
5-Day BOD (mg/l)	0.920	WHI0065
Ult. CBOD / 5-Day BOD	2.300	EPA MOA
pH (su)	7.730	WHI0065
Ammonia (mg/l)	0.030	WHI0065
Alkalinity (mg/l)	0.000	Assumed

\*-\*-\*-\*-\* Effluent Parameters \*-\*-\*-\*-\*

Number of Discharges = 1

For Discharge Number 1 (ADoC NC Unit)

Parameter	Value	Comment
Flow (MGD)	0.090	Design Flow
Temperature (°C)	22.000	Reg. 2.505(A)
Dissolved Oxygen (mg/l)	5.000	Permit Limit
5-Day BOD (mg/l)	10.000	Permit Limit
Ult. CBOD / 5-Day BOD	2.300	EPA MOA
pH (su)	7.000	Assumed
Ammonia (mg/l)	5.000	Permit Limit
Alkalinity (mg/l)	0.000	Assumed
Upstream river mile	1.000	

\*-\*-\*-\*-\* Reach Information \*-\*-\*-\*-\*

Number of Reaches = 1  
Reaeration Type is O'Connor-Dobbins

For Reach Number 1

Parameter	Value	Comment
Length (mile)	3.500	303(d) Map
Velocity (fps)	0.100	Calculated
Slope (ft/mile)	33.300	USGS QUAD MAP
Average Depth (ft)	1.000	Calculated
Temperature (°C)	22.000	Calculated

BOD Removal Rate	(1/day)	0.400	EPA MOA
NH3 Decay Rate	(1/day)	0.400	EPA MOA
Sediment Oxygen Demand	(g/m <sup>2</sup> /day)	0.337	0.3*1.06 <sup>2</sup>
Photosynthesis/respiration	(mg/L/day)	0.000	Assumed

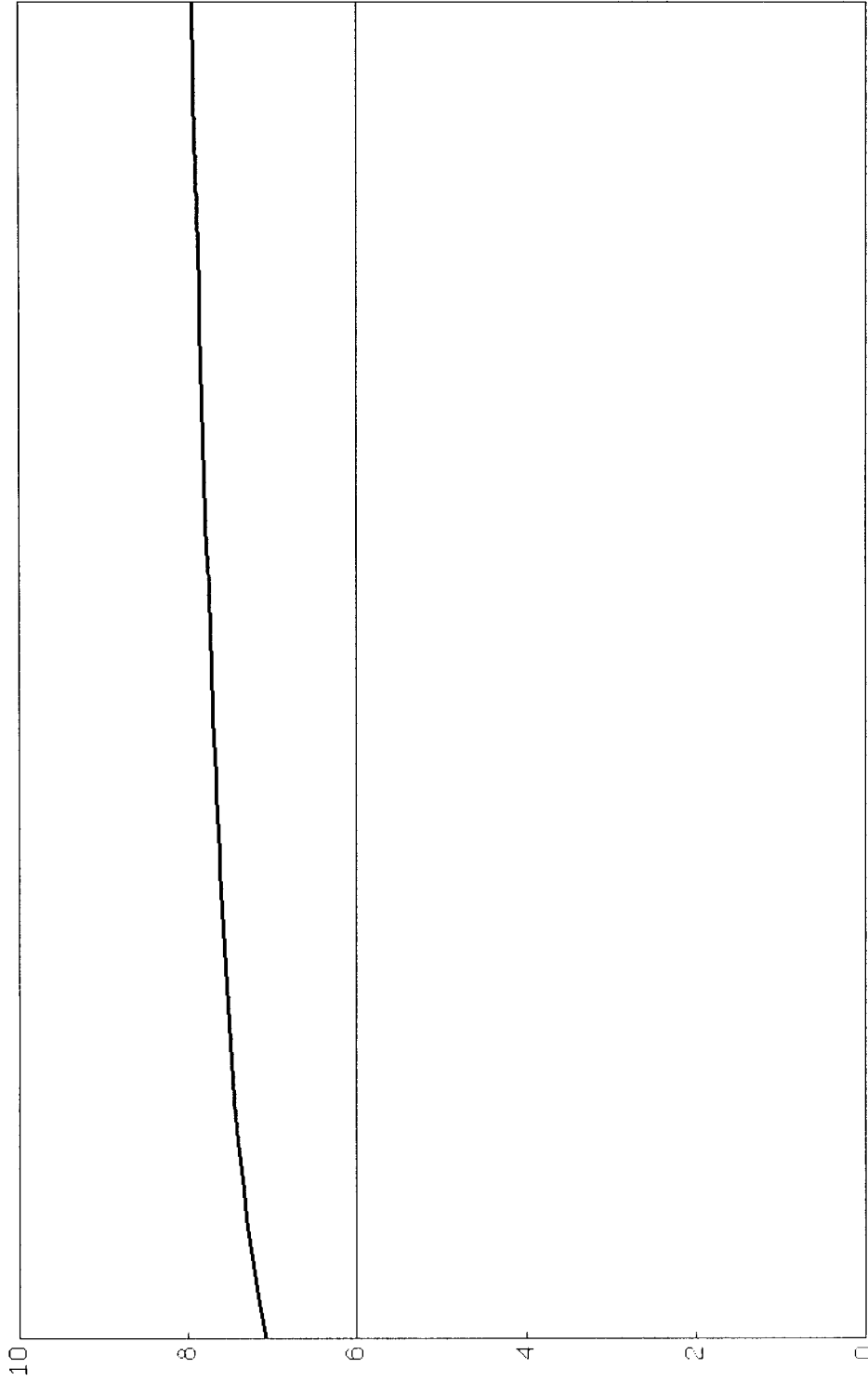
Temperature-corrected BOD removal rate	(1/day)	0.438
Temperature-corrected NH3 decay rate	(1/day)	0.467
Calculated reaeration rate at 20° C	(1/day)	4.079
Temperature-corrected reaeration rate	(1/day)	4.278
Calculated reach-averaged width	(ft)	9.991

\*-\*-\*-\*-\* Results for Moccasin Creek \*-\*-\*-\*-\*

Discharge is to -- Moccasin Creek  
Run Title is -- ADoC NC Unit PRIMARY

River Mile	DO Predicted	DO Observed	BOD Predicted	BOD Observed	NH3 Predicted	NH3 Observed
3.500	7.066	←	5.024		0.722	
3.400	7.155		4.891		0.702	
3.300	7.230		4.762		0.682	
3.200	7.292		4.636		0.663	
3.100	7.345		4.514		0.644	
3.000	7.391		4.394		0.626	
2.900	7.431		4.278		0.609	
2.800	7.467		4.165		0.591	
2.700	7.499		4.055		0.575	
2.600	7.528		3.948		0.559	
2.500	7.554		3.843		0.543	
2.400	7.579		3.742		0.528	
2.300	7.602		3.643		0.513	
2.200	7.624		3.546		0.498	
2.100	7.645		3.453		0.484	
2.000	7.664		3.361		0.471	
1.900	7.683		3.272		0.458	
1.800	7.701		3.186		0.445	
1.700	7.719		3.102		0.432	
1.600	7.735		3.020		0.420	
1.500	7.752		2.940		0.408	
1.400	7.767		2.862		0.397	
1.300	7.782		2.786		0.386	
1.200	7.797		2.713		0.375	
1.100	7.811		2.641		0.364	
1.000	7.825		2.571		0.354	
0.900	7.838		2.503		0.344	
0.800	7.852		2.437		0.334	
0.700	7.864		2.373		0.325	
0.600	7.877		2.310		0.316	
0.500	7.888		2.249		0.307	
0.400	7.900		2.189		0.298	
0.300	7.911		2.131		0.290	
0.200	7.922		2.075		0.282	
0.100	7.933		2.020		0.274	
-0.000						
-0.000	7.944		1.967		0.266	

Dissolved Oxygen Profile  
ADoC NC Unit PRIMARY



1

Reach

Max unionized ammonia = 0.0150 mg/L

DO (mg/L)