

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

Date: 04/19/2010

New Permit Renewal Permit Amended Permit

Type of Discharge: Municipal Wastewater

Facility Name: City of Melbourne

Permit No.: AR0020036

Design Flow Rate (MGD): 0.41

Receiving Stream: Mill Creek, then to Piney Creek, then to the White River

HUC + Reach Code:¹ 11010004+0409 **7Q10:** 0 cfs

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

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

May – October:² 10/15/3.9/6.0
November – March: 25/30/10.3/6.0
April:³ 25/30/3.9/6.0

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

Reach No.	Length (miles)	DO _C (mg/L)	Sag _C (mg/L)	Distance to Sag _C (miles)	DO _P (mg/l)	Sag _P (mg/L)	Distance to Sag _P (miles)
1	0.8	2.0	5.8	033	6.0	6.2	0.42
2	2.0	5.0	5.9	0.0	6.0	6.3	0.0

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

May – October: 10/15/Report/6.0
November – April: 25/30/Report/6.0

Outfall Location (Lat/Long): 36° 03' 33" N; 91° 55' 39" W

Remarks: This is for the reissuance of the discharge permit for this existing facility.

¹ The reach is from medium resolution NHD. The closest numbered reach downstream in the ADEQ's 2008 305(b) Report is 007 (Piney Creek).

² Per Reg. 2.106, the Critical Season is temperature dependent and tends to be from mid-May to mid-September.

³ The proposed NH3-N limit in April is based on Reg. 2.512.

Model Input Data

Facility Name: City of Melbourne

Permit Number: AR0020036

Outfall Lat./Long.: 36° 03' 33" N; 91° 55' 39" W

W.S. Drainage Area (mi²): < 10 Ecoregion: Ozark Highlands

	Critical Season (May-Oct.)		Primary Season (Nov.-Apr.)
	2.0	5.0	6.0
D.O. Standard (mg/L)	2.0	5.0	6.0
Temp. Standard (°C)	29		22
Q stream (cfs)	0.63		1.0
Velocity stream (fps)	0.2		0.2
Depth stream (ft)	0.5		0.5

Q_{DESIGN} (MGD): 0.41 Planning Seg.: 4F

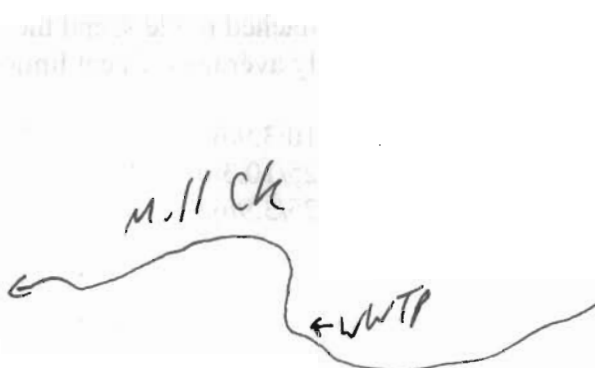
Receiving Stream: Mill Creek, then to Piney Creek, & then to the White River

HUC + Reach Code:¹ 11010004+0409 Permit Type: Municipal

Other Facilities: 7Q10: 0 cfs

Name	Permit#	Coord.	Q (MGD)	Limits
None				

Flow Diagram:



¹ The reach is from medium resolution NHD. The closest numbered reach downstream in the ADEQ's 2008 305(b) Report is 007 (Piney Creek).

Engineer: car
Date: 4/19/10

Input Model Coefficients

Reach 1

Coefficient – at 20° C	Input Value	Justification
BOD _{ult.} /BOD ₅	2.3	EPA Guidance
K _d (1/day)	0.4	Draft EPA MOA
K _n (1/day)	0.4	Draft EPA MOA
SOD (g/m ² /day)	0.8	Draft EPA MOA
K _a (1/day)	Model	O'Connor-Dobbins

Reach 2

Coefficient – at 20° C	Input Value	Justification
BOD _{ult.} /BOD ₅	2.3	EPA Guidance
K _d (1/day)	0.4	Draft EPA MOA
K _n (1/day)	0.4	Draft EPA MOA
SOD (g/m ² /day)	0.5	Draft EPA MOA
K _a (1/day)	Model	O'Connor-Dobbins

Recommendations:

Based on the current permit, the attached models, and the attached toxicity spreadsheet, the following are the proposed monthly average effluent limits (in mg/L) (CBOD5/NH3-N/DO):

May – October:² 10/3.9/6.0
 November – March: 25/10.3/6.0
 April:³ 25/3.9/6.0

² Per Reg. 2.106, the Critical Season is temperature dependent and tends to be from mid-May to mid-September.

³ The proposed NH3-N limit in April is based on Reg. 2.512.

Engineer: *CWR*
 Date: 4/19/10

Ammonia Calculations

Facility Name	City of Melbourne	Ecoregion or River name	Ozark Highlands
Major or Minor	Minor	Watershed area (mi ²)	9 < 10
Permit Number	AR0020036	Regulation No. 2 Chronic Toxicity Criteria (Instream Concentration)	
Receiving Stream	Mill Creek	AML, mg/l	3.9
7Q10, cfs	0	April	3.9
0.25/0.67 multiplier	0.67	May - October	3.9
Qb, cfs	0.00	November - March	10.3
Qe, MGD	0.41		
Qe, cfs	0.63		
Cb, mg/l	0		

Allowable Effluent Conc., mg/l

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

Qe	Effluent Flow	Allowable Effluent Conc. (Ce), mg/l	
Ce	Allowable Effluent Concentration	$C_e = (IWC (Q_e + Q_b) - C_b \times Q_b) / Q_e$	
Qb	% of Low Flow of Receiving Stream	Monthly Avg., mg/l	Daily Max, mg/l
Cb	Background Concentration	April	3.9
IWC	Instream Waste Concentration Chronic Toxicity Criteria	May - October	3.9
		November - March	10.3

Chronic Toxicity Criteria vs. D.O. Model Limits

Month	Monthly Average, mg/l	D.O. limit	Permit Limits
April	Toxicity limit 3.9	D.O. limit 15	Daily Maximum, mg/l Toxicity limit 3.9
May - October	no fishery	3.9	no fishery
November - March	10.3	15	10.3
			D.O. limit 22.5
			5.9
			22.5
			Permit Limits 3.9
			5.9
			10.3

BVC

 * SIMPLIFIED METHOD PROGRAM *
 * COMPLETE INPUT LISTING *

20036-C, SMP

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

Name of receiving stream ----- Mill Creek
 Number of discharges ----- 1
 Number of reaches ----- 2
 Reaeration type ----- O'Connor-Dobbins
 Run title ----- Melbourne - Critical

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

Parameter	Value	Comment
Flow (cfs)	0.000	7Q10
Temperature (°C)	29.000	Reg. 2 Critical
Dissolved Oxygen (mg/l)	0.000	
5-Day BOD (mg/l)	0.000	
Ult. CBOD / 5-Day BOD	2.300	EPA Guidance
pH (su)	-0.000	
Ammonia (mg/l)	0.000	
Alkalinity (mg/l)	-0.000	

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

Number of Discharges = 1

For Discharge Number 1 (CityofMelbourne)

Parameter	Value	Comment
Flow (MGD)	0.410	DesignFlowRate
Temperature (°C)	29.000	Reg. 2 Critical
Dissolved Oxygen (mg/l)	6.000	Previous Permit
5-Day BOD (mg/l)	10.000	Previous Permit
Ult. CBOD / 5-Day BOD	2.300	EPA Guidance
pH (su)	-0.000	
Ammonia (mg/l)	3.900	Previous Permit
Alkalinity (mg/l)	-0.000	
Beginning of Reach Number	1.000	

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

Number of Reaches = 2
 Reaeration Type is O'Connor-Dobbins

For Reach Number 1

Parameter	Value	Comment
Length (mile)	0.800	Google Earth
Velocity (fps)	0.200	
Slope (ft/mile)	22.500	Google Earth
Average Depth (ft)	0.500	
Temperature (°C)	29.000	Calculated

BOD Removal Rate	(1/day)	0.400	Draft EPA MOA
NH3 Decay Rate	(1/day)	0.400	Draft EPA MOA
Sediment Oxygen Demand	(g/m ² /day)	1.350	k20 = 0.8
Photosynthesis/respiration	(mg/L/day)	-0.000	

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)	16.317
Temperature-corrected reaeration rate	(1/day)	20.218
Calculated reach-averaged width	(ft)	6.339

For Reach Number 2

Parameter	Value	Comment
Length (mile)	2.000	Google Earth
Velocity (fps)	0.200	
Slope (ft/mile)	22.500	Google Earth
Average Depth (ft)	0.500	
Temperature (°C)	29.000	Reg. 2 Critical
BOD Removal Rate (1/day)	0.400	Draft EPA MOA
NH3 Decay Rate (1/day)	0.400	Draft EPA MOA
Sediment Oxygen Demand (g/m ² /day)	0.840	k20 = 0.5
Photosynthesis/respiration (mg/L/day)	-0.000	

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)	16.317
Temperature-corrected reaeration rate	(1/day)	20.218
Calculated reach-averaged width	(ft)	6.339

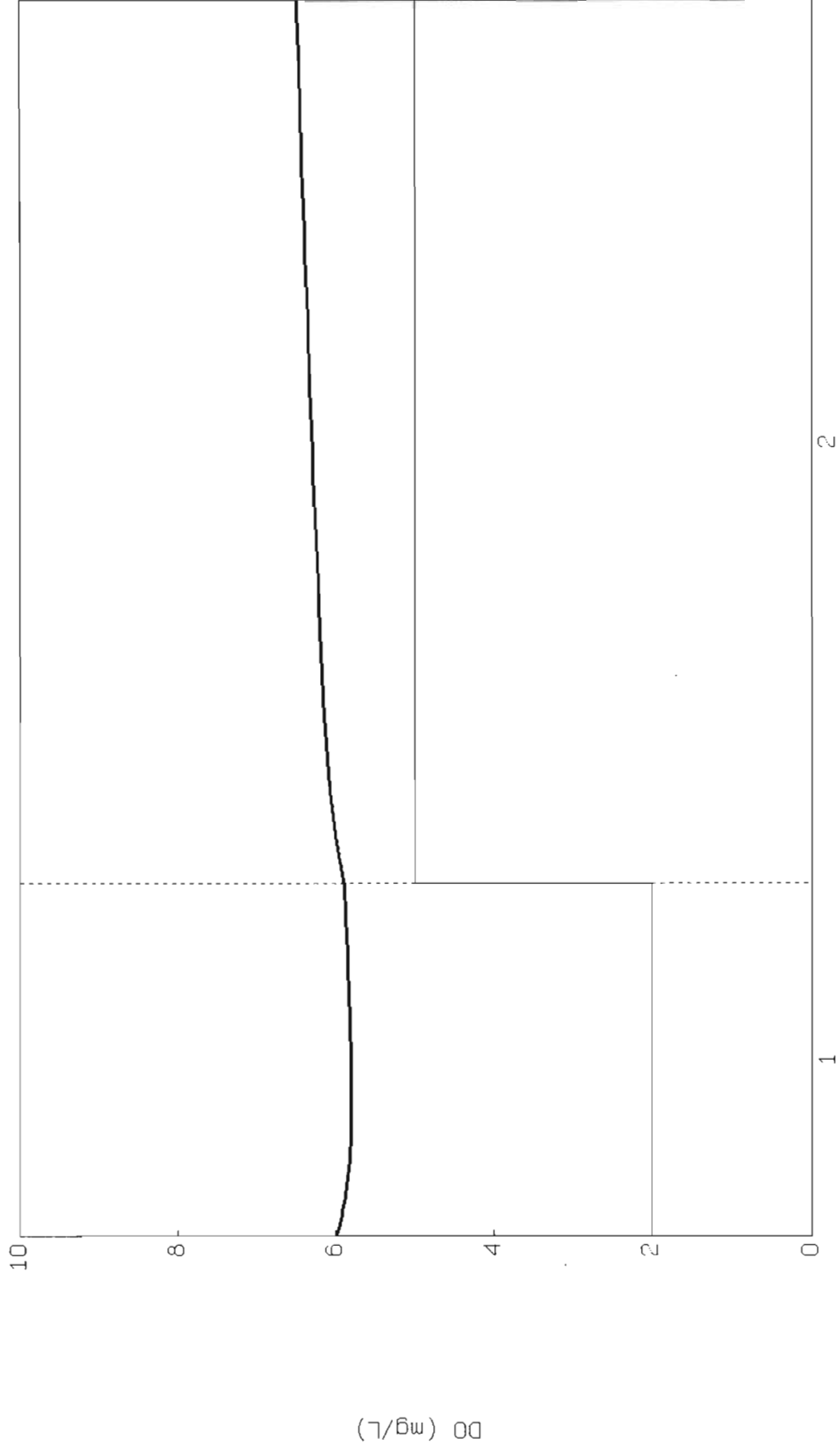
--*-*-* Results for Mill Creek *-*-*-*-*

Discharge is to -- Mill Creek
Run Title is -- Melbourne - Critical

River Mile	DO Predicted	DO Observed	BOD Predicted	BOD Observed	NH3 Predicted	NH3 Observed
2.800	6.000		23.000		3.900	
2.780	5.967		22.915		3.881	
2.760	5.938		22.831		3.862	
2.740	5.913		22.746		3.843	
2.720	5.892		22.662		3.825	
2.700	5.874		22.579		3.806	
2.680	5.859		22.496		3.787	
2.660	5.846		22.413		3.769	
2.640	5.835		22.330		3.750	
2.620	5.827		22.248		3.732	
2.600	5.820		22.165		3.714	
2.580	5.814		22.084		3.696	
2.560	5.810		22.002		3.678	
2.540	5.807		21.921		3.660	
2.520	5.805		21.840		3.642	
2.500	5.804		21.760		3.624	
2.480	5.803		21.679		3.607	
2.460	5.803		21.599		3.589	
2.440	5.804		21.520		3.572	
2.420	5.806		21.440		3.554	
2.400	5.808		21.361		3.537	
2.380	5.810		21.282		3.520	
2.360	5.813		21.204		3.502	

2.340	5.816	21.126	3.485
2.320	5.819	21.048	3.468
2.300	5.823	20.970	3.452
2.280	5.826	20.893	3.435
2.260	5.830	20.816	3.418
2.240	5.834	20.739	3.401
2.220	5.839	20.662	3.385
2.200	5.843	20.586	3.368
2.180	5.847	20.510	3.352
2.160	5.852	20.435	3.335
2.140	5.857	20.359	3.319
2.120	5.861	20.284	3.303
2.100	5.866	20.209	3.287
2.080	5.871	20.135	3.271
2.060	5.876	20.060	3.255
2.040	5.881	19.986	3.239
2.020	5.885	19.913	3.223
2.000	5.890	19.839	3.208
1.900	5.991	19.476	3.130
1.800	6.057	19.119	3.055
1.700	6.103	18.769	2.981
1.600	6.139	18.426	2.909
1.500	6.169	18.088	2.839
1.400	6.196	17.757	2.770
1.300	6.220	17.432	2.703
1.200	6.243	17.113	2.638
1.100	6.266	16.800	2.574
1.000	6.287	16.492	2.512
0.900	6.308	16.190	2.452
0.800	6.328	15.894	2.392
0.700	6.348	15.603	2.335
0.600	6.368	15.317	2.278
0.500	6.387	15.037	2.223
0.400	6.405	14.761	2.170
0.300	6.423	14.491	2.117
0.200	6.441	14.226	2.066
0.100	6.459	13.965	2.016
-0.000			
-0.000	6.476	13.710	1.968

Dissolved Oxygen Profile
Melbourne - Critical



Max unionized ammonia = 0.0000 mg/L

BVC

 * SIMPLIFIED METHOD PROGRAM *
 * COMPLETE INPUT LISTING *

20036_P_SMP

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

Name of receiving stream ----- Mill Creek
 Number of discharges ----- 1
 Number of reaches ----- 2
 Reaeration type ----- O'Connor-Dobbins
 Run title ----- Melbourne - Primary

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

Parameter	Value	Comment
Flow (cfs)	0.365	to = 1 cfs
Temperature (°C)	22.000	Reg. 2 Primary
Dissolved Oxygen (mg/l)	7.400	Assume 85% Sat.
5-Day BOD (mg/l)	1.000	Assumed
Ult. CBOD / 5-Day BOD	2.300	EPA Guidance
pH (su)	-0.000	
Ammonia (mg/l)	0.050	Assumed
Alkalinity (mg/l)	-0.000	

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

Number of Discharges = 1

For Discharge Number 1 (CityofMelbourne)

Parameter	Value	Comment
Flow (MGD)	0.410	DesignFlowRate
Temperature (°C)	22.000	Reg. 2 Primary
Dissolved Oxygen (mg/l)	6.000	Previous Permit
5-Day BOD (mg/l)	25.000	
Ult. CBOD / 5-Day BOD	2.300	EPA Guidance
pH (su)	-0.000	
Ammonia (mg/l)	15.000	
Alkalinity (mg/l)	-0.000	
Beginning of Reach Number	1.000	

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

Number of Reaches = 2
 Reaeration Type is O'Connor-Dobbins

For Reach Number 1

Parameter	Value	Comment
Length (mile)	0.800	Google Earth
Velocity (fps)	0.200	
Slope (ft/mile)	22.500	Google Earth
Average Depth (ft)	0.500	
Temperature (°C)	22.000	Calculated

BOD Removal Rate	(1/day)	0.400	Draft EPA MOA
NH3 Decay Rate	(1/day)	0.400	Draft EPA MOA
Sediment Oxygen Demand	(g/m ² /day)	0.900	k20 = 0.8
Photosynthesis/respiration	(mg/L/day)	-0.000	

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)	16.317
Temperature-corrected reaeration rate	(1/day)	17.113
Calculated reach-averaged width	(ft)	9.989

For Reach Number 2

Parameter	Value	Comment
Length (mile)	2.000	Google Earth
Velocity (fps)	0.200	
Slope (ft/mile)	22.500	Google Earth
Average Depth (ft)	0.500	
Temperature (°C)	22.000	Reg. 2 Primary
BOD Removal Rate (1/day)	0.400	Draft EPA MOA
NH3 Decay Rate (1/day)	0.400	Draft EPA MOA
Sediment Oxygen Demand (g/m ² /day)	0.560	k20 = 0.5
Photosynthesis/respiration (mg/L/day)	-0.000	

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)	16.317
Temperature-corrected reaeration rate	(1/day)	17.113
Calculated reach-averaged width	(ft)	9.989

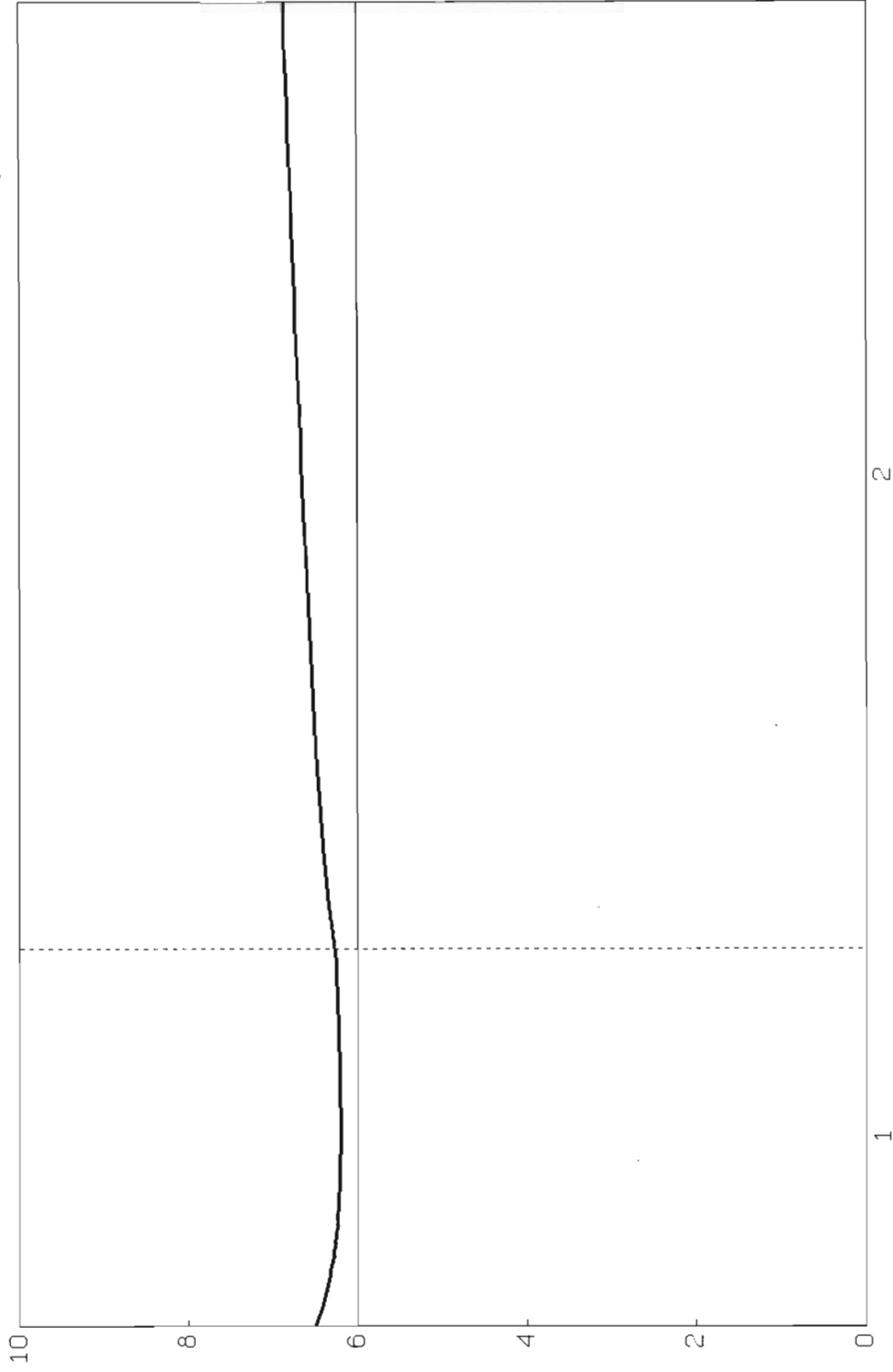
--*-*-* Results for Mill Creek *-*-*-*-*

Discharge is to -- Mill Creek
Run Title is -- Melbourne - Primary

River Mile	DO Predicted	DO Observed	BOD Predicted	BOD Observed	NH3 Predicted	NH3 Observed
2.800	6.512		37.329		9.537	
2.780	6.470		37.229		9.510	
2.760	6.432		37.129		9.483	
2.740	6.399		37.030		9.456	
2.720	6.370		36.931		9.429	
2.700	6.345		36.832		9.402	
2.680	6.322		36.734		9.375	
2.660	6.303		36.635		9.349	
2.640	6.285		36.537		9.322	
2.620	6.271		36.440		9.295	
2.600	6.258		36.342		9.269	
2.580	6.247		36.245		9.243	
2.560	6.238		36.148		9.216	
2.540	6.230		36.051		9.190	
2.520	6.223		35.955		9.164	
2.500	6.218		35.858		9.138	
2.480	6.214		35.762		9.112	
2.460	6.211		35.667		9.086	
2.440	6.208		35.571		9.060	
2.420	6.207		35.476		9.034	
2.400	6.206		35.381		9.008	
2.380	6.206		35.286		8.983	
2.360	6.206		35.192		8.957	

2.340	6.207	35.098	8.932
2.320	6.209	35.004	8.906
2.300	6.210	34.910	8.881
2.280	6.213	34.817	8.856
2.260	6.215	34.724	8.830
2.240	6.218	34.631	8.805
2.220	6.221	34.538	8.780
2.200	6.224	34.446	8.755
2.180	6.228	34.353	8.730
2.160	6.232	34.262	8.705
2.140	6.235	34.170	8.681
2.120	6.239	34.078	8.656
2.100	6.244	33.987	8.631
2.080	6.248	33.896	8.607
2.060	6.252	33.806	8.582
2.040	6.257	33.715	8.558
2.020	6.261	33.625	8.533
2.000	6.266	33.535	8.509
1.900	6.343	33.089	8.389
1.800	6.400	32.648	8.270
1.700	6.444	32.214	8.153
1.600	6.480	31.785	8.037
1.500	6.512	31.362	7.924
1.400	6.541	30.945	7.812
1.300	6.568	30.533	7.701
1.200	6.594	30.126	7.592
1.100	6.619	29.725	7.484
1.000	6.644	29.330	7.379
0.900	6.668	28.939	7.274
0.800	6.691	28.554	7.171
0.700	6.714	28.174	7.070
0.600	6.737	27.799	6.970
0.500	6.759	27.429	6.871
0.400	6.781	27.064	6.774
0.300	6.803	26.704	6.678
0.200	6.825	26.349	6.583
0.100	6.846	25.998	6.490
-0.000			
-0.000	6.867	25.652	6.398

Dissolved Oxygen Profile
Melbourne - Primary



DO (mg/L)

Reach

Max unionized ammonia = 0.0000 mg/L