Second Amendment to Exhibit F to Huntsville Petition

City of Huntsville, Arkansas Section 2.306 Site Specific Water Quality Study: Town Branch, Holman Creek, and War Eagle Creek ("the Study")

Revised pages 4,64,66,67,69,70 and 75 attached –revised language is underlined attached as well are letters received from the Arkansas Natural Resources Commission and from the Arkansas Department of Health, neither of which identify an existing domestic water supply use on the reaches of Town Branch or Holman Creek that are at issue in this Rulemaking

2.0 SIGNIFICANT FINDINGS AND RECOMMENDATIONS

2.1 Recommendations

The following recommendations are based on the information developed during this study of the Town Branch, Holman Creek and War Eagle Creek.

1. Criteria for the Town Branch, Holman Creek and War Eagle Creek should be amended as follows:

Town Branch from Point of Discharge of the City of Huntsville WWTP downstream to the confluence with Holman Creek.			**Holman Creek from the confluence with Town Branch downstream to the confluence with War Eagle Creek.**			**War Eagle Creek from the confluence with Holman Creek to Clifty Creek.**			**War Eagle Creek downstream from the confluence with Clifty Creek to Beaver Lake.**		
Site Specific Criteria Proposed			**Site Specific Criteria Proposed**			**Site Specific Criteria Proposed**					
Chloride (mg/L)	TDS (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	TDS (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	TDS (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	TDS (mg/L)	Sulfate (mg/L)
185	525	41	185	525	41	~~185~~ 130	~~525~~ 407	~~41~~ 30	97	337	24

2. It should be specified that a critical background flow of 4.0 cfs be applied by listing Town Branch, and Holman Creek ~~and War Eagle Creek~~ (with asterisks) in Reg. 2.511. The 4.0 cfs critical background flow was selected for each creek since they are both small watershed streams and un-gauged.
3. The critical background flow of 7.2 cfs (the 7Q10 for War Eagle at the Holman Creek confluence) was used in the development of the Site Specific Criteria (SSC) for War Eagle Creek. War Eagle Creek is a larger watershed stream and is gauged; therefore 7Q10 was selected as the critical background flow. At such time as Regulation 2 is amended to implement Act 954 of 2013, the proposed SSC could revert back to the present Ecoregion values.
4. Removal of the Domestic Water Supply use is requested for Town Branch beginning at Latitude 36.112330°, Longitude -93.732833° and extending downstream to its confluence with Holman Creek at Latitude 36.118158°, Longitude -93.736039°; and for Holman Creek beginning at its confluence with Town Branch at Latitude 36.118158°, Longitude -93.736039° and extending downstream to its confluence with War Eagle Creek at Latitude 36.140824°, Longitude -93.729594°.

Qb = The background flow of the receiving stream (4.0 cfs, 7.2 cfs, or 10.9 cfs)

Cb = The background concentration of chloride, sulfate or TDS in the receiving stream (ecoregion background values)

Qe = The discharge (design) flow of the City of Huntsville WWTF

Ce = The effluent concentrations of chloride, sulfate or TDS from the City of Huntsville WWTF (estimated 95th percentile from data obtained during this study and from DMR data)

7.2.1 Methods

The procedure for evaluating instream concentrations and developing permit limits for dissolved minerals can be found in *ADEQ Discharge Permit, Toxic Control Implementation Procedure* in Arkansas' 1995 Continuing Planning Process (CPP). The values used for the background concentration are chloride (6 mg/L), sulfate (6 mg/L) and TDS (143 mg/L) in accordance with the CPP in Appendix D, *Mineral Implementation Policy*, for streams in the Ozark Highlands with a 7Q10 flow rate of less than 100 cfs. A background flow of 4 cfs was used ~~in each stream~~ for Town Branch and Holman Creek calculations, as allowed for determining instream mineral concentrations in the WQS. As stated in Appendix D of the referenced CPP, the critical flow of 4.0 cfs "provides for maintenance of the ecoregion mineral standard in all perennial fishery streams 50 percent of the time or more." The background flow for each calculation (for ~~all three streams~~ Town Branch and Holman Creek) was 4 cfs, i.e., the flows were not added together, so 4.0 cfs rather than ~~12~~ 8 cfs upstream flow was used for the Holman Creek calculations. Use of 4.0 cfs is also consistent with the Reg 2 definition of critical flow as used for minerals criteria implementation. For War Eagle Creek the 7Q10 flow at different points in the stream was used; both to compare projected instream concentrations of minerals with the domestic water supply use criteria (see Section 7.3.2), and to derive recommended Site Specific Criteria. The City of Huntsville WWTF Outfall 001 effluent concentrations for chloride, TDS, and sulfate were derived from DMR data collected by City personnel during the study period and data collected during the monthly field sampling trips conducted during the period (7/6/2011 through 6/27/2012). The effluent data from the City of Huntsville WWTF were checked for normality, transformed if needed and 95th and 99th percentile values for chloride TDS, and sulfate calculated. Procedures used in the effluent data percentile calculation process are provided in Appendix C. The resulting percentile values are provided in Table 7.1.

7.2.3 Calculations for Holman Creek

The calculations used to determine the SSC for Holman Creek, below the confluence with Town Branch are as follows:

$SSC_{chloride}$=
[(4 cfs x 6 mg/L) + (3.1 cfs x 416 mg/L) /(4 cfs + 3.1 cfs)] = 185 mg/L

SSC_{TDS}=
[(4 cfs x 143 mg/L) + (3.1 cfs x 1019 mg/L) /(4 cfs + 3.1 cfs)] = 525 mg/L

$SSC_{sulfate}$=
[(4 cfs x 6 mg/L) + (3.1 cfs x 87 mg/L) /(4 cfs + 3.1 cfs)] = 41 mg/L

Values used in the calculation process for the determination of the site specific criteria for Holman Creek were as shown in Table 7.3.

Table 7.3. Calculation values, and the recommended site specific criteria for Holman Creek.

Parameters	Chloride	TDS	Sulfate
Qb, cfs	4.0	4.0	4.0
Cb, mg/L	6.0	143.0	6.0
Qe, cfs	3.1	3.1	3.1
Ce, mg/L	416	1019	87
Site Specific Criteria (mg/L)	185	525	41

7.2.4 Calculations for War Eagle Creek

The calculations used to determine the site specific criteria for War Eagle Creek were calculated in two locations (from Holman Creek to Clifty Creek and from Clifty Creek to Beaver Lake) are as follows:

Holman Creek to Clifty Creek (7Q10 = 7.2 cfs)

$SSC_{chloride}$=
[(~~4 cfs~~ 7.2 cfs x 6 mg/L) + (3.1 cfs x 416 mg/L) / (~~4 cfs~~ 7.2 cfs + 3.1 cfs)] = ~~185~~ 130 mg/L

SSC_{TDS}=
[(~~4 cfs~~ 7.2 cfs x 143 mg/L) + (3.1 cfs x 1019 mg/L) / (~~4 cfs~~ 7.2 cfs + 3.1 cfs)] = ~~525~~ 407 mg/L

$SSC_{sulfate}$=
[(~~4 cfs~~ 7.2 cfs x 6 mg/L) + (3.1 cfs x 87 mg/L) / (~~4 cfs~~ 7.2 cfs + 3.1 cfs)] = ~~41~~ 30 mg/L

Clifty Creek to Beaver Lake (7Q10 = 10.9 cfs)

$SSC_{chloride}$=
[(10.9 cfs x 6 mg/L) + (3.1 cfs x 416 mg/L) / (10.9 cfs + 3.1 cfs)] = 97 mg/L

SSC_{TDS}=
[(10.9 cfs x 143 mg/L) + (3.1 cfs x 1019 mg/L) / (10.9 cfs + 3.1 cfs)] = 337 mg/L

$SSC_{sulfate}$=
[(10.9 cfs x 6 mg/L) + (3.1 cfs x 87 mg/L) / (10.9 cfs + 3.1 cfs)] = 24 mg/L

Values used in the calculation process for the determination of the site specific criteria for War Eagle Creek were as shown in Table 7.4.

Table 7.4. Calculation values, and the recommended site specific criteria for War Eagle Creek.

Parameters	Chloride	TDS	Sulfate
Qb, cfs	~~4.0~~ 7.2, 10.9	~~4.0~~ 7.2, 10.9	~~4.0~~ 7.2, 10.9
Cb, mg/L	6.0	143.0	6.0
Qe, cfs	3.1	3.1	3.1
Ce, mg/L	416	1019	87
Site Specific Criteria (mg/L)	~~185~~ 130, 97	~~525~~ 407, 337	~~41~~ 30, 24

The site specific criteria determined through the calculation process were then compared with the existing criteria. Table 7.5 provides this comparison.

Table 7.5. Comparison of proposed site specific criteria amendments and existing criteria for each stream.

Town Branch from Point of Discharge of Huntsville WWTP downstream to the confluence with Holman Creek			Holman Creek from the confluence with Town Branch downstream to the confluence with War Eagle Creek			War Eagle Creek from the confluence with Holman Creek to the confluence with Clifty Creek			War Eagle Creek downstream from the confluence with Clifty Creek to Beaver Lake.		
Site Specific Criteria Proposed			Site Specific Criteria Proposed			Site Specific Criteria Proposed			Site Specific Criteria Proposed		
Chloride (mg/L)	TDS (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	TDS (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	TDS (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	TDS (mg/L)	Sulfate (mg/L)
185	525	41	185	525	41	~~185~~ 130	~~525~~ 407	~~41~~ 30	97	337	24
Calculated Ecoregion Reference Stream Values											
Chloride (mg/L)	TDS (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	TDS (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	TDS (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	TDS (mg/L)	Sulfate (mg/L)
17.3	250	22.7	17.3	250	22.7	17.3	250	22.7	17.3	250	22.7

the SSC would meet the Domestic Water Supply Use criteria of 250 mg/L chloride, 500 mg/L TDS, and 250 mg/L sulfate in War Eagle Creek at Hindsville, where the gauge is located. The mass balance calculations are as follows:

Chloride =
[(9.5 cfs x 6 mg/L) + (3.1 cfs x 416 mg/L) /(9.5 cfs + 3.1 cfs)] = 107 mg/L < 250 mg/L

TDS =
[(9.5 cfs x 143 mg/L) + (3.1 cfs x 1019 mg/L) /(9.5 cfs + 3.1 cfs)] = 359 mg/L < 500 mg/L

Sulfate =
[(9.5 cfs x 6 mg/L) + (3.1 cfs x 87 mg/L) /(9.5 cfs + 3.1 cfs)] = 26 mg/L < 250 mg/L

The resulting instream concentration of minerals, at the proposed levels, result in values considerably less than the Domestic Water Supply criteria. Therefore, it is not necessary to remove any drinking water uses from War Eagle Creek downstream of Hindsville. To evaluate the section of War Eagle Creek between Hindsville and the confluence with Holman Creek, flow in War Eagle Creek at the confluence of Holman Creek was estimated using a watershed size based methodology. The watershed size of War Eagle Creek at Hindsville is 263 mi2 and it has a 7Q10 of 9.5 cfs at that location. The 9.5 cfs equates to 0.036 cfs/square mile of watershed area. The watershed area of War Eagle Creek at the confluence of Holman Creek is 200 mi2 which equates to a 7Q10 flow of 7.2 cfs (200 mi2*0.036 cfs). An additional reach of War Eagle Creek was evaluated to determine if reduced site specific criteria were appropriate for application further downstream. This was accomplished by calculating watershed size of War Eagle Creek at its confluence with Clifty Creek, which is a sizable tributary approximately 5.8 miles downstream from the Hindsville Gauge. The watershed size at that point is 302 mi2, therefore the 7Q10 just downstream of the War Eagle and Clifty Creek confluence is 10.9 cfs (302 mi2*0.036 cfs). The mass balance calculations using ~~this~~ these 7Q10 flows are as follows:

Holman Creek to Clifty Creek

Chloride =
[(7.2 cfs x 6 mg/L) + (3.1 cfs x 416 mg/L) / (7.2 cfs + 3.1 cfs)] = 130 mg/L < 250 mg/L

TDS =
[(7.2 cfs x 143 mg/L) + (3.1 cfs x 1019 mg/L) / (7.2 cfs + 3.1 cfs)] = 407 mg/L < 500 mg/L

Sulfate =
[(7.2 cfs x 6 mg/L) + (3.1 cfs x 87 mg/L) / (7.2 cfs + 3.1 cfs)] = 30 mg/L < 250 mg/L

Clifty Creek to Beaver Lake

Chloride=
[(10.9 cfs x 6 mg/L) + (3.1 cfs x 416 mg/L) / (10.9 cfs + 3.1 cfs)] = 97 mg/L < 250 mg/L

TDS =
[(10.9 cfs x 143 mg/L) + (3.1 cfs x 1019 mg/L) / (10.9 cfs + 3.1 cfs)] = 337 mg/L < 500 mg/L

Sulfate =
[(10.9 cfs x 6 mg/L) + (3.1 cfs x 87 mg/L) / (10.9 cfs + 3.1 cfs)] = 24 mg/L < 250 mg/L

The resulting instream concentration of minerals, at the proposed levels, result in values less than the Domestic Water Supply Use criteria. Therefore, it is not necessary to remove the Domestic Water Supply Use from any section of War Eagle Creek in the study area.

8.0 ALTERNATIVE ANALYSES

This section summarizes the analyses of alternatives for the Huntsville WWTF to meet projected water quality based effluent projected limitations for chloride, sulfate, and TDS. Current discharge concentrations of chloride, TDS and sulfate would not be anticipated to maintain the projected water quality based effluent limits that would likely be assigned during the next permit renewal. In addition to examining the development of site specific criteria, alternatives to amending the water quality criteria were considered.

The primary source of dissolved minerals discharged from the WWTP is from an industrial discharger to the system, the Butterball LLC turkey processing facility. Butterball owns and operates a turkey processing facility in the City of Huntsville, located at 1294 N. College Street. Effluent from the Butterball facility makes up approximately 80% of the total volume of wastewater received by and treated at the City's WWTF. Butterball contributes the majority of the chloride and TDS loads that are ultimately discharged by the WWTF. However, the recent increase in sulfate levels discharged by the Huntsville WWTF is believed to be the result of aluminum sulfate additions by the WWTF which have recently been implemented to meet new (June 2011) discharge limits for total phosphorus.

Alternatives were examined to determine if the projected water quality based permit limits for chloride, TDS and sulfate could be met by the City of Huntsville without amending the water quality criteria. These alternatives were as follows:

1) no action,
2) no discharge, or removal of the industrial source,
3) treatment,

10.0 SELECTED ALTERNATIVE

Based on the facility biomonitoring record, the results of the aquatic life field study, the mass balance modeling, toxicity modeling, the USGS modeling effort, and the assessment of alternatives presented previously, the selected alternative is to modify the WQS using site specific criteria for chloride, TDS and sulfate as presented in the Table 10.1.

Table 10.1. Site Specific Criteria Recommendations.

Town Branch from Point of Discharge of the City of Huntsville WWTP downstream to the confluence with Holman Creek.			**Holman Creek from the confluence with Town Branch downstream to the confluence with War Eagle Creek.**			**War Eagle Creek from the confluence with Holman Creek to the confluence with Clifty Creek.**			**War Eagle Creek downstream from the confluence with Clifty Creek to Beaver Lake.**		
Site Specific Criteria Proposed			**Site Specific Criteria Proposed**			**Site Specific Criteria Proposed***			**Site Specific Criteria Proposed***		
Chloride (mg/L)	TDS (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	TDS (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	TDS (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	TDS (mg/L)	Sulfate (mg/L)
185	525	41	185	525	41	~~185~~ 130	~~525~~ 407	~~41~~ 30	97	337	24

**It should be noted that at such time as Act 954 of 2013 has been implemented, using average flow, the proposed Site Specific Criteria for War Eagle Creek may revert back to the present Ecoregion values. The average flow of War Eagle Creek from the most current, uninterrupted data set (Oct 1998- current) is 310.7 cfs, or 1.181 cfs/mi^2. When adjusted for watershed size, the average flow of War Eagle Creek at the confluence with Holman Creek is 236.3 cfs. The discharge concentration of minerals will be below the Ecoregion values at average flow in War Eagle Creek as shown below:*

Chloride =
[(236 cfs x 6 mg/L)] + (3.1 cfs x 416 mg/L) / (236 cfs + 3.1 cfs)] = 11.3 mg/L (<17.3 mg/L)

TDS=
[(236 cfs x 143 mg/L)] + (3.1 cfs x 1019 mg/L) / (236 cfs + 3.1 cfs)] = 154.4 mg/L (<250 mg/L)

Sulfate=
[(236 cfs x 6 mg/L)] + (3.1 cfs x 87 mg/L) / (236 cfs + 3.1 cfs)] = 7.1 mg/L (<22.7 mg/L)