EXHIBIT E

CROOKED CREEK USE ATTAINABILITY ANALYSIS – HARRISON AND YELLEVILLE, ARKANSAS



USE ATTAINABILITY ANALYSIS REPORT CROOKED CREEK BOONE AND MARION COUNTIES, ARKANSAS

REVISED JUNE 8, 2015

USE ATTAINABILITY ANALYSIS REPORT CROOKED CREEK BOONE AND MARION COUNTIES, ARKANSAS

Prepared for

City of Harrison PO Box 1715 Harrison, AR 72601

and

City of Yellville PO Box 647 Yellville, AR 72687

Prepared by

FTN Associates, Ltd.
3 Innwood Circle; Suite 220
Little Rock, AR 72211

FTN No. R04315-0002-001

REVISED June 8, 2015

EXECUTIVE SUMMARY AND CONCLUSIONS

ES.1 Summary

The City of Harrison, Arkansas, discharges treated wastewater to Crooked Creek under authority of its National Pollutant Discharge Elimination System (NPDES) permit for the Harrison Waste Water Treatment Plant (HWWTP). The HWWTP discharge enters Crooked Creek approximately 73.4 miles upstream of its confluence with the White River. This permit was scheduled for renewal in October 2012. The Arkansas Department of Environmental Quality (ADEQ) is considering future permit limits for dissolved minerals (total dissolved solids [TDS], sulfate, and chloride) in Harrison's permit when it is renewed. A segment of Crooked Creek upstream and downstream of the HWWTP (reach 11010003-049) was listed as impaired for TDS, chloride, and sulfate on the Arkansas 2008 303(d) list (which is the latest EPA-approved list) due to unknown sources. The Arkansas draft 2012 303(d) list also lists the suspected sources of the TDS, chloride, and sulfate impairments as unknown.

Under the authority of its NPDES permit, the City of Yellville, Arkansas, discharges treated wastewater from its WWTP (YWWTP) to Crooked Creek approximately 22.5 miles upstream of its confluence with the White River. The NPDES permit (No. AR0034037) is scheduled for renewal in March 2015. A segment of Crooked Creek downstream of the HWWTP and upstream and downstream of the YWWTP discharge (stream segment 11010003-048) was listed as impaired for TDS, chloride, and sulfate on the Arkansas 2008 303(d) list due to unknown sources. The Arkansas draft 2012 303(d) list also list the suspected sources of the TDS, chloride, and sulfate impairments as unknown.

An analysis of discharge TDS, sulfate, and chloride concentrations for HWWTP and YWWTP revealed that both discharges meet current sulfate and chloride criteria for Crooked Creek (20 mg/L for both sulfate and chloride); however, neither discharge meets the current TDS criterion of 200 mg/L. However, further analysis showed that if permit limits for either city were set to instream criteria for sulfate or chloride due to the impairment listings, neither city would consistently meet such limits. Accordingly, Harrison and Yellville undertook a use attainability analysis (UAA) to evaluate alternatives for meeting anticipated permit limits for minerals.

ES.2 Alternative Evaluations

UAA guidance requires that a technical and economic evaluation be made of possible alternatives to direct discharge of the water. Based on a number of similar evaluations in previous UAAs, the alternatives for management of effluents with elevated dissolved minerals are limited. Three alternatives that have been reviewed for similar applications include:

(1) reverse osmosis (RO) treatment of the wastewater, (2) pumping the wastewater to a larger stream that holds the potential for dilution of the minerals, and (3) treatment using a constructed wetland. FTN completed the alternatives evaluation based on previous experience, information from published literature, and from data provided by the city.

Treatment using a constructed wetlands was dismissed for both facilities due the fact that constructed wetlands could only be used to reduce sulfate in the discharges, but not TDS or chloride. A reduction in sulfate would result in the production of bicarbonate in place of sulfate (Hedin et al. 1989), resulting in no net reduction in TDS. In addition, wetland treatment would have no effect on TDS as calcium, sodium, bicarbonate, or chloride (Hedin et al. 1989), which comprise, on average, 54% of the HWWTP discharge TDS (see Section 4.3). Similarly, calcium, sodium, bicarbonate, and chloride comprise an average of 79% of the TDS of the YWWTP discharge and would be virtually unaffected by wetland treatment.

The remaining analysis focused (1) RO treatment to remove or reduce dissolved minerals; and (2) pumping the wastewater to a larger stream that holds the potential for dilution of the minerals. Tables ES.1 and ES.2 provide cost estimates for the direct discharge option and the two alternative options for the HWWTP and YWWTP, respectively.

Table ES.1. Summary of capital, operating, and implementation costs for various options to attain compliance with permit limits for the Harrison WWTP.

Option Description	Estimated Capital Cost	Estimated Annual Operating Cost	Implementation Cost
Discharge to Crooked Creek			\$150,000
RO Treatment	\$5,600,000	\$5,950,000	
Pipeline to White River	\$24,000,000	\$150,000	

Table ES.2. Summary of capital, operating, and implementation costs for various options to attain compliance with permit limits for the Yellville WWTP.

Option Description	Estimated Capital Cost	Estimated Annual Operating Cost	Implementation Cost
Discharge to Crooked Creek			\$150,000
RO Treatment	\$2,250,000	\$375,000	
Pipeline to White River	\$3,400,000	\$100,000	

The capital costs and annual operating costs associated with both alternative options are prohibitively expensive, indicating that the most cost-effective option for the HWWTP and YWWTP discharges is direct discharge. Implementing this option, however, will require modified water quality standards for TDS, sulfate, and chloride in Crooked Creek. Section 8.0 provides more information with regard to the alternatives analysis.

ES.3 Use Analysis

The use attainability analysis indicated that the existing mineral regime is supporting the primary contact recreation, secondary contact recreation, drinking water supply, industrial water supply, and agricultural water supply designated uses. With regard to the fisheries (aquatic life) use, the results of the analysis of biological communities can be summarized as follows:

- 1. Both outfalls have a minor impact on downstream TDS, sulfate, and chloride concentrations;
- 2. Habitat evaluations indicated very similar habitat upstream and downstream of the YWWTP. Discharge data collected in the immediate vicinity of the macroinvertebrate sampling locations also show similar depths and velocities upstream and downstream. Based on the habitat evaluations, Wolman pebble counts, and flow transect data, it was concluded that habitat is not a likely cause of the observed impairment of the downstream macroinvertebrate assemblage compared to the upstream assemblage and to least-disturbed ecoregion reference conditions;
- There is no discernible adverse impact on fish communities in Crooked Creek due to the presence of the HWWTP. Because the impact of the YWWTP on downstream water quality is similar to that of the HWWTP, it is likely that the YWWTP water quality has a similarly negligible adverse impact on the downstream fish communities;

- 4. Spring samples upstream versus downstream of the discharges show no significant impairment to moderate impairment of the benthic community in the downstream reaches (see Table 7.7). However, the magnitude and timing of the TDS, sulfate, and chloride increases downstream of the discharges are not commensurate with the downstream changes in the benthic macroinvertebrate communities:
- 5. A total of five independent biological samples (two macrobenthic samples with two duplicates, and one fish sample) were collected in the upstream and downstream reaches of the HWWTP. Three of the five (two macrobenthic and the fish sample) showed no impairment, and the remaining two showed slight downstream impairment. These results are consistent with similar habitat characteristics in the upstream and downstream reaches. For example, percent algal cover, which would be expected to respond to differences in water quality due to the discharges, did not change from upstream to downstream. Therefore, the HWWTP has only minimal effects on the biology in the downstream reach; and
- 6. TDS concentrations exceed the Crooked Creek site-specific criterion at all locations, including those upstream of the HWWTP and YWWTP discharges. Based on data collected during the study, sulfate and chloride values rarely exceeded the Crooked Creek criteria. Benthic macroinvertebrate communities show moderate to slight impairment when compared to communities in least-disturbed streams. TDS concentrations in the least-disturbed streams considered in this study were similar or higher and also exceeded the Crooked Creek site-specific criterion. Therefore, the existing minerals concentrations in Crooked Creek, including those due to input from the HWWTP and YWWTP, can be expected to support Ozark Highland ecoregion least-disturbed benthic macroinvertebrate communities.

These findings demonstrate conclusively that the modest increases in TDS, sulfate, and chloride concentrations downstream of the HWWTP and YWWTP outfalls do not cause adverse impacts to aquatic life, and also demonstrate that the existing TDS concentrations in the Crooked Creek reaches upstream and downstream of the HWWTP and YWWTP do not limit benthic macroinvertebrate communities and can be expected to support the Ozark Highland fisheries designated use.

ES.4 Proposed Criteria

Proposed criteria are based on existing mineral conditions in Crooked Creek. Existing conditions were based on available monitoring data from ADEQ ambient monitoring of Crooked Creek. Because the 2008 Arkansas 303(d) list is the latest EPA-approved list (which evaluated data from the 2002 to 2007 date range), data from the past 10 years were examined for each of the ADEQ monitoring stations shown on Figure ES.1. Appendix G provides the ADEQ historical monitoring data for those monitoring stations. Ninety-fifth percentile values for each of the ADEQ monitoring stations are provided in Table ES.3.

Table ES.3. Ninety-fifth percentile values of ADEQ historical monitoring data for dissolved minerals in Crooked Creek.

	95	th Percentile V	alues at ADE	Q Monitorin	g Station (mg	/L)
Parameter		WHI0067	WHI0066	WHI0048A/ WHI0193 ^(a)		WHI0048C
TDS	226	233	269	226	221	238
Sulfate	11.6	9.4	24.4	9.4	7.6	10.2
Chloride	8.3	11.3	22.6	10.7	7.6	7.9
	11/28/2011 07/30/2013 ^(c)					12/09/2003 06/04/2013 ^(d)

Notes:

⁽a) ADEQ discontinued monitoring at WHI0048A and moved the sampling point upstream from Yellville to WHI0193.

⁽b) Date range queried was from August 1, 2003, to July 31, 2013, on ADEQ surface water quality monitoring data search page (http://www.adeq.state.ar.us/techsvs/water_quality/water_quality_station.asp, accessed August 20, 2013).

⁽c) Represents the full period of record for this station.

⁽d) Actual date range of data obtained from the search query for this station.

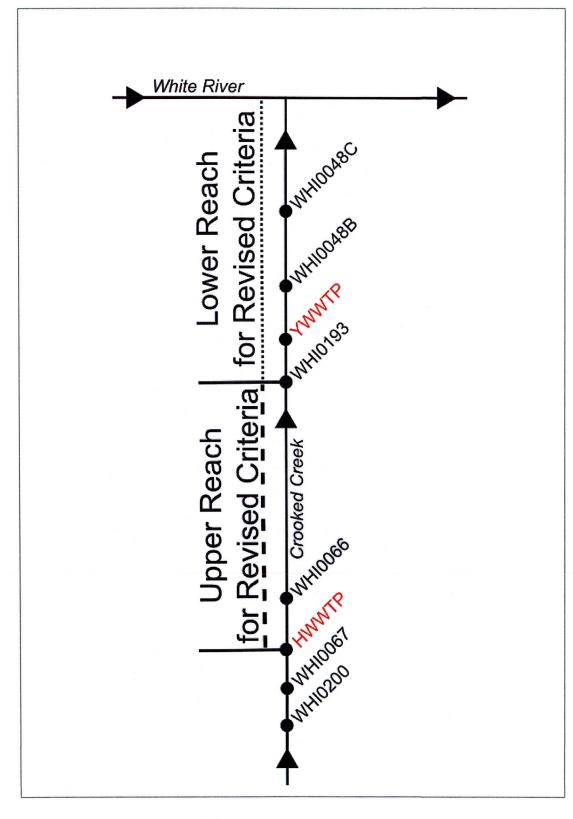


Figure ES.1. Schematic diagram of outfalls, ADEQ monitoring stations, and upper and lower reaches for revised criteria.

The proposed revised site-specific criteria (Table ES.4) are based on the values in Table ES.3 as described below for the following two reaches of Crooked Creek:

- 1. Upper Reach (Figure ES.1): From the HWWTP to ADEQ monitoring station WHI0193. The proposed revised TDS, sulfate, and chloride criteria for this reach (Table ES.4) are the highest of the 95th percentile values from stations WHI0066 and WHI0193 (Table ES.3).
- 2. Lower Reach (Figure ES.1): From ADEQ monitoring station WHI0193 to the mouth of Crooked Creek at the White River. The proposed revised TDS criterion for this reach (Table ES.4) is the highest of the 95th percentile values from stations WHI0048B and WHI0048C (Table ES.3). There are no proposed changes to the sulfate and chloride criteria in the lower reach.

Table ES.4. Proposed criteria for dissolved minerals in Crooked Creek.

	Exis	sting Crite	ria	Pro	posed Crite	ria
Stream Reach	Chloride (mg/L)	Sulfate (mg/L)	TDS (mg/L)	Chloride (mg/L)	Sulfate (mg/L)	TDS (mg/L)
Upstream reach (from HWWTP to WHI0193)	20	20	200	22.6	24.4	269
Downstream reach (from WHI0193 to mouth of Crooked Creek)	20	20	200	No change	No change	238

TABLE OF CONTENTS

EXEC	UTIVE	E SUMMARY AND CONCLUSIONS	i
	ES.1	Summary	i
	ES.2	Alternative Evaluations	ii
	ES.3	Use Analysis	iii
	ES.4	Proposed Criteria	v
1.0	INTR	ODUCTION	1-1
	1.1	Background	1-1
	1.2	UAA Objectives	1-3
	1.3	UAA Approach	1-3
	1.4	Facility Process Description	1-5
2.0	SAM	PLING STATIONS	2-1
	2.1	Field Surveys	2-1
	2.2	Routine Biweekly Sampling	2-1
3.0		ICABLE ARKANSAS WATER QUALITY STANDARDS EC REGULATION NO. 2)	3-1
4.0		HARGE AND RECEIVING STREAM WATER QUALITY RACTERISTICS	4-1
	4.1	Water Quality and Flow Sampling	4-1
		4.1.1 Water Quality and Flow Sampling During Aquatic Life Surveys	4-1
		4.1.2 Biweekly Sampling	4-2
	4.2	Water Quality and Flow Measurement Results and Discussion	4-2
	4.3	Ionic Composition of Effluents and Receiving Streams	4-8
	4.4	Discharge and Receiving Stream Water Quality Characteristics Conclusions	4-11
5.0	TOX	CITY EVALUATION	5-1
	5.1	Literature-Based Evaluation	5-1
	5.2	Effluent Testing	5-2
	5.3	Toxicity Evaluation Conclusions	5-5

TABLE OF CONTENTS (CONTINUED)

6.0	ATTA	INABL	E USES	6-1
	6.1	Primar	ry and Secondary Contact Recreation	6-1
	6.2	Domes	stic Water Supply	6-1
	6.3	Indust	rial Water Supply	6-1
	6.4	Agricu	ıltural Water Supply: Crops	6-1
	6.5	Agricu	ıltural Water Supply: Livestock	6-3
	6.6	Aquati	ic Life	6-3
7.0	AQUA	ATIC LI	FE ATTAINMENT EVALUATION	7-1
	7.1	Habita	t Evaluation	7-3
		7.1.1	Habitat Characteristics: Results and Discussion	7-4
		7.1.2	Habitat Characteristics: Conclusions	7-10
	7.2	Biolog	gical Community Survey Methodology	7-10
		7.2.1	Benthic Macroinvertebrate Field and Laboratory Methods	7-10
		7.2.2	Benthic Macroinvertebrate Data Analysis	7-11
		7.2.3	Fish Sampling Methods	7-12
	7.3	Biolog	gical Characteristics Results and Discussion	7-13
		7.3.1	Benthic Macroinvertebrates	7 - 13
		7.3.2	Fish	7-16
	7.4	Additi	onal Factors Potentially Affecting Use Attainability	7-18
		7.4.1	Timeliness of Sampling Efforts	7-18
		7.4.2	Other Water Quality Variables	7-19
	7.5	Aquat	ic Life Use Attainability	7-19
8.0	EVAL	UATIC	ON OF ALTERNATIVES	8-1
	8.1	TDS T	Treatment Through Reverse Osmosis	8-2
		8.1.1	Technical Considerations	8-2
		8.1.2	Concentrate Disposal Options	8-3
		8.1.3	Economic Considerations for the Harrison WWTP	8-4
		8.1.4	Economic Considerations for the Yellville WWTP	8-6
	8.2	Pipelii	ne	8-7

\mathbf{AP}	PE	ND	IX	A
---------------	----	----	----	---

Site Photographs from Fall 2012 and Spring 2013 Aquatic Life Field Survey

Appendix A: Site Photographs from Fall and Spring Sampling



Photo A.1. CC-0 on September 19, 2012.



Photo A.2. CC-0 on April 2, 2013.

Appendix A: Site Photographs from Fall and Spring Sampling



Photo A.3. HWWTP Outfall 001 on September 20, 2012.



Photo A.4. HWWTP Outfall 001 on April 2, 2013.

Appendix A: Site Photographs from Fall and Spring Sampling



Photo A.5. CC-1 on September 19, 2012.



Photo A.6. CC-1 on April 2, 2013.

Appendix A: Site Photographs from Fall and Spring Sampling



Photo A.7. CC-2 on September 19, 2012.



Photo A.8. CC-2 on April 3, 2013.

Appendix A: Site Photographs from Fall and Spring Sampling



Photo A.9. YWWTP Outfall 001 on September 19, 2012.



Photo A.10. YWWTP Outfall 001 on April 3, 2013.

Appendix A: Site Photographs from Fall and Spring Sampling



Photo A.11. CC-3 on April 3, 2013.

APPENDIX B

Biweekly Sampling Data

Appendix B Biweekly Sampling Data

Table B.1. Biweekly sampling results from Highway 65 bridge (upstream of HWWTP).

	Alkalinity									Hardness
	(as CaCO ₃)	LDS	Chloride	Sulfate	Bicarbonate	Total Ca	Total Mg	Total Na	Total K	(as CaCO ₃)
Sampling Date	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
5/10/2012	177	266	7.44	4.41	106.00	71.6	1.76	3.41	1.24	179
5/21/2012		207	6.45	3.97						
6/5/2012		242	6.52	3.95						
6/21/2012		250	6.54	4.08						
7/5/2012		232	7.07	4.43						
7/17/2012	160	244	6.45	4.08	26	67.2	1.84	3.14	1.36	168
7/31/2012		213	6.82	4.62						
8/16/2012		197	7.55	4.74						
8/30/2012		182	68.7	4.81						
9/11/2012	159	179	68'9	4.84	96	8:99	1.97	3.47	1.27	167
9/24/2012		207	7.59	5.93						
10/8/2012		227	89.7	5.14						
10/22/2012		205	7.31	4.97						
11/5/2012		208	7.04	5.13						
11/20/2012	166	182	7.42	4.72	100	71.4	1.94	3.79	1.46	178
12/3/2012		215	7.72	5.21						
12/18/2012		219	8.12	5.37						
1/3/2013	210	210	8.64	5.26						
1/14/2012	146	188	6.93	4.93	88	66.4	1.86	3.84	1.32	166
1/28/2013		188	7.94	6.9						
2/11/2013		196	62.9	7.08						
2/28/2013		155	7.2	9.61						
3/13/2013		160	6.59	8.45						
3/26/2013	109	147	6.57	6.79	99	52.4	1.85	3.63	1.18	131
4/11/2013		184	7.5	8.49						
4/23/2013		196	6.51	8.17						

Table B.2. Biweekly sampling results from HWWTP discharge.

	Alkalinity (as						Total	Total		Hardness	j	Color Street Street	NO3+
Sampling Date	$CaCO_3)$ (mg/L)	TDS (mg/L)	Chloride (mg/L)	Sulfate (mg/L)	Bicarbonate (mg/L)	Iotal Ca (mg/L)	Mg (mg/L)	Na (mg/L)	Lotal K (mg/L)	$(as CaCO_3)$ (mg/L)	Nitrate (mg/L)	Nitrite (mg/L)	MO_2 (mg/L)
5/10/2012*	174	294	9.03	6.31	105	71.6	1.77	3.89	1.31	186			
5/21/2012*		220	6.71	4.1									
6/5/2012*		263	7.46	4.51									
6/21/2012*		242	6.97	4.52									
7/5/2012*		216	7.5	4.92									
7/17/2012*	155	244	6.81	4.46	7 6	65.4	1.79	3.71	1.46	171			
7/31/2012		411	54.2	59.7									
8/16/2012		373	59	63.3									
8/30/2012		387	89	77.8									
9/11/2012	40	338	57.6	42.8	24	42.9	2.84	40.7	13.5	119			
9/24/2012		417	6.65	54									
10/8/2012		438	59.3	58.4									
10/22/2012		324	55.5	41.4							22.5	0.142	22.6
11/5/2012		352	61	9.99							20.7	<0.100	20.7
11/20/2012	31	331	57.7	8.09	61	43.3	3.58	62.1	12.7	123	22.3	<0.100	22.3
12/3/2012		382	63.8	73									
12/18/2012		350	61.4	53.2									
1/3/2013	210	334	9.95	42.6							18.6	<0.1	18.6
1/14/2013	37	297	47.5	43.9	22	40.8	3.22	9.44	10.1	115	15.2	<0.100	15.2
1/28/2013		315	59	63							15.4	<0.100	15.4
2/11/2013		235	41.4	35.4							15.2	<0.100	15.2
2/28/2013		267	42.7	37.4							3.38	0.26	3.64
3/13/2013		265	36.9	49.9							5.6	0.142	5.74
3/26/2013	69	288	40.4	46	42	45.9	2.91	40.5	8.07	127	12.2	<0.100	12.2
4/11/2013		349	54.8	77.9							7.16	<0.100	7.16
4/23/2013		301	45.9	55.6							1.47	0.501	1.97

* Samples collected from instream and not included in statistical summaries.

Appendix B Biweekly Sampling Data

Table B.3. Biweekly sampling results from Silver Valley Bridge (downstream of HWWTP).

Alkalinity							E 19		Hardness
(as CaCO ₃)	LDS	Chloride	Sulfate	Bicarbonate	Total Ca	Total Mg	Total Na	Total K	(as CaCO ₃)
(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
173	242	10.7	8.51	104.00	69.2	1.80	6.05	1.68	165.55
	230	9.44	7.14						
	268	10.9	7.62						
	243	9.5	8.05						
	227	10.1	9.27						
148	255	9.56	7.42	86	63.1	1.94	7.44	2.22	
	252	15.7	14.4						
	232	16.8	14.9						
	228	19.2	18.6						
149	213	10.6	7.63	96	63.5	1.99	6.32	2.07	166.754
	249	18.1	15.7						
	251	14	14						
	219	13	9.12						
	213	11.3	9.47						
156	216	12.1	8.99	94	70	2.11	7.96	2.27	183.479
	222	13.4	12.1						
	223	13.2	9.81						
210	246	13.8	8.14						
129	196	12.3	9.62	78	58.4	1.91	8.52	2.3	153.69
	209	12.4	11.2						
	204	92.6	90.6						
	162	10.2	10.9						
	163	8.65	9.97						
113	165	9.49	11.8	68	55.1	1.97	6.17	1.62	145.697
	197	10.7	11.4						
	207	68.6	10.9						

Table B.4. Biweekly sampling results from Arkansas Highway 14 bridge (upstream of YWWTP).

	Alkalinity (as CaCO ₃)	SQL	Chloride	Sulfate	Bicarbonate	Total Ca	Total Mg	Total Na	Total K	7 🗳
Sampling Date	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
9/24/2012		1	-	-						
10/8/2012		-	-	-						
10/19/2012		179	8.63	7.78						
11/5/2012		1	-	-						
11/19/2012		1	1	-						
12/3/2012		1	-	-						
12/17/2012		1	-	-						
1/2/2013		183	9.1	8.82						
1/14/2013	161	194	8.16	9.23	97	56.7	10.1	4.05	1.59	183.172
1/29/2013		207	8.46	9.11						
2/11/2013		210	6.51	8.94						
2/26/2013		170	5.75	7.72						
3/11/2013		157	5.12	6.91						
3/25/2013	167	207	6.12	7.42	101	64.3	9.48	3.28	1.33	199.596
4/8/2013		210	6.18	7.61						

^{*}Note: Consistent flow was not observed in this reach of Crooked Creek until January 2013.

Table B.5. Biweekly sampling results from YWWTP.

	Alkalinity TDS	TDS	Chloride	Sulfate	Sulfate Bicarbonate	Total Ca	Total Mø	1500	Total K	Total Total Hardness Nitrate Nitrite	Nitrate	Nitrite	NO ₃ +
Sampling Date		(mg/L)		(mg/L)	(mg/L)	(mg/L)	(mg/L)	10.00	(mg/L)	(mg/L)	(mg/L) (mg/L)	(mg/L)	(mg/L)
9/24/2012		328	36.9	23.1									
10/8/2012		347	38.6	19									
10/19/2012		307	28.9	21.7									
11/5/2012		254	39.3	20.2									
11/19/2012	181	293	39.2	19.2	110	44.6	18	25.1	7.82	185			
12/3/2012		276	43.1	18.7									
12/17/2012		292	42.4	22.3							0.723	0.723 <0.100	0.723
1/2/2013		280	43.2	26.5							1.35	<0.100	1.35
1/14/2013	217	309	39.7	76	132	51.7	20.6	30.2	29.6	214	0.601	0.601 <0.100	0.601
1/29/2013		312	39.3	24.5							0.405	0.405 <0.100	0.405
2/11/2013		301	18.6	30							<0.100	<0.100 <0.100	<0.100
2/26/2013		261	22.4	27.1							1.86	<0.100	1.86
3/11/2013		256	17.1	24.2							0.973	<0.100	0.973
3/25/2013	227	293	21.3	27.4	138	60.3	29.3	15.1	4.23	271	9.0	<0.100	9.0
4/8/2013		336	30.3	24.6							0.176	<0.100	0.176

Table B.6. Biweekly sampling results from Oxford property (downstream of YWWTP).

	Alkalinity									Hardness
	(as CaCO ₃)	LDS	Chloride	Sulfate	Bicarbonate Total Ca Total Mg	Total Ca	Total Mg	Total Na	Total K	Total K (as CaCO ₃)
Sampling Date	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
9/24/2012		ı	ı	1						
10/8/2012		1	•							
10/19/2012		ı	1	•						
11/5/2012		1	1	1						
11/19/2012		1	1	1						
12/3/2012		1	1							
12/17/2012		ı	ı	ı						
1/2/2013		-	1	ı						
1/14/2013	165	203	7.5	10.6	26	55.7	13.3	3.84	1.6	193.852
1/29/2013		-	-	1						
2/11/2013		215	6.28	69.6						
2/26/2013		175	5.67	8.63						
3/11/2013		174	5.09	7.24						
3/25/2013	171	205	6.02	7.46	104	66.1	10.8	3.19	1.31	209.526
4/8/2013		223	6.21	7.65						

*Note: Consistent flow was not observed in this reach of Crooked Creek until February 2013.

TABLE OF CONTENTS (CONTINUED)

	8.3	Summary of Costs	8-8
	8.4	Alternatives Analysis Conclusions	8-9
9.0	PROF	POSED SITE-SPECIFIC CRITERIA	9-1
	9.1	Synopsis of Supporting Information	9-1
	9.2	Proposed Criteria	9-2
10.0		RENCES	

LIST OF APPENDICES

APPENDIX A:	Site Photographs from Fall 2012 and Spring 2013 Aquatic Life Field Survey
APPENDIX B:	Biweekly Sampling Data
APPENDIX C:	Laboratory Reports
APPENDIX D:	Aquatic Life Survey Field Sheets and Data Forms
APPENDIX E:	Benthic Macroinvertebrate Assessment Methodology, Results, and Conclusions
APPENDIX F:	Benthic Macroinvertebrate Taxa and Abundance for Crooked Creek Stations and Least-Disturbed Streams
APPENDIX G:	ADEQ Historical Monitoring Data

LIST OF TABLES

Table ES.1	Summary of capital, operating, and implementation costs for various options to attain compliance with permit limits for the Harrison WWTP	ii
Table ES.2	Summary of capital, operating, and implementation costs for various options to attain compliance with permit limits for the Yellville WWTP	iii
Table ES.3	Ninety-fifth percentile values of ADEQ historical monitoring data for dissolved minerals in Crooked Creek	v
Table ES.4	Proposed criteria for dissolved minerals in Crooked Creek	vii
Table 2.1	Description of sampling locations and information collected during fall 2012 field surveys	2-4
Table 2.2	Description of sampling locations and information collected during the spring 2013 field survey	2-4
Table 2.3	Description of sampling locations and information collected during the routine biweekly sampling	2-7
Table 3.1	Summary of default designated uses and mineral criteria applicable to waterbodies downstream of the HWWYP and YWWTP discharges	3-1
Table 4.1	Analytes and analytical methods for analysis of outfall and receiving stream samples	4-1
Table 4.2	Summary of results of flow, water chemistry analyses of grab samples, and in situ measurements taken concurrently with biological sampling on September 19 and 20, 2012	4-3
Table 4.3	Summary of results of flow, water chemistry analyses of grab samples, and in situ measurements taken concurrently with biological sampling on November 27 and 28, 2012	4-4
Table 4.4	Summary of results of flow, water chemistry analyses of grab samples, and in situ measurements taken concurrently with biological sampling on April 2 and 3, 2013	4-4

LIST OF TABLES (CONTINUED)

Table 4.5	Summary of Crooked Creek flows expressed as the proportion of flow upstream of the discharges to the flow downstream of discharges	4-5
Table 4.6	Summary of TDS, sulfate, and chloride concentrations from biweekly sampling of Crooked Creek upstream and downstream of the HWWTP	4-6
Table 4.7	Summary of TDS, sulfate, and chloride concentrations from biweekly sampling of Crooked Creek upstream and downstream of the YWWTP	4-7
Table 4.8	Average concentrations of major cations and anions from the discharges and from Crooked Creek upstream and downstream of the discharges	4-10
Table 4.9	Average proportion of major cations and anions from the discharges and from Crooked Creek upstream and downstream of the discharges	4-10
Table 5.1	Ion concentrations used for input to return an estimated survival of 50% in a 48-hour acute toxicity test using <i>C. dubia</i>	5-3
Table 5.2	Estimated IC25 concentrations based on model predictions per Mount et al. (1997) and the ACRs from Lasier and Hardin (2010)	5-3
Table 5.3	Results of chronic toxicity tests on HWWTP and YWWTP samples	5-4
Table 5.4	Comparison of estimated chronic toxicity thresholds with measured mineral concentrations from HWWTP and YWWTP samples collected November 28, 2012, and April 2, 2013	5-5
Table 6.1	Influence of soil salinity and irrigation water salinity on crop tolerance and yield potential	6-2
Table 6.2	Irrigation water salinity for selected relative rice yield measurements calculated using US Salinity Laboratory linear regression equations	6-3

LIST OF TABLES (CONTINUED)

Table 7.1	Basic information for least-disturbed reference sites used in the analysis of benthic macroinvertebrate communities	7-2
Table 7.2	Summary of habitat evaluation performed September 19 and 20, 2012	7-6
Table 7.3	Summary of physical and habitat characteristics evaluation performed September 19 and 20, 2012	7-6
Table 7.4	Summary of habitat evaluation performed April 2 and 3, 2013	7-7
Table 7.5	Summary of physical and habitat characteristics evaluation performed April 2 and 3, 2013	7-8
Table 7.6	Fish community biocriteria for Ozark Highlands streams	7-12
Table 7.7	Summary of upstream versus downstream comparisons of benthic macroinvertebrate communities in Crooked Creek	7-13
Table 7.8	Comparison matrix of overall percent similarity between least-disturbed reference streams and Crooked Creek sites	7-14
Table 7.9	Summary of overall percent similarity between least-disturbed reference streams and Crooked Creek sites	7-15
Table 7.10	Summary of mineral concentrations from ADEQ sampling of Long Creek and Yocum Creek least-disturbed streams	7-15
Table 7.11	Summary of fish collections conducted September 19 and 20, 2012	7-17
Table 7.12	Summary of fish community biocriteria metrics for sampling conducted September 19 and 20, 2012	7-18
Table 8.1	Summary of capital, operating, and implementation costs for	
	various options to attain compliance with permit limits for the Harrison WWTP	8-8
Table 8.2	Summary of capital, operating, and implementation costs for various options to attain compliance with permit limits for the Yellville WWTP	
	Tentine WWII	0-0
Table 9.1	Ninety-fifth percentile values of ADEQ historical monitoring data for dissolved minerals in Crooked Creek	9-4
Table 9.2	Proposed criteria for dissolved minerals in Crooked Creek	

LIST OF FIGURES

Figure ES.1	Schematic diagram of outfalls, ADEQ monitoring stations, and upper and lower reaches for revised criteria	vi
Figure 1.1	Map of stream locations, watershed boundaries, and watershed areas	1-2
Figure 2.1	Map of waterbodies sampled during the study and locations of sampling stations	2-2
Figure 2.2	Schematic diagram of discharge sources and receiving streams	2-3
Figure 2.3	Aquatic life and biweekly sampling stations for Crooked Creek near the Harrison WWTP	2-5
Figure 2.4	Aquatic life and biweekly sampling stations for Crooked Creek near the Yellville WWTP	2-6
Figure 4.1	Time-series plots of TDS concentrations in Crooked Creek upstream and downstream of HWWTP and YWWTP discharges	4-9
Figure 7.1	Substrate composition in Crooked Creek and the reference streams	7-9
Figure 9.1	Schematic diagram of outfalls, ADEQ monitoring stations, and upper and lower reaches for revised criteria	9-3

1.0 INTRODUCTION

1.1 Background

The City of Harrison, Arkansas (Harrison), discharges treated wastewater under authority of its National Pollutant Discharge Elimination System (NPDES) permit (No. AR0034321) for the Harrison Waste Water Treatment Plant (HWWTP). This permit was scheduled for renewal in October 2012. The discharge enters Crooked Creek, which flows approximately 73.4 miles to the White River at the Marion-Baxter county line in Arkansas (Figure 1.1). The Arkansas Department of Environmental Quality (ADEQ) is considering future permit limits for dissolved minerals (total dissolved solids [TDS], sulfate, and chloride) in Harrison's permit when it is renewed. In the Arkansas 2008 303(d) list, stream segment 11010003-049 (located on Crooked Creek upstream and downstream of the HWWTP discharge) was listed as impaired due to exceedances of the Arkansas TDS, chloride, sulfate, and beryllium water quality standards (WQS). The suspected source of the TDS, chloride, sulfate, and beryllium noted on the Arkansas 2008 303(d) list was unknown. The Arkansas draft 2012 303(d) list proposes removing beryllium as a cause of impairment. The suspected source of the TDS, chloride, and sulfate noted on the Arkansas draft 2012 303(d) list is unknown.

The City of Yellville, Arkansas (Yellville) discharges treated wastewater under authority of its NPDES permit (No. AR0034037) for the Yellville Waste Water Treatment Plant (YWWTP). This permit is scheduled for renewal in March 2015. The discharge enters Crooked Creek, which flows approximately 22.5 miles to the White River at the Marion-Baxter county line in Arkansas (Figure 1.1). In the Arkansas 2008 303(d) list, stream segment 11010003-048 (located on Crooked Creek downstream of the HWWTP and upstream and downstream of the YWWTP discharge) was listed as impaired due to exceedances of the WQS for temperature, TDS, sulfate, and chloride. The suspected source of the temperature noted on the Arkansas 2008 303(d) list was resource extraction. The suspected sources of the dissolved minerals noted on the Arkansas 2008 303(d) list were unknown. The Arkansas draft 2012 303(d) list proposes removing temperature as a cause of impairment. The suspected sources of the dissolved minerals noted on the Arkansas draft 2012 303(d) list are unknown.

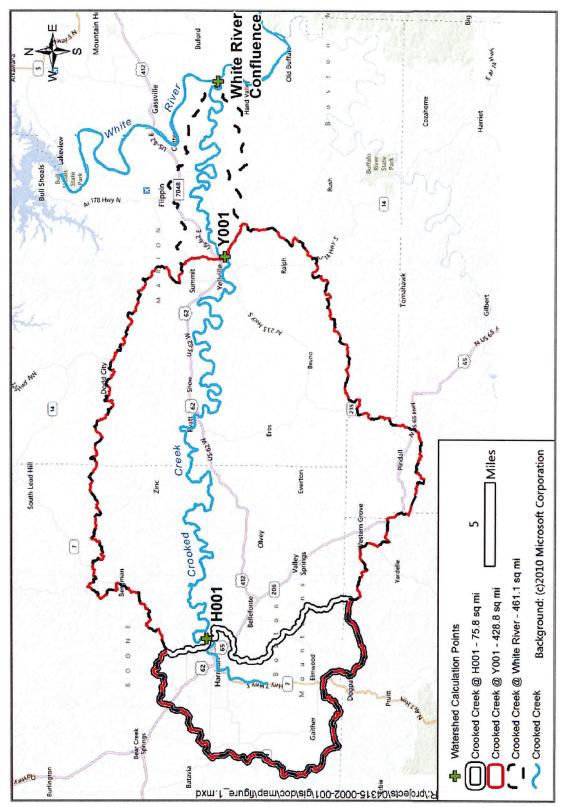


Figure 1.1. Map of stream locations, watershed boundaries, and watershed areas.

An analysis of discharge TDS, sulfate, and chloride concentrations for HWWTP and YWWTP revealed that both discharges meet the current sulfate and chloride criteria for Crooked Creek (20 mg/L for both sulfate and chloride); however, neither discharge could meet the current TDS limits based on the current TDS criterion (200 mg/L). Further analysis showed that if permit limits for either city were set to instream criteria for sulfate or chloride due to the impairment listings, neither city would consistently meet such limits. Accordingly, Harrison and Yellville undertook a use attainability analysis (UAA) to evaluate alternatives for meeting anticipated permit limits for minerals.

1.2 UAA Objectives

The UAA study reported herein was conducted with the following objectives:

- 1. Determine existing and attainable uses in waterbodies downstream of the HWWTP and YWWTP discharges (Crooked Creek, White River);
- 2. Determine if the existing direct discharges from the HWWTP and YWWTP support existing and attainable uses in downstream waterbodies; and
- 3. Evaluate options for permit compliance, including treatment, alternative discharge locations, and site-specific minerals criteria.

1.3 UAA Approach

Preliminary evaluation of water quality near the HWWTP and YWWTP discharges indicated the following:

- TDS concentrations routinely exceed the Crooked Creek site-specific criterion upstream and downstream of both discharges,
- A discharge limitation on TDS in the NPDES permits will not prevent exceedances of the site-specific TDS criterion in Crooked Creek downstream of the respective outfalls due to the fact that the TDS criterion is exceeded upstream of both outfalls, and
- Sulfate and chloride concentrations rarely exceed the Crooked Creek site-specific criteria upstream or downstream of either discharge based on the UAA study data, but ADEQ historical data from Crooked Creek show exceedances of criteria in approximately 10% of the measurements for both parameters.

Therefore, in addition to the evaluation of treatment and alternative discharge locations, this UAA includes an evaluation of site-specific TDS, sulfate, and chloride criteria and modification of the Crooked Creek site-specific criteria.

This proposal is in accordance with §2.303 and §2.308 of Regulation No. 2 (APCEC 2014), which allow the development of site-specific criteria using scientifically defensible methods that fully protect and maintain existing uses, meet the requirements for public participation per the *State of Arkansas Continuing Planning Process* (CPP) (ADEQ 2000), and allow for consideration of controls that would result in substantial and widespread economic and social impact.

The following were components of the approach to address these issues:

- 1. A waterbody survey to document current water quality and biological conditions in waterbodies receiving the discharges and on other area streams;
- 2. Analysis of the toxicity of the effluent discharges;
- 3. An evaluation of the technical, environmental, and economic feasibility of treatment to reduce TDS, sulfate, and chloride; and
- 4. An evaluation of the technical, environmental, and economic feasibility of moving the discharges to an alternate location.

Development of the UAA approach followed applicable guidance in the following documents:

- 1. The US Environmental Protection Agency (EPA) Water Quality Standards Handbook: Second Edition (EPA 1994);
- 2. The EPA Technical Support Document for Waterbody Surveys and Assessments for Conducting UAAs (EPA 1983);
- 3. The Water Environment Research Foundation's (WERF) reports "Suggested Framework for Conducting UAAs and Interpreting Results" (WERF 1997a) and "A Comprehensive UAA Technical Reference" (WERF 1997b);
- 4. The State of Arkansas Continuing Planning Process (ADEQ 2000);
- 5. APCEC Regulation No. 2, including §2.306 (2014); and
- 6. 40 CFR 131.10(a) through (k).

The UAA process included development of a UAA study plan to document the various strategies and planned tasks for ADEQ and EPA review. The revised plan (November 12, 2012) incorporated comments from ADEQ. As part of this process, ADEQ indicated conceptual agreement with the proposed UAA approach.

1.4 Facility Process Description

The treatment process for the HWWTP consists of a bar screen, a primary clarifier followed by two parallel oxidation ditches, ultraviolet treatment, and an aeration cascade. The design flow is 2.6 million gallons per day (mgd).

The treatment process for the YWWTP consists of extended action aeration and activated sludge followed by clarification, UV, and post-aeration. The design flow is 0.75 mgd.

2.0 SAMPLING STATIONS

2.1 Field Surveys

Sampling stations were chosen by FTN and ADEQ to characterize aquatic life in Crooked Creek upstream and downstream of the HWWTP and YWWTP discharges. The locations of the FTN sampling stations are indicated on Figure 2.1, illustrated schematically on Figure 2.2, and described in Tables 2.1 and 2.2. A reference stream location was not chosen, as no comparable stream was located within the near vicinity. Photographs of selected locations from the fall 2012 and spring 2013 sampling are provided in Appendix A. Sampling upstream and downstream of the YWWTP was not possible during the fall due to lack of stream flow.

2.2 Routine Biweekly Sampling

During May 2012 through April 2013, Harrison and Yellville personnel collected biweekly grab samples from the outfalls and from Crooked Creek locations upstream and downstream of the respective outfalls. In general, these locations (Figures 2.3 and 2.4, Table 2.3) were different from the aquatic life sampling locations. Due to a lack of consistent flow, samples were not collected consistently at the sampling locations upstream and downstream of the YWWTP until January and February 2013, respectively.

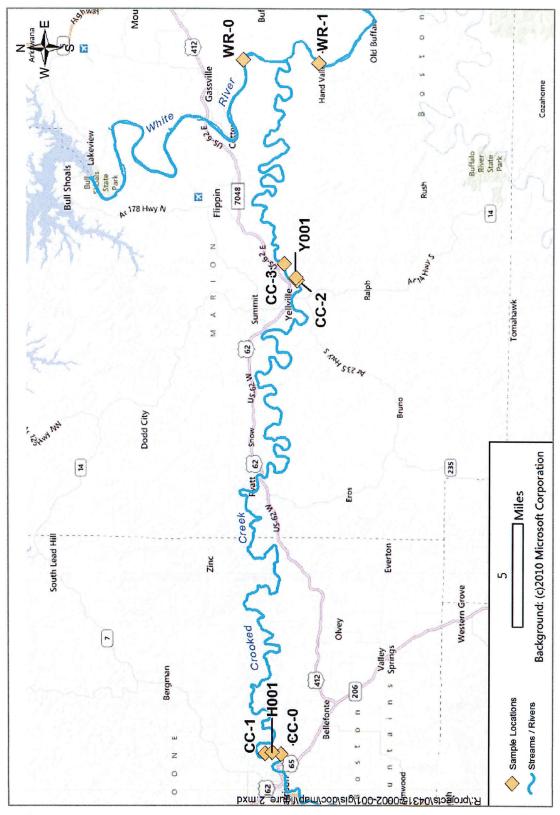


Figure 2.1. Map of waterbodies sampled during the study and locations of sampling stations.

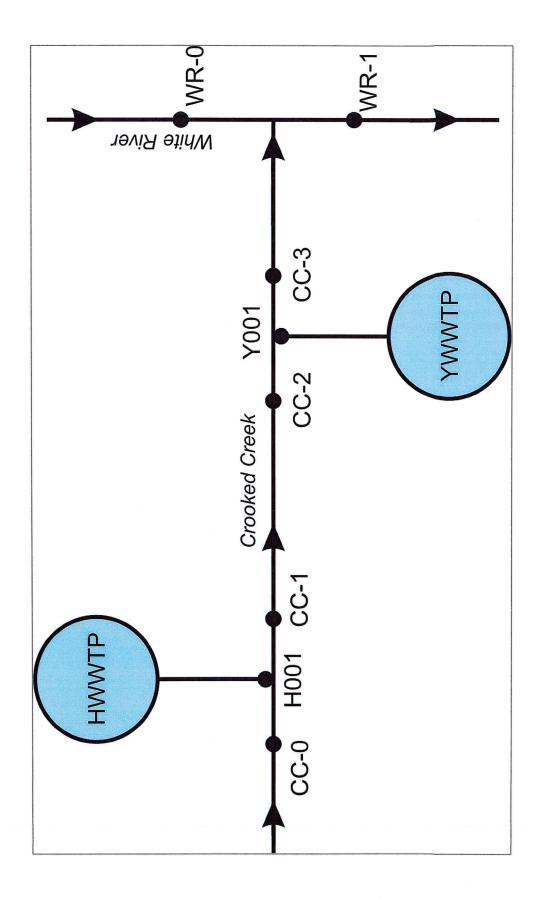


Figure 2.2. Schematic diagram of discharge sources and receiving streams.

Table 2.1. Description of sampling locations and information collected during the fall 2012 field surveys.

Station		GPS Co	ordinates	Water				
ID	Description	Latitude	Longitude	Quality	Flow	Fish	Benthos	Habitat
CC-0	Crooked Creek upstream of HWWTP	36.23164	-93.07636	X	X	X	X	X
H001	HWWTP Outfall 001	36.23792	-93.07446	X	X	(A		
CC-1	Crooked Creek downstream of HWWTP	36.24304	-93.07551	X	X	X	X	X
CC-2	Crooked Creek upstream of YWWTP	36.21989	-92.66565					
Y001	YWWTP Outfall 001	36.22049	-92.66333	X	X	e district		
CC-3	Crooked Creek downstream of YWWTP	36.22920	-92.65119					
WR-0	White River upstream of mouth of Crooked Creek	36.25771	-92.47438	X				
WR-1	White River downstream of mouth of Crooked Creek	36.20376	-92.47803	X				

Table 2.2. Description of sampling locations and information collected during the spring 2013 field survey.

Station		GPS Co	ordinates	Water				
ID	Description	Latitude	Longitude	Quality	Flow	Fish	Benthos	Habitat
CC-0	Crooked Creek upstream of HWWTP	36.23164	-93.07636	X	X		X	
H001	HWWTP Outfall 001	36.23792	-93.07446	X	X			
CC-1	Crooked Creek downstream of HWWTP	36.24304	-93.07551	X	X		X	
CC-2	Crooked Creek upstream of YWWTP	36.21989	-92.66565	X	X		X	
Y001	YWWTP Outfall 001	36.22049	-92.66333	X	X			
CC-3	Crooked Creek downstream of YWWTP	36.22920	-92.65119	X	X		X	
WR-0	White River upstream of mouth of Crooked Creek	36.25771	-92.47438	X				
WR-1	White River downstream of mouth of Crooked Creek	36.20376	-92.47803	X				

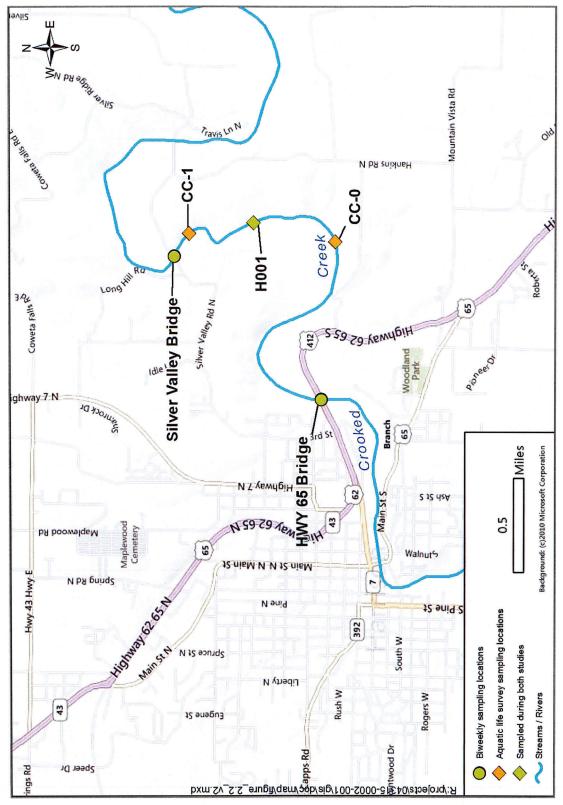


Figure 2.3. Aquatic life and biweekly sampling stations for Crooked Creek near the Harrison WWTP.

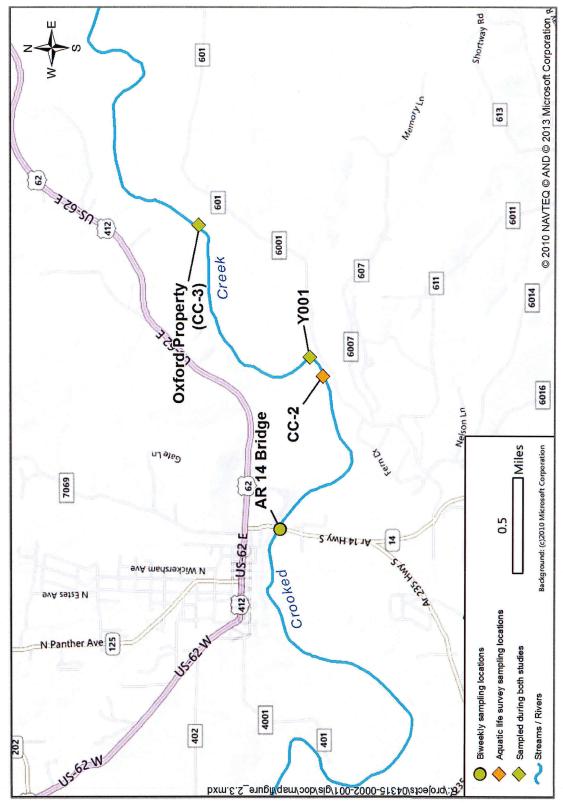


Figure 2.4. Aquatic life and biweekly sampling stations for Crooked Creek near the Yellville WWTP.

Table 2.3. Description of sampling locations and information collected during the routine biweekly sampling.

		GPS Coo	rdinates	Water
Station ID	Description	Latitude	Longitude	Quality
US-65 bridge	Crooked Creek upstream of HWWTP	36.23270	-93.09133	X
H001	HWWTP Outfall 001	36.23792	-93.07446	X
Silver Valley Road bridge	Crooked Creek downstream of HWWTP	36.24432	-93.07771	X
AR-14 bridge	Crooked Creek upstream of YWWTP	36.22281	-92.67928	X
Y001	YWWTP Outfall 001	36.22049	-92.66333	X
Oxford property	Crooked Creek one mile downstream of YWWTP*	36.22920	-92.65119	X

^{*}Same location as CC-3.

3.0 APPLICABLE ARKANSAS WATER QUALITY STANDARDS (APCEC REGULATION NO. 2)

Potentially affected waterbodies (Crooked Creek and White River) are located in the Ozark Highlands ecoregion. Table 3.1 summarizes default designated uses and mineral criteria applicable to waterbodies downstream of the HWWTP and YWWTP discharges. Stream locations, watershed boundaries and watershed areas are provided on Figure 1.1.

Table 3.1. Summary of default designated uses and mineral criteria applicable to waterbodies downstream of the HWWTP and YWWTP discharges.

		Applica	Applicable Mineral Criteria (mg/L)				
Waterbody	Designated Uses	Chloride	Sulfate	TDS			
	Primary Contact Recreation						
0 1 10 1 5 5	Secondary Contact Recreation						
Crooked Creek from	Perennial Ozark Highlands Fishery] 20	20	200			
HWWTP Outfall 001 to YWWTP Outfall 001	Domestic Water Supply		20	200			
Y W W IP Outrail 001	Industrial Water Supply						
	Agricultural Water Supply						
	Primary Contact Recreation		20				
Crooked Creek from	Secondary Contact Recreation						
YWWTP Outfall 001 to	Perennial Ozark Highlands Fishery] 20		200			
confluence with White	Domestic Water Supply			200			
River	Industrial Water Supply]					
	Agricultural Water Supply						
	Primary Contact Recreation						
	Secondary Contact Recreation						
White Diver desympton	Trout Fishery						
White River downstream	Perennial Ozark Highlands Fishery	\supseteq 20	20	100			
of confluence with Crooked Creek	Domestic Water Supply		20	180			
CIOOKEU CIEEK	Industrial Water Supply						
	Agricultural Water Supply						
	Other Uses						

4.0 DISCHARGE AND RECEIVING STREAM WATER QUALITY CHARACTERISTICS

4.1 Water Quality and Flow Sampling

4.1.1 Water Quality and Flow Sampling During Aquatic Life Surveys

During the fall 2012 and spring 2013 aquatic life surveys, FTN collected grab samples at the sampling locations described in Tables 2.1 and 2.2 according to FTN sampling protocols. Samples were taken from mid-surface from flowing portions of the stream using a clean plastic jug. The sample was then split into aliquots and placed into sample containers containing preservative appropriate for the analysis of selected parameters (Table 4.1). Samples were placed on ice immediately upon collection and delivered to American Interplex Corporation Laboratories (AIC), which is certified by ADEQ for the selected analyses.

Table 4.1. Analytes and analytical methods for analysis of outfall and receiving stream samples.

Analyte	Method (or equivalent)
Chloride (Cl ⁻)	EPA 300.0
Sulfate (SO ₄ -2)	EPA 300.0
Calcium (Ca ⁺²)	EPA 200.7
Magnesium (Mg ⁺²)	EPA 200.7
Sodium (Na ⁺)	EPA 200.7
Potassium (K ⁺)	EPA 200.7
Total Alkalinity	SM 2320B
Hardness	EPA 200.7
TDS	SM 2540C

Stream flow was measured within each sampling reach indicated. Flows were measured by measuring stream width, depth and current velocity per US Geological Survey protocols (1982) using a calibrated wading rod and a Marsh-McBirney (Flow Mate Model 2000) flow meter. All flow measurements were made concurrently with grab sample collection.

In situ measurements of temperature (°C), dissolved oxygen (DO; mg/L), pH (standard units), and specific conductance (conductivity; μ S) were taken using Hydrolab Minisonde Multiprobe water quality monitors. Instruments were calibrated on the day of use or deployment.

Calibration of the DO function on all instruments was performed using air calibration.

Calibration of conductivity and pH functions was performed using standard buffers (pH) and calibration standards (conductivity). Calibration was checked upon completion of each day's measurements by comparing instrument readings with readings in standard buffers, calibration standards or saturated air, as appropriate. All calibration information was documented and retained as part of the project records. Discreet in situ measurements were taken in mid-current at mid-depth concurrently with grab samples.

4.1.2 Biweekly Sampling

At the request of ADEQ, Harrison and Yellville personnel collected biweekly water quality data in Crooked Creek upstream and downstream of their WWTP discharges, flow permitting, at the sampling locations described in Section 2.2 (Table 2.3). Samples were collected from May 10, 2012, through April 23, 2013, at the HWWTP. Consistent flow was not achieved in Crooked Creak upstream of YWWTP until approximately January 2, 2013, or in Crooked Creek downstream of the YWWTP until approximately February 11, 2013 (around 40 days after consistent flow was established at the upstream site); thus sampling was intermittent during that time and generally spanned from October 2012 to April 2013. Note that the biweekly sampling locations were not the same as those used for the aquatic life survey (see Tables 2.1 through 2.3). Samples were routinely analyzed for TDS, sulfate, and chloride (Table 4.1). On selected dates, samples were analyzed for additional analytes (calcium, magnesium, sodium, potassium, and alkalinity). Bicarbonate ion concentrations were estimated based on measured total alkalinity and assumed pH values of 8.0 su for receiving stream samples and 7.5 su for outfall samples. Samples were shipped overnight to Environmental Testing and Consulting, Inc. (ETC), which is certified by ADEQ for these analyses.

4.2 Water Quality and Flow Measurement Results and Discussion

Results of flow, in situ, and dissolved minerals measurements collected by FTN during the aquatic life surveys are presented in Tables 4.2 through 4.4 for the September 2012 (fall).

¹ Environmental Testing and Consulting, Inc., 2790 Whitten Road, Memphis, TN 38133

November 2012 (fall), and April 2013 (spring) sampling, respectively. Samples collected in fall 2012 showed TDS in excess of the Crooked Creek site-specific criterion of 200 mg/L upstream and downstream of the HWWTP. Additionally, sulfate and chloride concentrations were in excess of the Crooked Creek site-specific criteria of 20 mg/L downstream of the HWWTP. Water quality samples were not collected upstream and downstream of the YWWTP during the fall 2012 sampling due to lack of surface flow. Samples collected in spring 2013 showed TDS in excess of the Crooked Creek site-specific criterion downstream of the YWWTP.

Table 4.2. Summary of results of flow, water chemistry analyses of grab samples, and in situ measurements taken concurrently with biological sampling on September 19 and 20, 2012.

		Station									
Parameter	CC-0	H001	CC-1	CC-2	Y001	CC-3	WR-0	WR-1			
Date (a)	9/20	9/20	9/19	NM	9/19	NM	9/20	9/20			
Time (a) (24 h)	1823	1908	1930	NM	1015	NM	2132	2213			
Flow (gpm)	6,934	2,083	8,074	NM	128	NM	NM	5.74x10 ^{5 (c)}			
Temperature (°C)	20.63	23.49	20.51	NM	23.62	NM	18.86	18.04			
DO (mg/L)	9.70	6.80	9.61	NM	5.13	NM	10.86	NM			
pH (su)	7.17	6.80	7.47	NM	7.37	NM	7.93	7.93			
Specific Conductance (μS)	356.1	619.2	377.9	NM	573.7	NM	277.2	273.5			
TDS (mg/L)	220	410	230	NM	340	NM	160	150			
Sulfate (mg/L)	5.6	53	11	NM	25	NM	6.7	6.5			
Chloride (mg/L)	8.3	55	13	NM	36	NM	5.5	5.1			

Notes: Bold entries indicate values not meeting site-specific water quality criteria; NM = not measured.

- (a) Date and time of sample collection and in situ measurements.
- (b) HWWTP and YWWTP outfalls flows obtained from the cities.
- (c) White River flows obtained from USGS gage near Norfork (http://waterdata.usgs.gov/ar/nwis/uv?site_no=07057370)

Samples collected at the White River stations downstream of Crooked Creek showed mineral concentrations well below site-specific criteria. One sample collected on the White River upstream of Crooked Creek exceeded sulfate and TDS criteria (Table 4.4).

Flow measurements taken during the aquatic life surveys are summarized in Table 4.5 to provide an indication of the contribution of the discharges to the total downstream flow.

Table 4.3. Summary of results of flow, water chemistry analyses of grab samples, and in situ measurements taken concurrently with biological sampling on November 27 and 28, 2012.

			1000	St	ation							
Parameter	CC-0	H001	CC-1	CC-2	Y001	CC-3	WR-0	WR-1				
Date (a)	11/28	11/28	11/28	NM	11/28	NM	11/27	11/27				
Time (a) (24 h)	0840	1600	1213	NM	1710	NM	1723	1655				
Flow (gpm)	4,566	1,736	5,024	NM	120	NM	NM	1.80x10 ^{6 (c)}				
Temperature (°C)	8.30	13.85	10.69	NM	13.25	NM	NM	NM				
DO (mg/L)	9.96	9.14	9.80	NM	10.98	NM	NM	NM				
pH (su)	7.46	7.26	7.89	NM	7.67	NM	NM	NM				
Specific Conductance (μS)	377	669	417	NM	477	NM	NM	NM				
TDS (mg/L)	230	430	280	NM	270	NM	150	170				
Sulfate (mg/L)	6.2	110	29	NM	21	NM	7.0	6.5				
Chloride (mg/L)	8.9	65	21	NM	41	NM	6.1	5.6				

Notes: Bold entries indicate values not meeting site-specific water quality criteria; NM = not measured.

Table 4.4. Summary of results of flow, water chemistry analyses of grab samples, and in situ measurements taken concurrently with biological sampling on April 2 and 3, 2013.

	Station								
Parameter	CC-0	H001	CC-1	CC-2	Y001	CC-3	WR-0	WR-1	
Date (a)	4/2	4/2	4/2	4/3	4/3	4/3	4/2	4/2	
Time ^(a) (24 h)	1552	1200	1445	0907	0826	1149	2002	2037	
Flow (gpm)	17,782	3,194	19,059	88,493	224	72,464	NM	1.88x10 ⁶ (c	
Temperature (°C)	12.95	14.30	12.69	9.57	11.47	10.54	10.98	8.92	
DO (mg/L)	10.21	8.28	10.21	9.39	8.24	9.54	8.34	10.78	
pH (su)	7.50	7.70	7.64	7.98	7.67	8.06	7.22	7.77	
Specific Conductance (µS)	320	587	329	335	530	329	544	297	
TDS (mg/L)	160	340	200	190	320	240	220	78	
Sulfate (mg/L)	5.8	66	8.8	7.8	25	7.0	56	7.7	
Chloride (mg/L)	6.9	51	7.8	5.3	23	5.7	4.9	4.7	

Notes: Bold entries indicate values not meeting site-specific water quality criteria; NM = not measured.

⁽a) Date and time of sample collection and in situ measurements.

⁽b) HWWTP and YWWTP outfalls flows obtained from the cities.

⁽c) White River flows obtained from USGS gage near Norfork (http://waterdata.usgs.gov/ar/nwis/uv?site_no=07057370)

⁽a) Date and time of sample collection and in situ measurements.

⁽b) HWWTP and YWWTP outfalls flows obtained from the cities.

⁽c) White River flows obtained from USGS gage near Norfork (http://waterdata.usgs.gov/ar/nwis/uv?site_no=07057370)

Table 4.5. Summary of Crooked Creek flows expressed as the proportion of flow upstream of the discharges to the flow downstream of discharges.

Location	September 2012	November 2012	April 2013
HWWTP	0.859	0.909	0.933
YWWTP	No flow	No flow	0.997*

^{*}Calculated as the upstream flow divided by sum of the effluent flow and upstream flow.

Results of biweekly measurements of TDS, sulfate and chloride in samples collected by Harrison and Yellville upstream and downstream of their WWTP outfalls are summarized in Tables 4.6 and 4.7, respectively, and presented in their entirety in Appendix B (laboratory reports for all analytical testing are provided in Appendix C). These tabular summaries do not include data collected during the fall 2012 and spring 2013 aquatic life survey sampling events because the biweekly sampling and aquatic life sampling were performed at different locations on Crooked Creek.

Biweekly samples showed TDS in excess of the Crooked Creek site-specific criterion upstream and downstream of the HWWTP on a routine basis with over 50% of the measured values upstream of the discharge exceeding the 200-mg/L criterion. Biweekly samples did not show sulfate or chloride values exceeding the Crooked Creek site-specific criteria upstream or downstream of the HWWTP; however, FTN sampling in November 2012 as part of the aquatic life field survey showed exceedances in sulfate and chloride values downstream of the HWWTP. The 95th percentile of the biweekly sulfate and chloride values did not exceed the Crooked Creek site-specific criteria during the monitoring period.

Biweekly samples collected also showed TDS in excess of the Crooked Creek site-specific criterion upstream and downstream of the YWWTP, with over 25% of the measured values upstream of the discharge exceeding the 200-mg/L criterion. Biweekly samples collected by Yellville and FTN did not show sulfate or chloride values exceeding the Crooked Creek site-specific criteria upstream or downstream of the YWWTP during the monitoring period.

Table 4.6. Summary of TDS, sulfate, and chloride concentrations from biweekly sampling of Crooked Creek upstream and downstream⁽¹⁾ of the HWWTP (May 10, 2012, through April 23, 2013).

	Summary Statistic		- M	Concentration (mg/L)	n	Downstream Increase		
Ion			Upstream	Effluent ⁽²⁾	Downstream	mg/L	%	
		25 th	185	300	208	7	3	
	Danaantila	50 th	206	336	223	14	7	
	Percentile	75 th	218	375	243	32	16	
TDS		95 th	249	418	254	41	20	
	Minimum		147	235	162	-24	-9	
	Mean		204	338	220	17	9	
	Maximum		266	438	268	46	25	
	Percentile	25 th	4.6	43.6	8.6	2.9	55.5	
		50 th	5.1	54.8	9.7	4.1	84.1	
		75 th	6.7	61.4	11.7	4.8	106.3	
Sulfate		95 th	9.3	77.8	15.5	10.1	213.7	
	Minimum		4.0	35.4	7.1	1.3	13.4	
	Mean		5.7	54.6	10.6	4.9	96.0	
	Maximum		9.8	77.9	18.6	13.8	286.7	
		25 th	6.6	47.1	9.9	3.1	44.6	
	Danaantila	50 th	7.1	57.1	11.1	4.3	57.9	
	Percentile	75 th	7.6	59.5	13.4	5.6	76.5	
Chloride		95 th	8.1	64.0	17.8	10.2	136.4	
	Minimum		6.5	36.9	8.7	2.1	31.3	
	Mean		7.2	54.1	12.1	4.9	67.3	
	Maximum		8.6	68.0	19.2	11.3	143.3	

Notes:

^{1.} See Table 2.3 for biweekly sampling locations.

^{2.} Effluent summary statistics exclude sampling dates from May 10, 2012, to July 17, 2012 (period of record begins July31, 2012, and continues through April 23, 2013). The "effluent" data collected prior to July 31, 2012, were collected from instream and are not representative of the outfall.

Table 4.7. Summary of TDS, sulfate, and chloride concentrations from biweekly sampling of Crooked Creek upstream and downstream⁽¹⁾ of the YWWTP (September 24, 2012, through April 8, 2013).

	Summary Statistic		Coi	centration	(mg/L)	Downstream Change		
Ion			Upstream ⁽²⁾	Effluent	Downstream ⁽³⁾	mg/L	%	
		25 th	179	278	182	5	3	
	Percentile	50 th	194	293	204	7	4	
	rercentile	75 th	207	311	213	12	6	
TDS		95 th	210	339	221	16	10	
	Minimum		157	256	174	-2	-1	
	Mean		194	295	199	8	4	
	Maximum		210	336	223	17	11	
		25 th	7.6	21.0	7.5	0.1	1.6	
	Percentile	50 th	7.8	24.2	8.1	0.5	6.6	
		75 th	8.9	26.3	9.4	0.9	10.9	
Sulfate		95 th	9.2	28.2	10.4	1.3	14.1	
	Minimum		6.9	24.2	7.2	0.0	0.5	
	Mean		8.1	26.3	8.5	0.6	6.8	
	Maximum		9.2	30.0	10.6	1.4	14.8	
		25 th	6.1	25.7	5.8	-0.2	-3.1	
	Percentile	50 th	6.5	38.6	6.1	-0.1	-1.5	
	1 Crecitine	75 th	8.5	39.5	6.3	0.0	-0.8	
Chloride		95 th	8.9	43.1	7.2	0.0	0.2	
	Minimum		5.1	17.1	5.1	-0.7	-8.1	
	Mean		6.6	27.0	6.1	-0.2	-2.5	
	Maximum		8.5	39.7	7.5	0.0	0.5	

Notes:

- 1. See Table 2.3 for biweekly sampling locations.
- 2. Consistent flows were not observed in this reach of Crooked Creek until January 2, 2013.
- 3. Consistent flows were not observed in this reach of Crooked Creek until February 11, 2013.

The average percent increase in TDS due to the discharges was 9% and 4% for the HWWTP and YWWTP, respectively (Tables 4.6 and 4.7). These percent increases represent TDS concentration increases of 17 mg/L and 8 mg/L for the HWWTP and YWWTP, respectively. The average sulfate increase due to the HWWTP discharge is 96%, but this only represents a 4.9-mg/L increase in sulfate concentration. At the YWWTP, the average downstream increase in sulfate concentrations is 6.8%, but only 0.6 mg/L. Average increases in chloride concentrations downstream of the HWWTP are similar to sulfate, 4.9 mg/L (67.3%). The YWWTP dilutes chloride levels in Crooked Creek; all downstream values are equal to or lower than the upstream values. These results indicate that the discharges have a relatively minor impact on the ionic strength of Crooked Creek. These effects are also illustrated on Figure 4.1 for TDS; visual inspection suggests that upstream-to-downstream differences are typically less than monthly or biweekly differences.

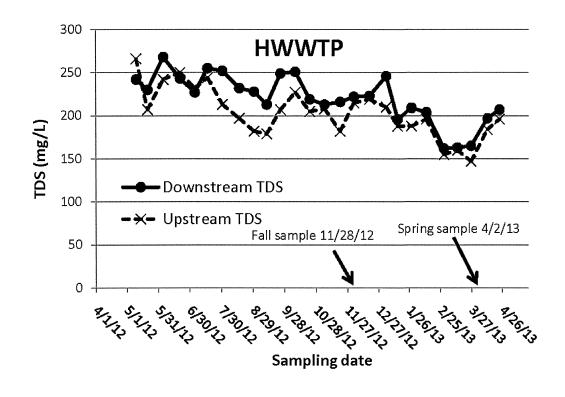
The flow summary provided in Table 4.5 clearly shows that the discharges contribute a relatively minor portion to the total downstream flow. The summary also indicates that flows during September 2012 were near critical low-flows². This information supports the biweekly sampling data showing that the discharges have a relatively minor impact on the water quality of Crooked Creek.

4.3 Ionic Composition of Effluents and Receiving Streams

Concentrations and proportions of major cations and anions (TDS, sulfate, chloride, bicarbonate, calcium, magnesium, sodium, potassium) from selected samples collected during the biweekly sampling are summarized in Tables 4.8 and 4.9 and presented in their entirety in Appendix B.

Tables 4.8 indicates that, as expected, the discharges differ from Crooked Creek by having higher concentrations of virtually all ions. Table 4.8 also shows that as suggested by upstream versus downstream differences in flows and minerals concentrations (see previous section), there is relatively little increase in the ion concentrations downstream of the discharges.

² The critical low-flow effluent dilution per NPDES permit number AR0034321 for the HWWTP is 84%.



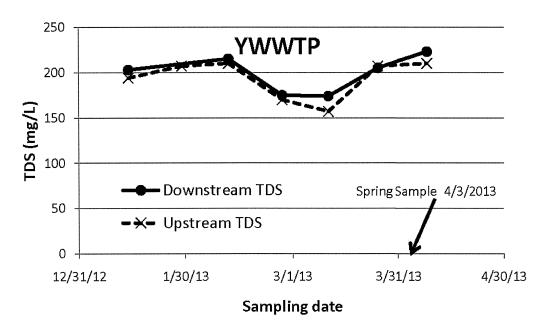


Figure 4.1. Time-series plots of TDS concentrations in Crooked Creek upstream and downstream of HWWTP and YWWTP discharges.

Table 4.8. Average concentrations of major cations and anions from the discharges and from Crooked Creek upstream and downstream of the discharges.

		HWWTP			YWWTP	
, Analyte	Upstream of Discharge	Discharge	Downstream of Discharge	Upstream of Discharge*	Discharge	Downstream of Discharge*
TDS (mg/L)	174	314	198	201	298	204
Chloride (mg/L)	6.95	50.8	11.1	7.14	33.4	6.76
Sulfate (mg/L)	6.07	48.4	9.51	8.33	24.2	9.03
Bicarbonate (mg/L)	87.5	26.8	82.5	99.0	127	101
Total Calcium (mg/L)	64.3	43.2	61.8	60.5	52.2	60.9
Total Magnesium (mg/L)	1.91	3.14	2.00	9.79	22.6	12.1
Total Sodium (mg/L)	3.68	47.0	7.24	3.67	23.5	3.51
Total Potassium (mg/L)	1.31	11.1	2.07	1.46	7.24	1.45
Hardness (mg/L)	168	121	162	191	224	202
Number of samples	4	4	4	2	3	2
Sampling Dates	09/11/2012, 11/20/2012, 01/14/2013, 03/26/2013 11/19/2012, 01/14/2013, 03/25					

^{*}Consistent flow was not observed in the reach of Crooked Creek upstream of the YWWTP until January 2013 and in the reach downstream of the YWWTP until February 2013; therefore there were no samples on November 19, 2012, for either of those reaches.

Table 4.9. Average proportion of major cations and anions from the discharges and from Crooked Creek upstream and downstream of the discharges.

	Upstream o	f Discharge	Effl	uent	Downstream	of Discharge
Analyte	Harrison	Yellville	Harrison	Yellville	Harrison	Yellville
Chloride	0.04	0.04	0.16	0.11	0.06	0.03
Sulfate	0.04	0.04	0.15	0.08	0.05	0.04
Bicarbonate	0.50	0.49	0.09	0.42	0.42	0.49
Total Calcium	0.37	0.30	0.14	0.18	0.31	0.30
Total Magnesium	0.01	0.05	0.01	0.08	0.01	0.06
Total Sodium	0.02	0.02	0.15	0.08	0.04	0.02
Total Potassium	0.01	0.01	0.04	0.02	0.01	0.01
Proportion of TDS as measured ions	0.99	0.95	0.76	0.97	0.89	0.95
Proportion of TDS as Ca, Mg, HCO ₃	0.88	0.84	0.24	0.68	0.74	0.85

Table 4.9 shows that the HWWTP and YWWTP effluents are substantially different in terms of ionic composition. The ionic composition of the HWWTP effluent is somewhat evenly distributed among sodium, sulfate, calcium, and chloride, which account for 60% of the total ionic makeup. In contrast, the calcium and bicarbonate ions dominate the ionic composition of the YWWTP effluent, accounting for 60% of the total ionic composition. Although the two discharges have substantially different ionic makeup, the ionic makeup of Crooked Creek upstream versus downstream of the discharges is relatively unaffected (Table 4.9) with calcium and bicarbonate dominating the ionic composition of Crooked Creek upstream and downstream of both discharges.

4.4 Discharge and Receiving Stream Water Quality Characteristics Conclusions

The primary findings of the UAA water quality survey included the following:

- Sulfate and chloride are only minor components of TDS in the Crooked Creek reaches upstream and downstream of the discharges. In contrast, calcium and bicarbonate dominate the TDS composition. Therefore, overall TDS was the primary focus of the evaluation of the designated use attainment. For the purpose of establishing criteria, appropriate sulfate and chloride concentrations should reflect concentrations that are consistent with protective TDS criteria.
- Background concentrations of TDS near Harrison and Yellville routinely exceed the Crooked Creek site-specific criterion.
- Concentrations of sulfate and chloride downstream of Harrison occasionally exceed the Crooked Creek site-specific criteria.
- The HWWTP and YWWTP discharges have a minimal effect on flows, TDS, sulfate, and chloride concentrations and on ionic composition of Crooked Creek downstream of the outfalls.
- Applicable (ecoregion) criteria are not exceeded in the White River downstream of the mouth of Crooked Creek.

5.0 TOXICITY EVALUATION

The Clean Water Act (CWA) prohibits toxic discharges. The potential toxicity of TDS in a discharge will depend on the ionic composition characteristic of the discharge, which can be evaluated three different ways:

- 1. Direct toxicity testing of the effluent through routine monitoring or special sampling,
- 2. Simulated toxicity testing using empirical models, and
- 3. Toxicity testing on effluent spiked with inorganic salts to mimic elevated TDS levels.

In general, the preferred approach is to test on effluent spiked with inorganic salts to mimic elevated TDS levels because it provides a direct measurement of the toxic threshold of TDS of a particular ionic composition. In the case of the HWWTP and YWWTP discharges, the actual ionic strength of the discharges is well below published toxic thresholds (Davies and Hall 2007; Elphick et al. 2011; Lasier and Hardin 2010; Mount et al. 1997; Soucek and Kennedy 2007; Soucek 2007, Soucek et al. 2011, van Dam et al. 2010) for the types of ions present, and the discharges have a relatively minor impact on the ionic strength and composition of the receiving stream. Therefore, evaluation of effluent toxicity tests and simulation using empirical models (Mount et al. 1997; Lasier and Hardin 2010) should provide sufficient information to evaluate the potential for toxicity to occur in whole effluent toxicity (WET) testing on the discharges.

5.1 Literature-Based Evaluation

This evaluation used empirical models developed by Mount et al. (1997) and Lasier and Hardin (2010) to estimate the chronic threshold of chloride and sulfate in the HWWTP and YWWTP discharges. Mount et al. (1997) developed empirical equations to predict percent survival in 48-hour acute toxicity tests on aqueous solutions made of calcium, magnesium, sodium, chloride, sulfate, and bicarbonate. Lasier and Hardin developed acute-to-chronic ratios

(ACRs) for *Ceriodaphnia dubia* in aqueous solutions dominated by chloride, sulfate, and bicarbonate. The approach used herein was to estimate the acute toxicity threshold of chloride and sulfate for *C. dubia* using equations developed by Mount et al. (1997) by "adding" chloride and sulfate as sodium chloride and sodium sulfate to a "simulated effluent" having the ionic composition of the HWWTP and YWWTP discharges indicated in Table 4.8.³ Successively more concentrated solutions were simulated until the predicted survival was 50%. The chloride, sulfate, and TDS concentrations that predicted 50% survival provided an estimate of the acute toxic threshold (LC50). This value was then multiplied by the ACRs reported by Lasier and Hardin (2010) for chloride (4.6) and sulfate (2.3) to estimate the chronic thresholds chloride and sulfate. An ACR of 3.0 was assumed for TDS.

Table 5.1 provides ion concentrations used for input to the Mount et al. (1997) model to return an estimated survival of 50% for the two discharges. Table 5.2 provides the estimated IC25 concentrations (concentration inhibiting *C. dubia* reproduction by 25%) based on model predictions per Mount et al. (1997) and the ACRs from Lasier and Hardin (2010). A comparison of these IC25 values with the maximum TDS, chloride and sulfate values from the biweekly sampling (Tables 4.6 and 4.7) is also presented in Table 5.2. The values summarized in Table 5.2 indicate that the estimated chronic toxicity thresholds exceed maximum mineral concentrations in the effluent by factors of two or more.

5.2 Effluent Testing

Only the HWWTP is required to conduct routine quarterly biomonitoring as a permit requirement. HWWTP has conducted quarterly biomonitoring from the third quarter of 2007 to the first quarter of 2011, at which point the frequency was reduced to semi-annual. When the permit expired in 2012, the biomonitoring frequency returned to quarterly. Between 2007 and the first quarter of 2013, there has been one WET test failure, which occurred during the first quarter of 2008. No lethal or sublethal toxicity was observed in the subsequent monthly retesting

³ For this simulation, we assumed that hardness and alkalinity in the discharges result from properties of the source water which are, in turn, the result of geologic features of the ecoregion. In contrast, anthropogenic inputs to the discharges were assumed to result in additional chloride and sulfate primarily as sodium salts. Accordingly, alkalinity and hardness were held constant in these "simulated effluents."

conducted as required by the permit. None of the 16 subsequent routine tests have shown lethal or sub-lethal toxicity at the critical dilution (84%).

Table 5.1. Ion concentrations used for input to the model by Mount et al. 1997 to return an estimated survival of 50% in a 48-hour acute toxicity test using *C. dubia*.

Ion Concentration	Effluent Source					
(mg/L)	HWWTP	YWWTP				
Sodium	1,010	801				
Potassium	11.1	7.24				
Calcium	43.2	52.2				
Magnesium	3.14	22.6				
Chloride	907	719				
Sulfate	864	685				
Bicarbonate ⁴	54.0	208				
TDS	2,892	2,342				
Cation/anion	1.05	1.02				

Table 5.2. Estimated IC25 (concentration inhibiting *C. dubia* reproduction by 25%) concentrations based on model predictions per Mount et al. (1997) and the ACRs from Lasier and Hardin (2010).

		K. Green	Effluen	t Source		
	HWWTP				YWWT	P
Ion (ACR)	LC50 ^(a) (mg/L)	IC25 ^(b) (mg/L)	IC25÷[max ^(c)]	LC50 ^(a) (mg/L)	IC25 ^(b) (mg/L)	IC25÷[max ^(c)]
Chloride (4.6)	907	197	2.9	719	156	3.9
Sulfate (2.3)	864	376	4.8	685	298	9.9
TDS (3.0)	2,892	964	2.2	2,342	781	2.3

Notes:

- (a) From Table 5.1.
- (b) Based on ACR.
- (c) Highest concentration from biweekly sampling.

Effluent samples from HWWTP and YWWTP were collected on November 28, 2012, and April 2, 2013, and tested for chronic toxicity to *C. dubia* in undiluted effluent per EPA (2002). The sample collected on November 28, 2012, was submitted to AIC for testing. The

⁴ Bicarbonate values in this table differ from those given in Tables 4.6 and 4.7 because Mount et al. (1997) calculated bicarbonates based on APHA (1989).

sample collected on April 2, 2013, was submitted to Huther and Associates, Inc. (HAI; 1156 North Bonnie Brae, Denton, TX 76201) for testing. HAI is certified by ADEQ for this type of testing. For each sampling date, the two effluents were tested concurrently with a common control. TDS, sulfate, and chloride concentrations were measured in each sample. Results are summarized in Table 5.3. Both samples submitted to AIC showed sub-lethal toxicity while neither sample submitted to HAI showed toxicity. Although the level of toxicity correlated with mineral concentrations with the tests performed by AIC, this was not the case with the data set as a whole. For example, the TDS concentration for the YWWTP sample tested by HAI was higher than the YWWTP TDS concentration tested by AIC, but the YWWTP sample tested by AIC showed sub-lethal toxicity while the YWWTP sample tested by HAI did not.

Table 5.3. Results of chronic toxicity tests on HWWTP and YWWTP samples.

7.2	Sample Collected 11/28/2012				2	Sample Collected 04/02/2013					
Sample	S100 ^(a)	R100 ^(b)	Chloride (mg/L)	Sulfate (mg/L)	TDS (mg/L)	S100	R100	Chloride (mg/L)		TDS (mg/L)	
Control	100	18.2	NM	NM	NM	100	21.7	NM	NM	NM	
HWWTP	100	12.9 ^(c)	65	110	430	100	23.5	51	66	340	
YWWTP	100	14.9 ^(c)	41	21	270	100	22.8	23	25	320	

Notes: NM=not measured

- (a) S100 = percent survival (n=10) in undiluted sample
- (b) R100 = average number of neonates per female in undiluted sample
- (c) Significantly less than the control (p = 0.05)

Table 5.4 compares mineral concentrations in the effluent samples collected from HWWTP and YWWTP on November 28, 2012, and April 2, 2013, to chronic toxicity thresholds developed in the previous section (Table 5.2). This comparison demonstrates that the estimated chronic toxicity thresholds are well above the measured ion concentrations from the effluent samples.

These results suggest that the toxicity observed in the samples collected on November 28, 2012, is not due to dissolved minerals.

Table 5.4. Comparison of estimated chronic toxicity thresholds (IC25 concentrations; see Table 5.2) with measured mineral concentrations from HWWTP and YWWTP samples collected November 28, 2012, and April 2, 2013 (see Table 5.3).

***	11.3	Effluent Source						
		All of the second	HWWTP			YWWTP		
Sampling Date	Ion	IC25* (mg/L)	Measured Concentration	IC25 ÷ [measured]	IC25* (mg/L)	Measured Concentration	IC25 ÷ [measured]	
	Chloride	197	65	3.0	156	41	3.8	
11/28/2012	Sulfate	376	110	3.4	298	21	14.2	
	TDS	964	430	2.2	781	270	2.9	
	Chloride	197	51	3.9	156	23	6.8	
04/02/2013	Sulfate	376	66	5.7	298	25	11.9	
	TDS	964	340	2.8	781	320	2.4	

^{*} Value from Table 5.2.

5.3 Toxicity Evaluation Conclusions

This evaluation of potential ion toxicity indicated the following:

- 1. The HWWTP effluent routinely passes NPDES biomonitoring tests;
- 2. TDS, sulfate, and chloride concentrations in the HWWTP and YWWTP samples showing sub-lethal toxicity effluent were well below chronic toxicity thresholds derived from published ion-toxicity relationships; and
- 3. TDS, sulfate and chloride concentrations from biweekly sampling of the HWWTP and YWWTP are well below chronic toxicity thresholds indicated by published ion-toxicity relationships.

This evaluation demonstrates that there is a very low potential for episodes of toxicity in routine WET testing due to current mineral concentrations.

6.0 ATTAINABLE USES

This section evaluates attainable uses in Crooked Creek in the presence of the HWWTP and YWWTP discharges.

6.1 Primary and Secondary Contact Recreation

Mineral content of surface water is not typically a relevant parameter used to consider the attainability of contact recreation uses. Therefore, current concentrations of dissolved minerals should have no effect on the attainability of these uses.

6.2 Domestic Water Supply

Current concentrations of TDS are well below secondary drinking water standards for TDS, sulfate, and chloride of 500, 250, and 250 mg/L, respectively. Therefore, the current mineral regime in the receiving streams will support this use.

6.3 Industrial Water Supply

Current concentrations of dissolved minerals do not affect the attainability of this use.

6.4 Agricultural Water Supply: Crops

The most commonly used guideline for salinity tolerance of crops is Ayers and Westcot (1985). In this document, yield potentials for a number of crops are associated with soil and water salinity values measured as electrical conductance. Salinity values associated with yield potentials for cotton, soybeans, and rice are summarized in Table 6.1. The water salinity (ECw) values reported in Ayers and Westcot (1985) have been calculated from the soil salinity (ECe) values reported (ECw = ECe/1.5). TDS values shown in Table 6.1 were calculated from the conductivity values (TDS = 650*conductivity). The average TDS concentration for Crooked Creek downstream of the HWWTP (220 mg/L; see Table 4.6) is well below the calculated irrigation water TDS values summarized in Table 6.1, thus indicating that effluent TDS would not be expected to negatively affect crop productivity. The US Salinity Laboratory

(US Department of Agriculture, Agricultural Research Services) has calculated linear regressions of irrigation water salinity (measured as the conductivity) to relative rice yield measurements based on experiments conducted in the late 1990s (Zeng and Shannon 2000). These relationships are based on the response of rice to sodium chloride (NaCl) solutions of various strengths that were used for irrigation in the experiments. Table 6.2 shows irrigation water conductivities for relative yields of grain weight per panicle and grain weight per plant that correspond to the yield potentials that are shown in Table 6.1. These values were calculated using Zeng and Shannon's (2000) linear regression equations. TDS values in Table 6.2 are calculated using the same equation as Table 6.1 values. The linear regression relationships developed by the US Salinity Laboratory indicate that a TDS concentration (due primarily to NaCl) of 1,000 mg/L could reduce rice productivity by about 10%. Tacker et al. (2001) also report that irrigation water with conductivity greater than 1.2 dS/m (approximately 780 mg/L TDS) is borderline for use on rice. The University of Arkansas Cooperative Extension Service reports that TDS levels greater than 770 parts per million (ppm) in irrigation water for rice are cause for concern.

Table 6.1. Influence of soil salinity (ECe) and irrigation water salinity (ECw) on crop tolerance and yield potential of selected crops (Ayers and Westcot 1985).

		100%	yield	90%	yield	rield 75% yield		50% yield		0% yield	
Crop	Parameter	ECe	ECw	ECe	ECw	ECe	ECw	ECe	ECw	ECe	ECw
Cotton	Cond, dS/m	7.7	5.1	9.6	6.4	13	8.4	17	12	27	18
Cotton	TDS, mg/L		3,315		4,160		5,460		7,800		11,700
Rice	Cond, dS/m	3	2	3.8	2.6	5.1	3.4	7.2	4.8	11	7.6
Rice	TDS, mg/L		1,300		1,690		2,210		3,120		4,940
Soybean	Cond, dS/m	5	3.3	5.5	3.7	6.3	4.2	7.5	5	10.	6.7
	TDS, mg/L		2,145		2,405		2,730		3,250		4,355

Table 6.2. Irrigation water salinity for selected relative rice yield measurements calculated using US Salinity Laboratory linear regression equations (Zeng and Shannon 2000).

Yield Measurement	Parameter	100	90	75	50	0
Cusin vysicht man maniala (a)	Conductance (dS/m)	0.49	1.71	3.54	6.59	12.68
Grain weight per panicle (a)	TDS (mg/L)	317	1,110	2,299	4,280	8,244
Grain weight per plant (b)	Conductance (dS/m)	0.46	1.52	3.12	5.78	11.10
Gram weight per plant	TDS (mg/L)	297	989	2,026	3,755	7,212

Notes:

This information indicates that Crooked Creek is suitable for irrigation, and the mineral concentrations in Crooked Creek will not affect the attainability of the agricultural water supply use.

6.5 Agricultural Water Supply: Livestock

There are no published guidelines for salinity/TDS in pasture irrigation water (personal communication, Bryce Baldridge, University of Arkansas Extension Agent, Lawrence County, University of Arkansas Extension Service, Walnut Ridge, Arkansas). However, field observations indicate that the land adjacent to Crooked Creek is used extensively as cattle pasture. This information indicates that these aspects of the agricultural water supply use are currently attained in Crooked Creek.

6.6 Aquatic Life

To evaluate the attainability of aquatic life uses (perennial Ozark Highlands fishery) water quality and biological surveys were conducted during the fall of 2012 (September 19 and 20 and November 27 and 28) and spring of 2013 (April 2 and 3). The purpose of the field surveys was as follows:

⁽a) ECw = (1.040 - relative yield)/0.082, $r^2 = 0.87$

⁽b) ECw = (1.043 - relative yield)/0.094, $r^2 = 0.83$

- 1. To establish the range of chemical, physical, habitat and biological conditions present in Crooked Creek upstream and downstream of the HWWTP and YWWTP outfalls; and
- 2. To evaluate factors (habitat, pollutants) that could potentially limit aquatic life in downstream stream reaches affected by the HWWTP and YWWTP discharges.

Attainability of the aquatic life use is addressed in Section 7 of this document.

7.0 AQUATIC LIFE ATTAINMENT EVALUATION

The evaluation of attainable aquatic life uses included a field survey of benthic macroinvertebrates, fish, and habitat upstream and downstream of the HWWTP during the dry season (September and November 2012) flow conditions and a field survey of benthic macroinvertebrates and habitat upstream and downstream of the HWWTP and YWWTP during the wet season (April 2013) flow conditions.

One objective of the analysis of biological communities was to evaluate the effects of elevated minerals due to the HWWTP and YWWTP discharges. Accordingly, this evaluation involved comparisons between upstream and downstream communities. Because sulfate and chloride are only minor components of TDS in the Crooked Creek reaches upstream and downstream of the discharges (Section 4.3), overall TDS was the primary focus of the evaluation of the designated use attainment. Monitoring data presented in Section 4.0 demonstrate that TDS concentrations at both the upstream and downstream sites in both reaches exceed the Crooked Creek TDS criterion of 200 mg/L. Therefore, upstream versus downstream comparisons of biological communities do not address potential effects on aquatic life due to the fact that TDS concentrations also exceed the criterion upstream of the outfall. Evaluation of potential effects due to TDS concentrations that exceed criteria must be based on comparisons with reference locations that do not exceed TDS criteria. Therefore, the comparisons of primary interest were as follows:

- 1. CC-0 versus CC-1 to assess potential effects on Crooked Creek due to the HWWTP discharge,
- 2. CC-2 versus CC-3 to assess potential effects on Crooked Creek due to the YWWTP discharge, and
- 3. All Crooked Creek locations versus least-disturbed Ozark Highland ecoregion reference streams to document potential differences in biological communities resulting from the existing minerals regime in Crooked Creek.

Comparisons with reference streams used available data from ADEQ's routine biological monitoring of least-disturbed waterbodies. An advantage of this type of comparison is that it can

account for variability among sites with information from several reference sites and comparison sites. A disadvantage of this approach is that the comparison is somewhat biased because Crooked Creek is not a least-disturbed system in the reaches upstream and downstream of the HWWTP and YWWTP discharges. Therefore, a certain level of impairment due to factors other than minerals (e.g., urbanization and other land uses) should be expected in those reaches.

Based on conversations with ADEQ staff, this approach used benthic macroinvertebrate and water quality collections from Yocum Creek (YC) and Long Creek (LC) at two locations on each stream (YC-1, YC-2, LC-1 and LC-2). Basic information for these sites is provided in Table 7.1. Both spring and fall macrobenthos collections were available from one or two sites on both reference streams. Field sampling methods used in ADEQ's routine biological monitoring (timed single-habitat collections from riffles) as well as sample sorting and taxonomic identification protocols were comparable to those used for this study.

Table 7.1. Basic information for least-disturbed reference sites used in the analysis of benthic macroinvertebrate communities.

Stream Name	Drainage Area (mi²)	Latitude	Longitude	Sample Date	ADEQ Sample Reference Number
Yocum Creek 1	55	36.41444	-93.3829	06/07/2001	ADEQ4k-50
1 ocum Creek i	33	30.41444	-93.3629	11/01/2000	ADEQ4k-3
Yocum Creek 2	55	36.41439	-93.3862	N/A	N/A
1 ocum Creek 2	33	30.41439	-93.3802	11/01/2000	ADEQ4k-4
Long Creek 1	190	36.38808	-93.3116	06/07/2001	ADEQ4k-48
Long Creek I	190	30.3000	-93.3110	10/31/2000	ADEQ4k-1
Long Charle 2	190	26 20702	-93.3116	06/07/2001	ADEQ4k-49
Long Creek 2	190	36.38793	-93.3110	10/31/2000	ADEQ4k-2

Sampling of the Crooked Creek biological communities involved the following efforts:

- Fall 2012: Fish and benthic macroinvertebrate sampling upstream and downstream of the HWWTP (locations CC-0 and CC-1, respectively), and
- Spring 2013: Benthic macroinvertebrate sampling upstream and downstream of HWWTP (CC-0 and CC-1, respectively) and YWWTP (CC-2 and CC-3, respectively).

Fall sampling in the YWWTP reach was not conducted because surface flow was absent, as is normal for that reach during that season. An examination of the results of the fall sampling of the HWWTP reach and consultation with ADEQ staff indicated that there would be no need for additional fish sampling during the spring 2013 and that an adequate assessment of effects on the biota due to mineral discharges could be made based on the fall benthic macroinvertebrate and fish sampling of the HWWTP reach and spring macroinvertebrate sampling of both the HWWTP and YWWTP reaches.

The approach to evaluating differences in communities using multiple reference and comparison sites was to compute the overall percent similarity for each pair-wise combination of reference and Crooked Creek sites. The magnitude and consistency of differences between reference and Crooked Creek sites were compared by examining the average and range of percent similarity across all pair-wise comparisons in light of differences in water quality (i.e., minerals).

7.1 Habitat Evaluation

Comparisons between upstream and downstream fish communities require that habitat is at least roughly equivalent between comparison reaches or that the confounding effects of habitat can be resolved based on habitat preferences of the biota. Benthic macroinvertebrate collection was conducted in a single habitat (riffle) within each reach so that habitat would have less potential to confound comparisons with the macroinvertebrate communities. Habitat characterization followed high-gradient stream habitat assessment procedures per Barbour et al. (1999). The characterization included visual evaluation of physical habitat and a scoring methodology that allowed a rough comparison of habitat quality among sites.

Physical variables assessed included the following:

- 1. Canopy cover,
- 2. Substrate type,
- 3. Sediment characteristics,
- 4. Dominant aquatic vegetation,
- 5. Proportion of reach with aquatic vegetation,

- 6. Pool/riffle ratio,
- 7. Average depth, width, current velocity,
- 8. Dominant riparian vegetation, and
- 9. Watershed features.

Scored habitat variables included the following:

- 10. Epifaunal substrate/available cover,
- 11. Embeddedness,
- 12. Velocity/depth regime,
- 13. Sediment deposition,
- 14. Channel flow status,
- 15. Channel alteration,
- 16. Frequency of riffles or bends,
- 17. Bank stability,
- 18. Vegetative protection, and
- 19. Riparian vegetative zone width.

Assessment of physical and habitat characteristics was conducted upstream (CC-0) and downstream (CC-1) of the HWWTP during September and November 2012 and April 2013, as well as upstream and downstream of YWWTP during April 2013, to identify potential habitat differences between the comparison reaches. The same FTN field personnel performed the evaluations of the upstream and downstream reaches.

7.1.1 Habitat Characteristics: Results and Discussion

Results of the assessment of physical characteristics and habitat variables upstream (CC-0) and downstream (CC-1) of the HWWTP for the fall 2012 sampling are presented in Tables 7.2 and 7.3. Results of the assessment of upstream and downstream locations for the spring 2013 sampling are presented in Tables 7.4 and 7.5. Completed habitat forms are provided in Appendix D. Nonpoint runoff from urbanization and pasture habitat within the immediate

vicinity potentially affected both upstream and downstream locations of both reaches. Neither of the stream reaches was channelized.

Crooked Creek habitat was comparable upstream and downstream of the HWWTP and was comprised of pools, riffles, and runs dominated by cobble and gravel with a small percentage of organic substrate components. Scored habitat variables (Tables 7.2 and 7.4) can be used to evaluate relative habitat quality. Although they are somewhat subjective and subject to investigator bias, they are useful for evaluating general trends and relationships and for detecting large differences in habitat. A given difference in total habitat scores can be due to small consistent differences among most or all parameters, or large differences among a few. In general, differences in total habitat scores of approximately 20 points or more can be considered to indicate an actual difference in habitat quality. By this criterion, the assessment indicated similar habitat quality of optimal condition in the reaches upstream and downstream of the HWWTP and the YWWTP (Tables 7.2 and 7.4).

Comparison of physical habitat variables (Tables 7.3 and 7.5) also indicated similar conditions upstream and downstream of both discharges. One notable seasonal difference was higher substrate coverage with attached algae in the reaches upstream and downstream of HWWTP in the spring sampling (up to 80% in both reaches; see Table 7.5) compared to the fall sampling (0% to 1%; see Table 7.3). Discharge data collected in the immediate vicinity of the macroinvertebrate sampling locations show similar depths and velocities in the upstream and downstream macroinvertebrate sampling locations. The downstream location was approximately 0.1 ft deeper and 0.14 ft/sec slower than the upstream location.

Table 7.2. Summary of habitat evaluation performed September 19 and 20, 2012.

Category	CC-0	CC-1*
Epifaunal Substrate/Available Cover	18	18
Embeddedness	18	17.5
Velocity/Depth Regime	19	17
Sediment Deposition	15	16
Channel Flow Status	14	16.5
Channel Alteration	20	20
Frequency of riffles	20	19
Bank Stability	7/9	6.5/7
Vegetative Protection	7/9	8.5/9
Riparian Vegetative Zone Width	3/10	6/9.5
Total Habitat Score	169	170.5

^{*} The score reported is the average of scores from two separate sections of the reach scored independently.

Table 7.3. Summary of physical and habitat characteristics evaluation performed September 19 and 20, 2012.

Ca	itegory	CC-0	CC-1	
Canopy cover		Partly open	Partly open	
	Bedrock	10	10	
	Boulder	5	10	
T	Cobble	35	25	
Inorganic substrate (%	Gravel	50	50	
coverage)	Sand	0	2	
	Silt	0	3	
	Clay	0	0	
0	CPOM	<5	5	
Organic substrate (%	FPOM	<1	<5	
composition)	Shell	0	0	
Dominant aquatic vegeta	tion	None	Rooted emergent	
Percent of reach with aqu	natic vegetation	0	1	
Pool/riffle ratio		1:2	1:3	
Average stream depth (m	1)	0.4	0.3	
Average stream width (m	1)	10	12.5	
Average current velocity	(m/s)	0.2	0.2	
Substrate odors		Normal	Normal	
Substrate oils		None	None	
Substrate deposits		None	None	
Embedded stones black of	on underside?	No	No	
Dominant riparian vegeta	ation	Trees (RB)/grasses (LB)	Trees (RB)/grasses (LB)	
	Land use	Forest/field/pasture	Forest/field/pasture	
Watershed features	Pollution sources	Yes	Yes	
	Erosion	Minimal	Minimal	
Weather		Clear/sunny	Clear/sunny	

Table 7.4. Summary of habitat evaluation performed April 2 and 3, 2013.

Category	CC-0	CC-1*	CC-2	CC-3
Epifaunal Substrate/Available Cover	19	17.5	16	19
Embeddedness	18	17	18	17
Velocity/Depth Regime	19	19	19	20
Sediment Deposition	19	16.5	18	18
Channel Flow Status	19	19	19	19
Channel Alteration	20	20	20	17
Frequency of Riffles (or bends)	20	19	13	19
Bank Stability (LB)	6	5.5	7	8
Bank Stability (RB)	9	7.5	9	9
Vegetative Protection (LB)	5	6.5	9	9
Vegetative Protection (RB)	10	8.5	10	9
Riparian Vegetative Zone Width (LB)	3	6.5	9	10
Riparian Vegetative Zone Width (RB)	10	9	10	9
Total Habitat Score	177	171.5	177	183

^{*} The score reported is the average of scores from two separate sections of the reach scored independently.

Table 7.5. Summary of physical and habitat characteristics evaluation performed April 2 and 3, 2013.

Cate	gory	CC-0	CC-1 (upstream portion)*	CC-1 (downstream portion)*	CC-2	CC-3
Canopy cover		Partly open	Partly open	Partly open	Partly open	Partly open
	Bedrock	10	10	10	0	0
	Boulder	5	10	10	< 1	5
Inorganic	Cobble	40	35	30	50	45
substrate	Gravel	45	45	50	50	50
(% coverage)	Sand	0	0	0	0	0
	Silt	0	0	0	0	0
	Clay	0	0	0	0	0
Organic	CPOM	10	5	< 5	0	0
substrate (%	FPOM	0	0	0	0	0
composition)	Shell	0	0	0	0	0
Dominant aquatic vegetation		Attached algae	Attached algae	Rooted & attached algae	None	None
Percent of read aquatic vegeta		80	80	5	0	0
Pool/riffle ration		1:1	1:1	1:2	4:1	4:1
Average strear	n depth (m)	NR	NR	NR	NR	NR
Average stream		10	NR	10	25	25
Average curre (m/s)	nt velocity	NR	NR	NR	NR	NR
Substrate odor	'S	Normal	Normal	Normal	Normal	Normal
Substrate oils		Absent	Absent	Absent	Absent	Absent
Substrate depo	sits	None	None	None	None	None
Embedded sto underside?	nes black on	No	No	No	No	No
Dominant ripa vegetation	rian	Trees, grasses	Trees, grasses	Trees	Trees	Trees
Watershed	Land use	Forest, field, pasture	Forest, field, pasture	Forest, field, pasture	Forest, field pasture	Forest, field pasture
features	Pollution sources	Yes	Yes	Yes	Yes	Yes
	Erosion	Moderate	Moderate	Moderate	Moderate	Moderate
Weather		Rain	Rain	Rain	Cloudy	Rain

^{*}Upstream and downstream portions of CC-1 refer to upstream and downstream portions of the reach in which sampling site CC-1 is located.

Substrate composition among the Crooked Creek sampling locations (where macroinvertebrate sampling was conducted) and the reference stream locations is summarized on Figure 7.1.

Both fall and spring sampling included the collection of a duplicate riffle sample from the location downstream of the HWWTP (CC-1). Differences between the duplicate samples were within the expected range of variability.

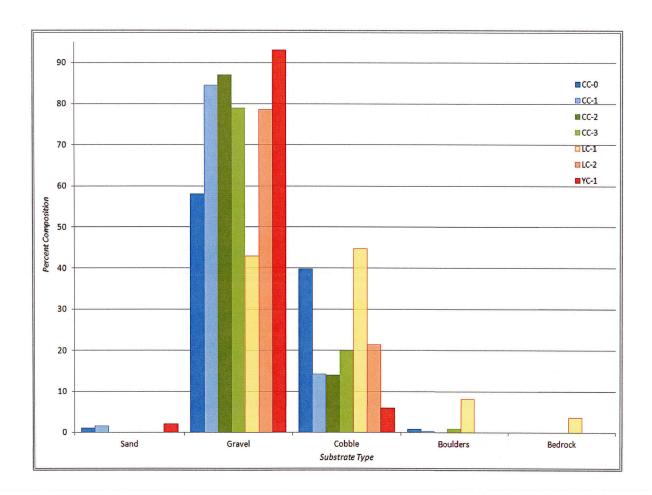


Figure 7.1. Substrate composition in Crooked Creek and the reference streams.

7.1.2 Habitat Characteristics: Conclusions

Habitat assessments indicated that within the study area, Crooked Creek is a waterbody with generally coarse substrates and land use dominated by forest and pasture. No differences in habitat quality upstream (CC-0) and downstream (CC-1) of the HWWTP were indicated by the assessment, including variables that could be affected by water quality such as an abundance of filamentous algae. Habitat evaluations indicated very similar habitat overall upstream and downstream of the YWWTP. The procedure classified habitat at both reaches as "optimal." The abundance and diversity of fish is expected to follow the same general pattern as habitat quality. Large deviations from this expectation indicate the influence of other limiting factors such as water quality.

Visual evaluation of Figure 7.1 indicates that (1) gravel and cobble substrates dominate all Crooked Creek and reference locations, and (2) the range of percent gravel and cobble composition at the sampling sites is within the range of percent gravel and cobble composition at the reference stream locations. This comparison shows that substrate composition was generally comparable between upstream and downstream sampling locations in Crooked Creek and between the reference stream locations and Crooked Creek sampling locations. None of the sites contained fine or embedded substrates that might be expected to impair benthic macroinvertebrate communities.

7.2 Biological Community Survey Methodology

7.2.1 Benthic Macroinvertebrate Field and Laboratory Methods

Invertebrate sampling was conducted using the five-minute traveling kick method (ADEQ 2010). Invertebrates were sampled using a D-frame kick net with 0.5-mm mesh net. Two riffles within each reach were sampled for a combined time of five minutes. Each riffle was sampled by starting at a downstream corner of the riffle and kicking the substrate along a diagonal path upstream through the riffle for 2.5 minutes. The two riffle samples were combined into one composite sample. After removal and washing of large debris, the entire content of the net was washed into wide-mouth plastic jars and immediately preserved with 70% ethanol.

Both fall and spring sampling included the collection of a duplicate riffle sample from the location downstream of the HWWTP (CC-1).

Samples were sorted in the laboratory by dispensing the entire sample onto a Caton grid. All organisms were sorted from randomly selected grids, one grid at a time, until a minimum of 250 organisms were collected. All individuals were counted in the selected grid. If one grid yielded greater than 250 organisms, the sub-sampling was considered complete. Some samples yielded large numbers of organisms in the first grid (e.g., the CC-1 duplicate yielded greater than 700 individuals). Sorted organisms were transferred to 70% ethanol in glass vials. To assure thorough removal of specimens from the sample, the sorted residue was retained and examined by a second biological technician. If the second sorting produced fewer than 10% of the number of organisms found in the initial sorting, the sorting of that sample was considered complete. If the second sorting produced more than 10% of the number of organisms found in the initial sorting, the sample was resorted until the 10% goal was reached.

Taxonomic identifications were carried out to the lowest practical taxon according to Merritt and Cummins (1996), Thorp and Covich (2001) and Houston (1980). In general, macroinvertebrates were identified to genus except for bivalve mollusks, gastropods, dipteran larvae, and decapod shrimp, which were identified to family. A voucher collection of invertebrate taxa collected at the sites was retained for further reference. Taxonomic identifications in the voucher collection were verified by a second taxonomist and identification discrepancies were resolved.

7.2.2 Benthic Macroinvertebrate Data Analysis

Benthic invertebrate data were evaluated following the bioassessment III protocols outlined in Plafkin et al. (1989) as modified by ADEQ (ADEQ personal communication). Appendix E provides a detailed description of this methodology as applied to this study for two types of comparisons: (1) locations downstream of the HWWTP and YWWTP discharges using upstream sites as a reference (CC-1 versus CC-0 for the HWWTP reach and CC-3 versus CC-2 for the YWWTP reach); and (2) all Crooked Creek stations versus least-disturbed waterbodies (LC-1, LC-2, YC-1, and YC-2).

7.2.3 Fish Sampling Methods

Prior to sampling each stream reach, the upper and lower ends of the reach were cordoned off using block nets. Fish sampling was conducted using a Smith-Root LR-24 DC current backpack electroshocker. Sampling of each reach was conducted by probing all available habitat beginning at the downstream end of the reach, and proceeding upstream. Two sampling passes were performed on each reach. Stunned fish were collected in a plastic bucket and maintained with aeration until processed. Each individual captured was identified in the field to species according to Robison and Buchanan (1988). Physical anomalies were documented. Individuals not positively identified in the field were killed, preserved in formalin, and identified in the laboratory. After processing, all living fish were returned to the sampling reach.

Fish data were evaluated using the fish community biocriteria for Ozark Highland streams (Table 7.6) established by ADEQ (personal communication). Total scores of 37 to 45 identify the stream as fully supporting the designated use, 25 to 36 as generally supporting, 13 to 24 as impaired, and 0 to 12 as not supporting.

Table 7.6. Fish community biocriteria for Ozark Highlands streams.

	Score					
Metric	5	3	1			
% Sensitive Individuals	>31	31-20	<20			
% Cyprinidae (Minnows)	48 – 64	39 - 47 or 65 - 73	<39 or >73			
% Ictaluridae (Catfishes)	>2 ^(a)	$1 - 2^{(a)}$	<1 or >3% bullheads			
% Centrarchidae (Sunfishes)	$4-15^{(b)}$	$<4 \text{ or } 15-20^{(b)}$	>20 or >2% green sunfish			
% Percidae (Darters)	>11	5 – 11	<5			
% Primary Feeders	<42	42 – 49	>49			
% "Key" Individuals	>23	23 - 16	<16			
Diversity*	>2.77	2.77 - 2.37	<2.37			
# Species	>WA*0.034+16.45	WA*0.034+16.45 to WA*0.034+12.26	<wa*0.034+12.26< td=""></wa*0.034+12.26<>			

Notes: WA = watershed area (mi²)

(a) No more than 7% bullheads.

(b) No more than 12% green sunfish.

7.3 Biological Characteristics Results and Discussion

7.3.1 Benthic Macroinvertebrates

Upstream versus Downstream of HWWTP and YWWTP Outfalls

Table 7.7 summarizes the percent similarity of benthic macroinvertebrate communities upstream versus downstream of the HWWTP and YWWTP. Appendix E provides a detailed description of how Table 7.7 was compiled. The fall samples indicated slight to no significant impairment at the location downstream of the HWWTP (CC-1 and CC-1 duplicate) relative to the upstream location (CC-0). The spring samples indicated slight to no significant impairment at the location downstream of the HWWTP and moderate impairment at the location downstream of the YWWTP.

Table 7.7. Summary of upstream versus downstream comparisons of benthic macroinvertebrate communities in Crooked Creek.

Season	Downstream Station	Percent Similarity with Reference (Upstream)	Interpretation
Fall	CC-1 (HWWTP)	68.8%	Slight impairment
ган	CC-1 duplicate (HWWTP)	93.8%	No significant impairment
	CC-1 (HWWTP)	75.0%	Slight impairment
Spring	CC-1 duplicate (HWWTP)	87.5%	No significant impairment
	CC-3 (YWWTP)	33.3%	Moderate impairment

One of the potential underlying mechanisms that may affect assemblage structure is the presence of stressors such as elevated mineral concentrations, which is the focus of this study. As shown in Section 4.0, the outfalls have a minor influence on downstream TDS concentrations at both locations. Average TDS, sulfate, and chloride concentrations increased by 17 mg/L, 4.9 mg/L, and 4.9 mg/L, respectively, in Crooked Creek below the HWWTP outfall (Table 4.6). This corresponded to a minimal change in the macroinvertebrate community downstream as represented by duplicate samples (no significant impairment to slight impairment; see Table 7.7). Upstream to downstream differences in TDS concentrations in both reaches are typically less than monthly or biweekly differences (Figure 4.1). It is not clear whether a cause and effect relationship would be expected to exist between small changes such as these. The YWWTP reaches showed the largest upstream to downstream assemblage differences (Table 7.7) but

showed the smallest upstream to downstream mineral differences in both absolute and relative terms, where average TDS and sulfate concentrations increased by 8 mg/L and 0.6 mg/L, respectively, downstream of the YWWTP outfall (Table 4.7). This result shows that the magnitude of the minerals increase downstream of the discharge is not commensurate with the downstream change in the benthic macroinvertebrate communities. If the macroinvertebrate assemblages are responding to the modest upstream to downstream increases in mineral concentrations (i.e., a less than 10% difference in upstream versus downstream 95th percentile TDS values), then the greatest upstream to downstream mineral differences (observed at the HWWTP) should cause the greatest upstream to downstream assemblage differences. The opposite was observed. Accordingly, there must be other underlying mechanisms affecting assemblage structure. These underlying factors do not appear to be related to physical habitat or substrate because those factors do not vary appreciably between upstream and downstream locations.

Crooked Creek Locations versus Least-Disturbed Reference Streams

Overall similarity values for each pair-wise combination of a Crooked Creek location versus a least-disturbed reference location are provided in Table 7.8 and summarized in Table 7.9. Appendix E provides a detailed description of how Tables 7.8 and 7.9 were compiled. Table 7.9 demonstrates that depending on the season and the particular sites that are compared, sites upstream or downstream of the HWWTP or YWWTP were slightly to moderately impaired relative to least-disturbed reference sites.

Table 7.8. Comparison matrix of overall percent similarity between least-disturbed reference streams and Crooked Creek sites.

Season	Site	YC-1	YC-2	LC-1	LC-2
	CC-0	52.9%	66.7%	46.7%	60.0%
Fall	CC-1	41.2%	66.7%	53.3%	60.0%
	CC-1 Dup	47.1%	86.7%	60.0%	73.3%
	CC-0	47.1%	No data	44.4%	50.0%
	CC-1	41.2%	No data	44.4%	44.4%
Spring	CC-1 Dup	41.2%	No data	38.9%	44.4%
	CC-2	58.8%	No data	66.7%	66.7%
	CC-3	29.4%	No data	27.8%	27.8%

Table 7.9. Summary of overall percent similarity between least-disturbed reference and Crooked Creek sites.

Season	Summary Statistic	Percent Similarity	Interpretation
	Minimum	41.2%	Moderate Impairment
Fall	Mean	59.5%	Slight Impairment
	Maximum	86.7%	No Significant Impairment
	Minimum	27.8%	Moderate Impairment
Spring	Mean	44.9%	Moderate Impairment
	Maximum	66.7%	Slight Impairment

A summary of TDS, chloride and sulfate concentrations from ten sampling events on Yocum Creek and Long Creek during the same general time period as the biological sample collection (2001 through 2004 for the water quality sampling versus 2000 and 2001 for the biological sampling), and during multiple seasons, shows an average TDS concentration of 228 mg/L (14% greater than the Crooked Creek criterion), with all measurements in excess of the Crooked Creek TDS criterion of 200 mg/L (Table 7.10). Sulfate and chloride values were all less than the current Crooked Creek criteria.

Table 7.10. Summary of mineral concentrations from ADEQ sampling of Long Creek and Yocum Creek least-disturbed streams.

Location	Sampling Date	TDS (mg/L)	Sulfate (mg/L)	Chloride (mg/L)
	10/10/2000	238	7.8	15.6
	11/07/2000	226	7.9	14.5
Long Creek (ADEQ WHI0071)	09/12/2000	227	6.9	14.0
, , , , , , , , , , , , , , , , , , ,	05/29/2001	229	9.7	17.0
	06/26/2001	226	9.2	17.0
	10/27/2003	235	5.9	12.2
77 G 1 (ADEO HUHO127)	01/12/2004	236	7.5	12.6
Yocum Creek (ADEQ WHI0137)	03/22/2004	233	6.9	12.8
	05/17/2004	207	5.7	9.9
Minimum		207	5.7	9.9
Mean		228	7.5	14.0
Maximum		238	9.7	17.0

These TDS concentrations exceed Crooked Creek criteria by similar or greater magnitudes than concentrations from biweekly monitoring of the Crooked Creek locations

during this study. This result demonstrates that TDS concentrations similar to the existing Crooked Creek concentrations, including those influenced by the discharges, will support a least-disturbed benthic macroinvertebrate community. This would also suggest that the slight changes in TDS upstream and downstream of the HWWTP do not cause the observed differences in the benthic macroinvertebrate community in that reach. Chloride and sulfate concentrations are higher in Crooked Creek than in the least-disturbed streams (though still generally lower than ecoregion criteria). As discussed in Section 4.3, chloride and sulfate are a minor part of the ionic makeup of Crooked Creek, with most TDS present as calcium and bicarbonate (Table 4.9). This is likely the case for Ozark Highland ecoregion streams in general. Therefore, for the purposes of aquatic life protection in this case, it is appropriate to focus on TDS.

7.3.2 Fish

Relative species abundances for the September 2012 collections are presented in Table 7.11. Biocriteria metrics and metric values (Ozark Highlands streams) for the September 2012 collection in the HWWTP reach are presented in Table 7.12.

Cyprinids dominated fish communities in terms of species composition and numbers of individuals in Crooked Creek upstream (CC-0) and downstream (CC-1) of the HWWTP (Table 7.11). Campostoma oligolepis was the most common cyprinid at both locations followed by Luxilus pilsbryi. In addition, the most common species by family at both sites were Hypentelium nigricans (Catostomidae), Noturus exilis (Ictaluridae), Ambloplites constellatus (Centrarchidae), Etheostoma caeruleum (Percidae), and Cottus carolinae (Cottidae). All dominant species by family, with the exception of Campostoma oligolepis and Cottus carolinae are key species in the Ozark Highlands. Cottus carolinae is an indicator species in the Ozark Highlands.

The fish communities upstream and downstream of the HWWTP were very similar with respect to the total taxa, relative abundances, and biocriteria metric values for the Ozark Highlands streams (Tables 7.11 and 7.12). The fish community IBI scores indicate that Crooked Creek "generally supports" Ozark Highland fish communities upstream of the HWWTP (CC-0) and "fully supports" those communities downstream of the HWWTP (CC-1).

Summary of fish collections (as percent relative abundance) conducted September 19 and 20, 2012. Table 7.11.

		Sampling Location		
Family	Species	CC-0	CC-1	
Cyprinidae	Campostoma oligolepis	52.1	48.6	
	Luxilus chrysocephalus	0.3	0.3	
	Luxilus pilsbryi*	14.0	11.7	
	Nocomis biguttatus	1.0	0.5	
Cyprinidae	Notropis nubilus**	4.3	5.1	
- J F	Notropis rubellus	1.3	1.4	
	Pimephales notatus	0.6	0.4	
	Semotilus atromaculatus	0.0	0.2	
C-44	Hypentelium nigricans*	1.2	0.9	
Catostomidae	Moxostoma duquesnii	0.5	0.5	
Ictaluridae	Ameiurus natalis	0.0	0.2	
	Noturus exilis*	3.2	1.8	
D 11:1	Fundulus catenatus	0.0	0.1	
Fundulidae	Fundulus olivaceus	0.0	0.1	
Poeciliidae	Gambusia affinis	0.2	0.1	
	Ambloplites constellatus*	2.3	2.8	
	Lepomis cyanellus	0.1	0.0	
Centrarchidae	Lepomis megalotis	0.8	1.0	
	Micropterus dolomieu*	0.4	0.5	
	Micropterus salmoides	0.1	0.1	
	Etheostoma blennioides	0.7	1.1	
Percidae	Etheostoma caeruleum*	14.1	18.6	
	Etheostoma zonale	0.4	1.1	
Cottidae	Cottus carolinae**	2.4	3.0	
	Total Taxa	20	23	
	Total Number	1,078	1,681	

^{*} Ozark Highlands ecoregion key species
** Ozark Highlands ecoregion indicator species

Table 7.12. Summary of fish community biocriteria metrics for sampling conducted September 19 through 20, 2012.

	Sampling Location						
	C	C -0	CC-1				
Biocriteria Metric	Metric Score	Metric Value	Metric Score	Metric Value			
% Sensitive Individuals	5	41.56	5	43.96			
% Cyprinidae	1	73.56	3	68.23			
% Ictaluridae	5	3.25	5	2.02			
(% bullheads)		0.00		0.18			
% Centrarchidae	3	3.71	5	4.34			
(% Green sunfish)		0.09		0.00			
% Percidae	5	15.21	5	20.70			
% Primary Feeders	1	56.96	1	54.07			
% Key Individuals	5	35.25	5	36.29			
Diversity	3	2.43	3	2.53			
# Species	3	15-20*	5	15-20*			
Total Score	3	51	3	7			

^{*}Metric value was calculated using a watershed size of 76 square miles.

7.4 Additional Factors Potentially Affecting Use Attainability

ADEQ's review of the draft UAA report requested evaluation of causal variables that might contribute to the impairment observed in the macrobenthic community downstream of YWWTP in the spring sampling, such as habitat variables (see Sections 7.1.1 and 7.1.2), timeliness of sampling efforts downstream of the YWWTP after consistent flow was re-established, and other water quality parameters such as nutrients.

7.4.1 Timeliness of Sampling Efforts

As discussed in Section 4.1.2, the sampling site downstream of YWWTP did not achieve consistent flow until approximately 40 days after consistent flow was achieved at the upstream sampling site. The biological sampling effort occurred in Crooked Creek approximately 90 and 50 days after consistent flow was achieved at the YWWTP upstream and downstream sites, respectively. The extent to which this difference could account for the observed differences in the macroinvertebrate communities is unclear. Differences in the time available for colonization might be expected to affect diversity measures such as taxa richness and community loss. The score for the upstream versus downstream comparison of taxa richness was zero for the YWWTP

reach in spring 2013 (see Table E.7 in Appendix E), which is consistent with this expectation. However, the comparison for the community loss metric (score = 4) does not support this expectation. It is unclear how time of colonization might affect the remaining metrics in Table E.7.

7.4.2 Other Water Quality Variables

FTN deployed data loggers upstream and downstream on the YWWTP in the spring of 2013 to monitor diel changes in dissolved oxygen, pH, conductivity, and temperature. However, the upstream logger malfunctioned during deployment, which precluded an upstream versus downstream comparison of those factors.

Biweekly sampling of the receiving streams and discharges included analyses of major anions and cations in selected samples, which demonstrated that the discharges have minimal effects on ion composition in Crooked Creek (Tables 4.8 and 4.9). However, the data set did not include upstream versus downstream measurements of nutrients, so nutrients cannot be evaluated as a potential factor. However, it should be noted that ADEQ stated in its comments on the draft UAA report that changes in the benthic macroinvertebrate community are consistent with effects due to nutrients.

7.5 Aquatic Life Use Attainability

Results of the analysis of biological communities with respect to existing mineral concentrations can be summarized as follows:

- 1. Both outfalls have a minor impact on downstream TDS, sulfate, and chloride concentrations;
- 2. Habitat evaluations indicated very similar habitat upstream and downstream of the YWWTP. Discharge data collected in the immediate vicinity of the macroinvertebrate sampling locations also show similar depths and velocities upstream and downstream. Based on the habitat evaluations, Wolman pebble counts, and flow transect data, it was concluded that habitat is not a likely cause of the observed impairment of the downstream macroinvertebrate assemblage compared to the upstream assemblage and to least-disturbed ecoregion reference conditions;

- 3. There is no discernible adverse impact on fish communities in Crooked Creek due to the presence of the HWWTP. Because the impact of the YWWTP on downstream water quality is similar to that of the HWWTP, it is likely that the YWWTP water quality has a similarly negligible adverse impact on the downstream fish communities;
- 4. Spring samples upstream versus downstream of the discharges show no significant impairment to moderate impairment of the benthic community in the downstream reaches. However, the magnitude and timing of the TDS, sulfate, and chloride increases downstream of the discharges are not commensurate with the downstream changes in the benthic macroinvertebrate communities;
- 5. A total of five independent biological samples (two macrobenthic samples with two duplicates, and one fish sample) were collected in the upstream and downstream reaches of the HWWTP. Three of the five (two macrobenthic and the fish sample) showed no impairment, and the remaining two showed slight downstream impairment. These results are consistent with similar habitat characteristics in the upstream and downstream reaches. For example, percent algal cover, which would be expected to respond to differences in water quality due to the discharges, did not change from upstream to downstream. Therefore, the HWWTP has only minimal effects on the biology in the downstream reach; and
- 6. TDS concentrations exceed the Crooked Creek site-specific criterion at all locations, including those upstream of the HWWTP and YWWTP discharges. Based on data collected during the study, sulfate and chloride values rarely exceeded the Crooked Creek criteria. Benthic macroinvertebrate communities show moderate to slight impairment when compared to communities in least-disturbed streams. TDS concentrations in the least-disturbed streams considered in this study were similar or higher and also exceeded the Crooked Creek site-specific criterion. Therefore, the existing minerals concentrations in Crooked Creek, including those due to input from the HWWTP and YWWTP, can be expected to support Ozark Highland ecoregion least-disturbed benthic macroinvertebrate communities.

These findings demonstrate conclusively that the modest increases in TDS, sulfate, and chloride concentrations downstream of the HWWTP and YWWTP outfalls do not cause adverse impacts to aquatic life, and also demonstrate that the existing TDS concentrations in the Crooked Creek reaches upstream and downstream of the HWWTP and YWWTP do not limit benthic macroinvertebrate communities and can be expected to support the Ozark Highland fisheries designated use.

8.0 EVALUATION OF ALTERNATIVES

UAA guidance requires that an evaluation be made of the alternatives to the direct discharge of the water. These alternatives are evaluated for technical and economic considerations. Based on a number of similar evaluations in previous UAAs, the alternatives for management of effluents with elevated dissolved minerals are limited. Three alternatives that have been reviewed for similar applications include: (1) reverse osmosis (RO) treatment of the wastewater, (2) pumping the wastewater to a larger stream that holds the potential for dilution of the minerals, and (3) treatment using a constructed wetland. FTN has completed this evaluation of alternatives based on previous experience, information from published literature, and from data provided by the city. The evaluation was primarily completed by Rex Robbins, PE, of FTN.

Based on preliminary screening of these three options, the use of a constructed wetland can be dismissed for both facilities. Constructed wetlands can only be used to reduce sulfate, which results in the production of bicarbonate in place of sulfate (Hedin et al. 1989). Sulfate makes up an average of 15% of the TDS of the HWWTP (Table 4.9). Therefore, although a constructed wetland could, in principle, reduce sulfate in the HWWTP discharge, the resulting TDS concentration would not be decreased (due to the replacement of the sulfate ions with bicarbonate ions) and no net benefit would be obtained. In addition, wetland treatment will have no effect on TDS as calcium, sodium, bicarbonate, or chloride (Hedin et al. 1989), which comprise, on average, 54% of the HWWTP discharge TDS (Table 4.9). Similarly, calcium, sodium, bicarbonate, and chloride comprise an average of 79% of the TDS of the YWWTP discharge and would be virtually unaffected by wetland treatment.

Accordingly, the following sections evaluate two alternatives for achieving compliance with the Arkansas water quality criteria:

- RO treatment to remove or reduce dissolved minerals; and
- Pumping the wastewater to a larger stream that holds the potential for dilution of the minerals.

These two alternatives will be compared with the anticipated cost of implementing revised site-specific criteria for dissolved minerals in Crooked Creek. The evaluation of these alternatives follows.

8.1 TDS Treatment Through Reverse Osmosis

Wastewater technologies, such as conventional precipitation, can efficiently remove the heavy metals from wastewater to meet the effluent requirements. However, these systems do not remove the dissolved compounds like sulfate and TDS. As a result, the effluent flow from the treatment plant is limited by the dilution of the flow in the receiving stream to reduce these constituents to acceptable concentrations.

RO is an advanced water/wastewater treatment process capable of removing dissolved contaminants such as TDS, sulfate, and chloride. It is essentially an extension of a filtration process in which highly pressurized feed water flows across a membrane, with a portion of the flow, identified as "permeate," going through the membrane. The rest of the feed is called "concentrate" because it carries off the concentrated contaminants rejected by the membrane. The concentrate amount depends on many factors and can vary between 10% to 30% of the feed. Depending on the size of the pores in the membrane, the process results in different classes of separation. For the removal of dissolved solids, a membrane capable of rejecting elemental particles must be utilized.

8.1.1 Technical Considerations

Based on the preliminary information available from equipment manufacturers, RO is a possible alternative treatment for effluent to meet the limits for TDS and sulfate. The RO permeate would be of high quality and meet downstream Arkansas WQS in this process.

The most common problems with RO involve the tendency for fouling problems when applied to concentrated waste streams and the cost of operation (i.e., electricity, membrane cleaning, etc.).

The disposal of the concentrated brine generated by this process is a larger problem. This issue generally becomes the controlling factor in the selection of RO for many applications. RO

separates the contaminants from water, but it does not chemically change them to other non-polluting compounds. This concentrate would require disposal by other methods.

8.1.2 Concentrate Disposal Options

The brine solution may be (1) solidified and disposed onsite, (2) transported offsite for stabilization prior to landfilling, or (3) transported offsite to a municipal or industrial wastewater treatment system. The waste brine solution is not a hazardous waste in Arkansas, but disposal in neighboring states may be restricted to industrial or hazardous waste facilities. Transportation will be a critical factor for two of the three options.

8.1.2.1 Onsite Stabilization

The concentrate could be stabilized onsite, using a cementitious element such as Portland cement or fly ash. This would require the construction of a mixing facility, purchase of the cementitious agent, crews, and equipment to mix the waste solution, regulatory authority to dispose of the waste onsite, and engineering support for selection and operation of a disposal area. The critical and unknown costs for this option are the mixing ratio for the waste solution/stabilization agent, and any required environmental protection controls for the disposal area. The mixing ratio determines the tonnage necessary for purchase of the stabilizing agent, and the environmental protection controls could range from open disposal on land adjacent to the facility or the installation of a landfill with liners and caps.

8.1.2.2 Offsite Treatment

The wastewater could be transported offsite by truck to an industrial or municipal wastewater treatment facility. It would be necessary to provide waste profile information to each facility to obtain cost information. For treatment and discharge, the treatment facility would need to be located at a site with capabilities for discharging to a large waterbody or to an underground disposal well. The critical cost component would be the cost of transportation and the cost per disposal on a per-gallon basis.

8.1.2.3 Offsite Stabilization

The wastewater could be transported to an industrial or municipal landfill for stabilization and disposal. Offsite disposal offers several advantages. The site earthwork balance does not have to account for onsite disposal, and there is a minimum of regulatory approval required when the waste is removed to an offsite facility. For local landfills, the costs may be lower than for landfills dedicated to industrial or hazardous waste, but the environmental control can differ from cell to cell, requiring more oversight of disposal operations.

8.1.3 Economic Considerations for the Harrison WWTP

For the Harrison WWTP, a set of conditions was chosen to provide a basis for sizing equipment and estimating operating costs. The water analysis and the design flow requirements are primary considerations in the sizing and cost of the equipment. Pumps and piping that are associated with the RO process would be required along with controls, building, utilities, etc.

The basic assumptions used in the analysis of costs for the HWWTP are shown below:

- 1. A design flow of approximately 2.6 mgd (1,800 gallons per minute [gpm]) is the basis for sizing the RO system.
- 2. An average flow rate of 2.6 mgd (1,800 gpm) is the basis for calculating operating costs.
- 3. To reduce the amount of brine requiring disposal, the system will consist of a minimum of three RO units in series, and a holding tank to facilitate disposal of the concentrate. Each pass will have a reject rate of 20%.
- 4. Approximately 8.3 million gallons per year at 5% solids will be generated as brine solution reject from the RO treatment system and will require disposal.
- 5. The treated effluent will be discharged to waters of the United States.
- 6. The waste brine solution would be about 5% solids.

The following cost information is based upon a three-stage RO system, able to sequentially concentrate the reject water to about 1/100 of its original volume. The concentrate could then be stored in an onsite holding tank.

The capital costs of installing an RO treatment system have been estimated by the US Army Corps of Engineers (USACE) to range from \$1.44 to \$2.13 per gallon per day. This is for a single-stage RO unit. For a three-stage RO unit, it is estimated that the costs would increase by a factor of 1.5. The costs were developed by USACE for a typical brackish water application in Florida. These values are widely cited in the literature, and although dated, are still considered adequate for a comparison of alternatives. Over this time period (since the mid-1990s), the cost of RO membranes has been reduced. However, the cost of ancillary equipment (i.e., equipment housing, pumping, piping) has increased. Therefore, the costs are considered valid for the intended use. For purposes of this discussion, the costs for installing an RO system are estimated at \$2.16 per gallon per day. This provides an estimated capital cost of the treatment system of approximately \$5,600,000.

USACE further estimated the operating costs of an RO system (less the costs of brine disposal) at about \$0.001 per gallon for a large-scale treatment system. This cost would translate to an annual operating cost of about \$950,000.

The above costs are based on generic estimates. However, these estimates provide a method for comparison between the different alternatives that are available. As stated above, the costs of disposal of the concentrate actually becomes the controlling factor with this application.

For the disposal of the concentrate, the critical cost components for offsite treatment or disposal are the cost of transportation and the per-ton disposal fee for the waste. Typical haul and disposal costs for a similar project have been shown to be about \$1.00 per gallon for transport and disposal at an Oklahoma facility. The use of a local landfill or a deep well disposal site in Louisiana, if acceptance of the waste can be obtained, may lower that cost to about \$0.60 per gallon. Even at this lower cost, the annual costs associated with disposal would be about \$5,000,000 per year. It is possible that, given these high costs, an evaporator or other means for drying the solids would be feasible. However, there would still be a dried product requiring disposal. The cost of installing and operating the drying equipment is not expected to be significantly lower than shown above for hauling and disposal.

Therefore, based on these preliminary calculations, RO treatment would have a capital cost of about \$5.6 million and an annual operating cost of about \$5,950,000.

8.1.4 Economic Considerations for the Yellville WWTP

For the Yellville WWTP, a set of conditions was chosen to provide a basis for sizing equipment and estimating operating costs. The water analysis and the design flow requirements are primary considerations in the sizing and cost of the equipment. Pumps and piping that are associated with the RO process would be required along with controls, building, utilities, etc.

The basic assumptions used in the analysis of costs for the YWWTP are shown below:

- 1. A design flow of approximately 0.75 mgd (520 gpm) is the basis for sizing the RO system.
- 2. An average flow rate of 0.29 mgd (200 gpm) will be the basis for calculating operating costs.
- 3. To reduce the amount of brine requiring disposal, the system will consist of a minimum of three RO units in series, and a holding tank to facilitate disposal of the concentrate. Each pass will have a reject rate of 20%.
- 4. Approximately 441,500 gallons per year at 5% solids will be generated as brine solution reject from the RO treatment system and will require disposal.
- 5. The treated effluent will be discharged to waters of the United States.
- 6. The waste brine solution would be about 5% solids.

The following cost information is based upon a three-stage RO system, able to sequentially concentrate the reject water to about 1/100 of its original volume. The concentrate could then be stored in an onsite holding tank awaiting disposal.

The capital costs of installing an RO treatment system have been estimated by USACE to range from \$1.44 to \$2.13 per gallon per day. This is for a single-stage RO unit. For a three-stage RO unit, it is estimated that the costs would increase by a factor of 1.5. For purposes of this discussion, the costs for installing an RO system are estimated at \$3 per gallon per day. This provides an estimated capital cost of the treatment system of approximately \$2,250,000.

USACE further estimated the operating costs of an RO system (less the costs of brine disposal) at about \$0.001 per gallon for a large-scale treatment system. This cost would translate to an annual operating cost of about \$110,000.

For both the capital and operating costs, the factors provided by USACE may be low due to the relative size of this application. However, the cost estimates should provide a method for comparison. Also, as stated above, the costs of disposal of the concentrate actually becomes the controlling factor with this application.

For the disposal of the concentrate, the critical cost components for offsite treatment or disposal are the cost of transportation and the per ton disposal fee for the waste. Typical haul and disposal costs for a similar project have been shown to be about \$1.00 per gallon for transport and disposal at an Oklahoma facility. The use of a local landfill or at a deep well disposal site in Louisiana, if acceptance of the waste can be obtained, may lower that cost to about \$0.60 per gallon. Even at this lower cost, the annual costs associated with disposal would be about \$265,000. It is possible that, given these high costs, an evaporator or other means for drying the solids would be feasible. However, there would still be a dried product requiring disposal. The cost of installing and operating the drying equipment is not expected to be significantly lower than shown above for hauling and disposal.

Therefore, based on these preliminary calculations, RO treatment would have a capital cost of about \$2,250,000 and an annual operating cost of about \$375,000.

8.2 Pipeline

This alternative is not attractive for either facility because there is not a waterbody nearby that could serve as an appropriate receiving stream. The only large river that could possibly serve as a receiving stream would be the White River, which is over 30 miles away from the HWWTP and 8 miles away from the YWWTP.

The estimated cost of building a pipeline from the HWWTP to the White River would be over \$24,000,000, including the purchase of right-of-way. The cost of pumping and maintenance would add another \$150,000 annually to the cost of this option for the HWWTP.

The estimated cost of building a pipeline from the YWWTP to the White River would be about \$3,400,000, including the purchase of right-of-way. The cost of pumping and maintenance would add another \$100,000 annually to the cost of this option for the YWWTP.

8.3 Summary of Costs

The three available options for management of the mineral concentrations from the facilities are as follows:

- 1. Direct discharge under modified dissolved minerals criteria;
- 2. Installation of an RO treatment system; or
- 3. Installation of a pipeline to the White River.

Tables 8.1 and 8.2 summarize the estimated costs with each option for each facility. Any capital and operating costs associated with the direct discharge option (e.g., effluent monitoring) would also be required in the other options, and therefore were not added to the cost estimates. The implementation costs for the direct discharge refer to costs for the UAA study and consulting and legal costs to support the rule-making process to modify the dissolved minerals criteria.

Table 8.1. Summary of capital, operating, and implementation costs for various options to attain compliance with permit limits for the Harrison WWTP.

Option Description	Estimated Capital Cost	Estimated Annual Operating Cost	Implementation Cost
Discharge to Crooked Creek			\$150,000
RO Treatment	\$5,600,000	\$5,950,000	
Pipeline to White River	\$24,000,000	\$150,000	

Table 8.2. Summary of capital, operating, and implementation costs for various options to attain compliance with permit limits for the Yellville WWTP.

Option Description	Estimated Capital Cost	Estimated Annual Operating Cost	Implementation Cost
Discharge to Crooked Creek			\$150,000
RO Treatment	\$2,250,000	\$375,000	
Pipeline to White River	\$3,400,000	\$100,000	

8.4 Alternatives Analysis Conclusions

The information presented in this section indicates that the most cost-effective option for the HWWTP and YWWTP discharges is direct discharge. Implementing this option, however, will require modified dissolved minerals criteria in Crooked Creek, the current receiving stream.

9.0 PROPOSED SITE-SPECIFIC CRITERIA

9.1 Synopsis of Supporting Information

As mentioned in Section 1.0, the reaches of Crooked Creek upstream and downstream of the HWWTP and YWWTP outfalls (stream segments 11010003-049 and 11010003-048, respectively) are listed on the 2008 303(d) list as impaired for TDS, sulfate, and chloride due to due to exceedances of existing site-specific minerals criteria for Crooked Creek. Because of these impairment listings, permit limits for dissolved minerals for the HWWTP and YWWTP could be set equal to the instream criteria for those reaches of Crooked Creek. This UAA proposes site-specific criteria that are similar to Ozark Highland ecoregion criteria. The observations and reasoning in support of the proposed criteria are as follows:

- 1. The UAA demonstrated that although the sulfate, chloride, and TDS concentrations in the HWWTP and YWWTP effluents exceed instream criteria, the discharges only have a minor effect on the mineral concentrations of Crooked Creek (Sections 4.2 and 4.3).
- 2. In the UAA study reaches, sulfate and chloride are minor components of the TDS, which is primarily composed of calcium and bicarbonate (Section 4.3). Therefore, under existing conditions, overall TDS should be the primary focus of minerals criteria, and site-specific TDS criteria should be based on TDS concentrations that protect the Ozark Highland fisheries designated use. Sulfate and chloride criteria should reflect concentrations that are consistent with protective TDS criteria.
- 3. The slight increase in mineral concentrations downstream of the HWWTP corresponded to a minimal change in the macroinvertebrate community (no significant impairment to slight impairment). It is not clear whether a cause and effect relationship would be expected to exist between small changes such as these. The YWWTP reaches showed the largest upstream to downstream assemblage differences and the smallest upstream to downstream mineral differences in both absolute and relative terms. If the macroinvertebrate assemblages are responding to the modest upstream to downstream increases in mineral concentrations (i.e., a less than 10% difference in upstream versus downstream 95th percentile TDS values), then the greatest upstream to downstream mineral differences (observed at the HWWTP) should cause the greatest upstream to downstream assemblage differences. The opposite was observed. This result shows that, when considering both discharges, the magnitude of the mineral increase downstream of the discharges is not commensurate with the downstream change in the benthic macroinvertebrate

- communities. Accordingly, there must be underlying factors other than habitat or minerals affecting assemblage structure.
- 4. Evaluations of mineral concentrations and biological communities in least-disturbed streams demonstrates that TDS concentrations similar to the existing Crooked Creek concentrations, including those influenced by the discharges, will support least-disturbed benthic macroinvertebrate communities (Sections 7.3 and 7.5).

Mineral concentrations similar to ecoregion criteria will support the Ozark Highland fisheries designated use provided that sulfate and chloride continue to have a minor contribution to TDS as indicated by existing conditions.

9.2 Proposed Criteria

Proposed criteria are based on existing mineral conditions in Crooked Creek. Existing conditions were based on available monitoring data from ADEQ ambient monitoring of Crooked Creek. Because the 2008 Arkansas 303(d) list is the latest EPA-approved list (which evaluated data from the 2002 to 2007 date range), data from the past 10 years were examined for each of the ADEQ monitoring stations shown on Figure 9.1. Appendix G provides the ADEQ historical monitoring data for those monitoring stations. Ninety-fifth percentile values for each of the ADEQ monitoring stations are provided in Table 9.1. The proposed revised site-specific criteria (Table 9.2) are based on the values in Table 9.1 as described below for the following two reaches of Crooked Creek:

- 1. Upper Reach (Figure 9.1): From the HWWTP to ADEQ monitoring station WHI0193. The proposed revised TDS, sulfate, and chloride criteria for this reach (Table 9.2) are the highest of the 95th percentile values from stationsWHI0066 and WHI0193 (Table 9.1).
- 2. Lower Reach (Figure 9.1): From ADEQ monitoring station WHI0193 to the mouth of Crooked Creek at the White River. The proposed revised TDS criterion for this reach (Table 9.2) is the highest of the 95th percentile values from stations WHI0048B and WHI0048C (Table 9.1). There are no proposed changes to the sulfate and chloride criteria in this reach.

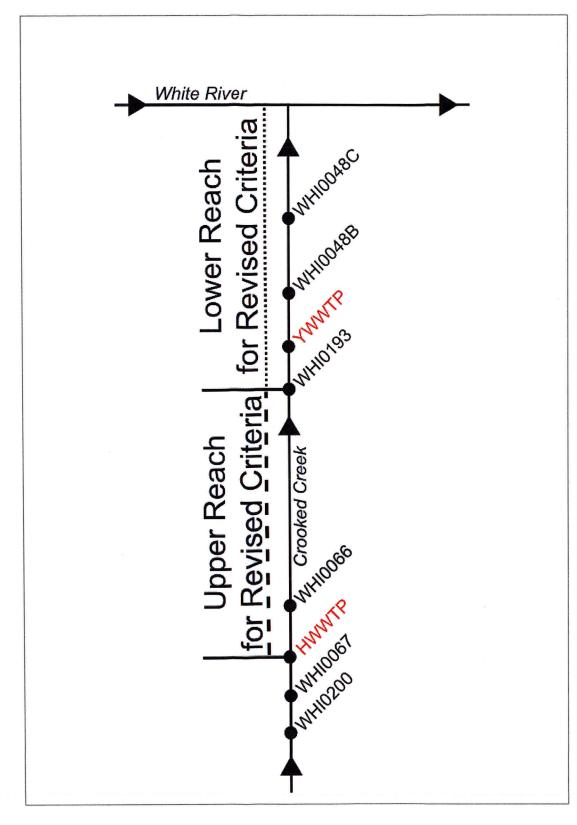


Figure 9.1. Schematic diagram of outfalls, ADEQ monitoring stations, and upper and lower reaches for revised criteria.

Table 9.1. Ninety-fifth percentile values of ADEQ historical monitoring data for dissolved minerals in Crooked Creek.

	95 th Percentile Values at ADEQ Monitoring Station (mg/L)						
Parameter	WHI0200	WHI0067	WHI0066	WHI0048A/ WHI0193 ^(a)	WHI0048B	WHI0048C	
TDS	226	233	269	226	221	238	
Sulfate	11.6	9.4	24.4	9.4	7.6	10.2	
Chloride	8.3	11.3	22.6	10.7	7.6	7.9	
Period of Record ^(b)		08/05/2003 07/30/2013 ^(d)	100,00,2000	08/19/2003 07/09/2013 ^(d)	12/09/2003 06/04/2013 ^(d)	12/09/2003 06/04/2013 ^(d)	

Notes:

- (a) ADEQ discontinued monitoring at WHI0048A and moved the sampling point upstream from Yellville to WHI0193.
- (b) Date range queried was from August 1, 2003, to July 31, 2013, on ADEQ surface water quality monitoring data search page (http://www.adeq.state.ar.us/techsvs/water_quality/water_quality station.asp, accessed August 20, 2013).
- (c) Represents the full period of record for this station.
- (d) Actual date range of data obtained from the search query for this station.

Table 9.2. Proposed criteria for dissolved minerals in Crooked Creek.

	Existing Criteria			Proposed Criteria		
Stream Reach	Chloride (mg/L)	Sulfate (mg/L)	TDS (mg/L)	Chloride (mg/L)	Sulfate (mg/L)	TDS (mg/L)
Upstream reach (from HWWTP to WHI0193)	20	20	200	22.6	24.4	269
Downstream reach (from WHI0193 to mouth of Crooked Creek)	20	20	200	No change	No change	238

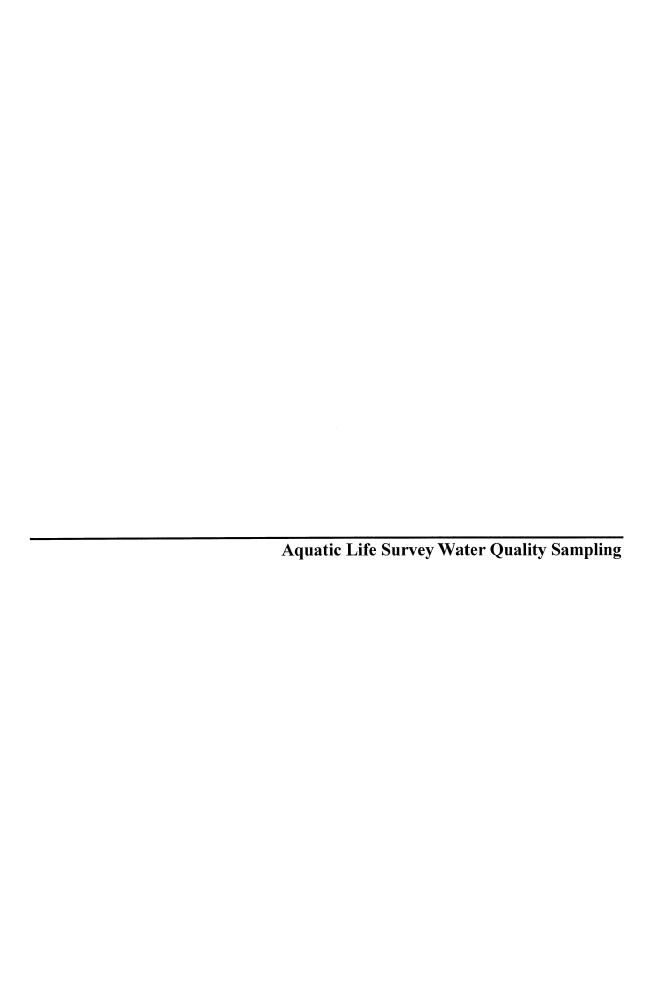
10.0 REFERENCES

- ADEQ. 2000. State of Arkansas Continuing Planning Process: Update and revisions, January 2000. Little Rock, AR: Arkansas Department of Environmental Quality, Water Division.
- ADEQ. 2010. Standard Operating Procedure for Macroinvertebrate Sampling Methodology for Wadeable Streams, April 2010. Little Rock, AR: Arkansas Department of Environmental Quality, Water Division Planning Section.
- APCEC. 2014. Regulation No. 2: Regulation establishing water quality standards for surface water of the State of Arkansas. Little Rock, AR: Arkansas Pollution Control and Ecology Commission.
- Arkansas Department of Pollution Control & Ecology. 1987. Physical chemical and biological characteristics of least-disturbed reference streams in Arkansas ecoregions. Little Rock, AR: Arkansas Department of Pollution Control & Ecology. June 1987.
- Ayers, R.S., and D.W. Westcot. 1985. *Water quality for Agriculture* [FAO Irrigation and Drainage Paper 29, revision 1). Rome: Food and Agriculture Organization of the United Nations.
- Barbour, M.T., J. Gerritsen, B.D. Snyder, and J.B. Stribling. 1999. *Rapid bioassessment protocols for use in streams and wadeable rivers: Periphyton, benthic macroinvertebrates and fish, second edition* [EPA 841-B-99-002]. Washington, DC: US Environmental Protection Agency, Office of Water.
- Davies, T.D., and K.J. Hall. 2007. Importance of calcium in modifying the acute toxicity of sodium sulfate to *Hyalella azteca* and *Daphnia magna*. *Environ*. *Toxicol*. *Chem.* 26: 1243-1247.
- Elphick J.R., M. Davies, G. Gilron, E.C. Canaria, B. Lo, and H.C. Bailey. 2011. An aquatic toxicological evaluation of sulfate: the case for considering hardness as a modifying factor in setting water quality guidelines. *Environ. Toxicol. Chem.* 30(1):247-253.
- Elphick, J.R., M. Davies, G. Gilron, E.C. Canaria, B. Lo, and H.C. Bailey. 2011. An aquatic toxicological evaluation of sulfate: the case for considering hardness as a modifying factor in setting water quality guidelines. *Environ. Toxicol Chem.* 30: 247-253.
- EPA. 1983. Technical support document for waterbody surveys and assessments for conducting use attainability analysis. Washington, DC: US Environmental Protection Agency, Office of Water Regulation and Standards.
- EPA. 1994. Water Quality Standards Handbook, second edition [EPA-823-B-94-006]. Washington, DC: US Environmental Protection Agency, Office of Water.

- Hedin, R.S., R. Hammack, and D. Hyman. 1989. "Potential Importance of Sulfate Reduction Processes in Wetlands Constructed to Treat Mine Drainage." Chapter 38b in *Constructed Wetlands for Wastewater Treatment*. Edited by Donald A. Hammer. Lewis Publishers, Inc. pp. 508-514.
- Houston, J. 1980. Checklist of the Damselflies (Odonata: Zygoptera) of Arkansas [Arkansas Biota Survey Checklist No. 25]. Arkansas Academy of Science. 1 p.
- James, D.W., R.J. Hanks, and J.H. Jurinak. 1982. *Modern Irrigated Soils*. New York: John Wiley and Sons.
- Lasier, P.J., and I.R. Hardin. 2010. Observed and predicted reproduction of *Ceriodaphnia dubia* exposed to chloride, sulfate, and bicarbonate. *Environ. Toxicol. Chem.* 29: 347-358.
- Maas, E.V. 1990. "Crop salt tolerance." Chapter 13 in Agricultural Salinity Assessment and Management Manual [ASCE Manuals and Reports on Engineering No. 71].
 Tanji, K.K. (ed). New York: American Society of Civil Engineers, Environmental and Water Resources Institute, Irrigation and Drainage Council, Water Quality and Drainage Committee. pp. 262-304.
- Merritt, R.W., and K.W. Cummins. 1996. *An Introduction to the Aquatic Insects of North America*. Dubuque, IA: Kendall/Hunt Publishing Company.
- Mount, D.R., D.D. Gulley, J.R. Hockett, T.D. Garrison, and J.M. Evans. 1997. Statistical models to predict the toxicity of major ions to *Ceriodaphnia dubia, Daphnia magna* and *Pimephales promelas* (fathead minnows). *Environ. Toxicol. Chem.* 16:2009-2019.
- Plafkin, J.L., M.T. Barbour, K.D. Porter, S.K. Gross, and R.M. Hughes. 1989. *Rapid bioassessment protocols for use in streams and rivers: Benthic macroinvertebrates and fish* [EPA 440-4-89-001]. Washington, DC: US Environmental Protection Agency, Office of Water Regulations and Standards.
- Robison, H.W., and T.M. Buchanan. 1988. *Fishes of Arkansas*. Fayetteville, AR: University of Arkansas Press. 536 p.
- Soucek, D.J. 2007. Comparison of hardness and chloride regulated acute effects of sodium sulfate on two freshwater crustaceans. *Environ. Toxicol. Chem.* 26: 773-253.
- Soucek, D.J., and A.J. Kennedy. 2005. Effects of hardness, chloride, and acclimation on the acute toxicity of sulfate to freshwater invertebrates. *Environ. Toxicol. Chem.* 24:1204-1210.
- Soucek, D.J., T.K. Linton, C.D. Tarr, A. Dickinson, N. Wickramanayake, C.G. Delos, and L.A. Cruz. 2011. Influence of water hardness and sulfate on the acute toxicity of chloride to sensitive freshwater invertebrates. *Environ. Toxicol. Chem.* 30: 930-938.
- Tacker, P., E. Vories, C. Wilson, and N. Slaton. 2001. "Water management." Chapter 9 in *Rice Production Handbook* (MP 192), edited by Nathan Slaton. Fayetteville, AR: University of Arkansas, Division of Agriculture, Cooperative Extension Service. Available online at http://www.uaex.edu/Other_Areas/publications/PDF/MP192/MP-192.asp.

- Thorpe, J.H.. and A.P. Covich (eds). 2001. *Ecology and Classification of North American Freshwater Invertebrates, second edition*. Academic Press. 1,056 pp.
- USGS. 1982. Measurement and Computation of Streamflow: Volume 1. Measurement of stage and discharge. United States Geological Survey Water-Supply Paper 2175.
- Van Dam, R.A., A.C. Hogan, C.D. McCullough, M.A. Houston, C.L. Humphrey, and A.J. Harford. 2010. Aquatic toxicity of magnesium sulfate and the influence of calcium in very low ionic concentration water. *Environ. Toxicol. Chem.* 29: 410-421.
- WERF. 1997a. A comprehensive UAA technical reference. Final Report, Project 91-NPS-1, 1997. Water and Environment Research Foundation.
- WERF. 1997b. A suggested framework for conducting UAAs and interpreting results. Final Report, Project 91-NPS-1, 1997. Water and Environment Research Foundation.
- Zeng, L., and M.C. Shannon. 2000. Salinity effects on seedling growth and yield components of rice. *Crop Sci.* 40:996-1003.

APPENDIX C Laboratory Reports







August 6, 2012 Control No. 159725 Page 1 of 5

FTN Associates, Ltd. ATTN: Mr. Jim Malcolm 3 Innwood Circle, Suite 220 Little Rock, AR 72211

This report contains the analytical results and supporting information for samples submitted on July 27, 2012. Attached please find a copy of the Chain of Custody and/or other documents received. Note that any remaining sample will be discarded two weeks from the original report date unless other arrangements are made.

This report is intended for the sole use of the client listed above. Assessment of the data requires access to the entire document.

This report has been reviewed by the Laboratory Director or a qualified designee.

John Overbey
Laboratory Director

This document has been distributed to the following:

PDF cc:

FTN Associates, Ltd. ATTN: Mr. Jim Malcolm jtm@ftn-assoc.com

FTN Associates, Ltd. ATTN: Mr. Pat Downey pjd@ftn-assoc.com

FTN Associates, Ltd. ATTN: Mr. Jeremy Rigsby jmr@ftn-assoc.com





August 6, 2012 Control No. 159725 Page 2 of 5

FTN Associates, Ltd. 3 Innwood Circle, Suite 220 Little Rock, AR 72211

SAMPLE INFORMATION

Project Description:

Seven (7) water sample(s) received on July 27, 2012 4315-050 Harrison UAA

Receipt Details:

A Chain of Custody was provided. The samples were delivered in one (1) ice chest.

Each sample container was checked for proper labeling, including date and time sampled. Sample containers were reviewed for proper type, adequate volume, integrity, temperature, preservation, and holding times. Any exceptions are noted below:

Sample Identification:

Laboratory ID	Client Sample ID	Sampled Date/Time	Notes
159725-1	H001 25JUL12 1030	25-Jul-2012 1030	
159725-2	HWWTP DS 25JUL12 1200	25-Jul-2012 1200	
159725-3	Y001 25JUL12 1503	25-Jul-2012 1503	
159725-4	Clear Cr Ref 26JUL12 1300	26-Jul-2012 1300	
159725-5	Crooked Cr US 26JUL12 1545	26-Jul-2012 1545	
159725-6	Crooked Cr HWY 7 26JUL12 1600	26-Jul-2012 1600	
159725-7	HWY 65 26JUL12 1610	26-Jul-2012 1610	

Qualifiers:

D Result is from a secondary dilution factor

References:

[&]quot;Methods for Chemical Analysis of Water and Wastes", EPA/600/4-79-020 (Mar 1983) with updates and supplements EPA/600/5-91-010 (Jun 1991), EPA/600/R-92-129 (Aug 1992) and EPA/600/R-93-100 (Aug 1993).

[&]quot;Test Methods for Evaluating Solid Waste Physical/Chemical Methods (SW846)", Third Edition.

[&]quot;Standard Methods for the Examination of Water and Wastewaters", 21st edition.

[&]quot;American Society for Testing and Materials" (ASTM).

[&]quot;Association of Analytical Chemists" (AOAC).





August 6, 2012 Control No. 159725 Page 3 of 5

FTN Associates, Ltd. 3 Innwood Circle, Suite 220 Little Rock, AR 72211

ANALYTICAL RESULTS

AIC No. 159725-1

Sample Identification: H001 25JUL12 1030

Analyte		Result	RL	Units	Qualifier
Total Dissolved Solids SM 2540 C	Prep: 31-Jul-2012 1502 by 285	390 Analyzed: 02-A	10 ug-2012 1132 by 285	mg/l Batch: W40586	
Chloride	Prep: 27-Jul-2012 1458 by 07	65	2	mg/l	D
EPA 300.0		Analyzed: 30-J	ul-2012 1200 by 07	Batch: S32860	Dil: 10
Sulfate	Prep: 27-Jul-2012 1458 by 07	99	2	mg/l	D
EPA 300.0		Analyzed: 30-J	ul-2012 1200 by 07	Batch: S32860	Dil: 10

AIC No. 159725-2

Sample Identification: HWWTP DS 25JUL12 1200

oumpio la omanioa di omanio.					
Analyte		Result	RL	Units	Qualifier
Total Dissolved Solids SM 2540 C	Prep: 31-Jul-2012 1502 by 285	250 Analyzed: 02-Aug-	10 2012 1132 by 285	mg/l Batch: W40586	
Chloride EPA 300.0	Prep: 27-Jul-2012 1458 by 07	19 Analyzed: 30-Jul-2	0.2 012 1250 by 07	mg/l Batch: S32860	
Sulfate EPA 300.0	Prep: 27-Jul-2012 1458 by 07	21 Analyzed: 30-Jul-2	0.2 012 1250 by 07	mg/l Batch: S32860	

AIC No. 159725-3

Sample Identification: Y001 25JUL12 1503

Analyte		Result	RL	Units	Qualifier
Total Dissolved Solids SM 2540 C	Prep: 31-Jul-2012 1502 by 285	330 Analyzed: 02-A	10 Aug-2012 1132 by 285	mg/l Batch: W40586	
Chloride EPA 300.0	Prep: 27-Jul-2012 1458 by 07	82 Analyzed: 30-J	2 Iul-2012 1523 by 07	mg/l Batch: S32860	D Dil: 10
Sulfate EPA 300.0	Prep: 27-Jul-2012 1458 by 07	24 Analyzed: 30-J	0.2 Iul-2012 1315 by 07	mg/l Batch: S32860	

AIC No. 159725-4

Sample Identification: Clear Cr Ref 26JUL12 1300

Analyte		Result	RL	Units	Qualifier
Total Dissolved Solids SM 2540 C	Prep: 02-Aug-2012 1205 by 285	160 Analyzed: 06-Aug-	10 2012 1332 by 285	mg/l Batch: W40605	
Chloride EPA 300.0	Prep: 27-Jul-2012 1458 by 07	7.9 Analyzed: 30-Jul-2	0.2 012 1340 by 07	mg/l Batch: S32860	
Sulfate EPA 300.0	Prep: 27-Jul-2012 1458 by 07	5.0 Analyzed: 30-Jul-2	0.2 012 1340 by 07	mg/l Batch: S32860	





August 6, 2012 Control No. 159725 Page 4 of 5

FTN Associates, Ltd. 3 Innwood Circle, Suite 220 Little Rock, AR 72211

ANALYTICAL RESULTS

AIC No. 159725-5

Sample Identification: Crooked Cr US 26JUL12 1545

Analyte		Result	RL	Units	Qualifier
Total Dissolved Solids SM 2540 C	Prep: 02-Aug-2012 1205 by 285	210 Analyzed: 06-Aug	10 -2012 1332 by 285	mg/l Batch: W40605	
Chloride EPA 300.0	Prep: 27-Jul-2012 1458 by 07	9.0 Analyzed: 30-Jul-	0.2 2012 1408 by 07	mg/l Batch: S32860	
Sulfate EPA 300.0	Prep: 27-Jul-2012 1458 by 07	5.6 Analyzed: 30-Jul-	0.2 2012 1408 by 07	mg/l Batch: S32860	

AIC No. 159725-6

Sample Identification: Crooked Cr HWY 7 26JUL12 1600

Analyte		Result	RL	Units	Qualifier
Total Dissolved Solids SM 2540 C	Prep: 02-Aug-2012 1205 by 285	170 Analyzed: 06-Aug-2	10 2012 1332 by 285	mg/l Batch: W40605	
Chloride EPA 300.0	Prep: 27-Jul-2012 1458 by 07	6.6 Analyzed: 30-Jul-20	0.2 012 1703 by 07	mg/l Batch: S32860	
Sulfate EPA 300.0	Prep: 27-Jul-2012 1458 by 07	3.2 Analyzed: 30-Jul-20	0.2 012 1703 by 07	mg/l Batch: S32860	

AIC No. 159725-7

Sample Identification: HWY 65 26JUL12 1610

Analyte		Result	RL	Units	Qualifier
Total Dissolved Solids SM 2540 C	Prep: 02-Aug-2012 1205 by 285	200 Analyzed: 06-Aug-	10 2012 1332 by 285	mg/l Batch: W40605	
Chloride EPA 300.0	Prep: 27-Jul-2012 1458 by 07	7.9 Analyzed: 30-Jul-2	0.2 012 1728 by 07	mg/l Batch: S32860	
Sulfate EPA 300.0	Prep: 27-Jul-2012 1458 by 07	5.1 Analyzed: 30-Jul-2	0.2 012 1728 by 07	mg/l Batch: S32860	







FTN Associates, Ltd. 3 Innwood Circle, Suite 220 Little Rock, AR 72211

DUPLICATE RESULTS

					RPD				
Analyte		AIC No.	Result	RPD	Limit	Preparation Date	Analysis Date	Dil	Qual
Total Dissolved Solids		159669-1	42 mg/l		- 11	31Jul12 1502 by 285	02Aug12 1132 by 285		
	Batch: W40586	Duplicate	40 mg/l	4.88	10.0	31Jul12 1502 by 285	02Aug12 1132 by 285		
Total Dissolved Solids		159725-4	160 mg/l			02Aug12 1205 by 285	06Aug12 1332 by 285		
	Batch: W40605	Duplicate	160 mg/l	1.23	10.0	02Aug12 1205 by 285	06Aug12 1332 by 285		

LABORATORY CONTROL SAMPLE RESULTS

	Spike									
Analyte	Amount	%	Limits	RPD	Limit	Batch	Preparation Date	Analysis Date	Dil	Qual
Chloride	20 mg/l	98.5	90.0-110			S32860	27Jul12 1459 by 07	30Jul12 1044 by 07		
Sulfate	20 mg/l	99.9	90.0-110			S32860	27Jul12 1459 by 07	30Jul12 1044 by 07		

MATRIX SPIKE SAMPLE RESULTS

Analyte	Sample	Spike Amount	%	Limits	Batch	Preparation Date	Analysis Date	Dil	Qual
Chloride	159725-1	20 mg/l	98.4	80.0-120	S32860	27Jul12 1459 by 07	30Jul12 1109 by 07		
	159725-1	20 mg/l	105	80.0-120	S32860	27Jul12 1459 by 07	30Jul12 1135 by 07		
	Relative Pe	rcent Difference:	4.61	10.0	S32860				
Sulfate	159725-1	20 mg/l	100	80.0-120	S32860	27Jul12 1459 by 07	30Jul12 1109 by 07		
	159725-1	20 mg/l	103	80.0-120	S32860	27Jul12 1459 by 07	30Jul12 1135 by 07		
	Relative Pe	rcent Difference:	1.83	10.0	S32860				

LABORATORY BLANK RESULTS

A 2000 March 2004 A 200	Danult	RL	PQL	QC Sample	Preparation Date	Analysis Date	Qual
Analyte	Result	KL	PUL	Sample			Quai
Total Dissolved Solids	< 10 mg/l	10	10	W40586-1	31Jul12 1502 by 285	02Aug12 1132 by 285	
Total Dissolved Solids	< 10 mg/l	10	10	W40605-1	02Aug12 1205 by 285	06Aug12 1332 by 285	
Chloride	< 0.2 mg/l	0.2	0.2	S32860-1	27Jul12 1459 by 07	30Jul12 1019 by 07	
Sulfate	< 0.2 mg/l	0.2	0.2	S32860-1	27Jul12 1459 by 07	30Jul12 1019 by 07	

August 6, 2012 Control No. 159725

Page 5 of 5



Date Project Name				Project N 4315-050	Project No. 4315-050		d f	Project Manager (Print) Jim Malcolm	: (Print)		Pagel_	of 1
Name:		Submitted by:						Par	Parameters (Method Number)	1 Number)	Lab Turn-Around-Time	mi.L-puno.
Phone:		FTN Associates, Ltd. 3 Innwood Circle, Suite 220 Little Rock, AR 72211 (501) 225-7779 • Fax (501)	ciates, I Circle k, AR 7	, Ltd. le, Suite 72211	Ltd. , Suite 220 2211 Fax (501) 225-6738	6738	<u> </u>	loride			24 Hours 48 Hours	10 10
Sampler Signature(s)	/	Recorded By (Print) Jeremy Rigsby	/ (Print) sby					n., 91			Other	`
	SAMPLE DESCRIPTION	CRIPTION						811u				
Sample Identification	Date	Time	Matrix*	* O	No. of Containers	Comp	Grab	s ,sat			Laborato	Laboratory Notes
H001	25 JUL 12	1030	×		1		×	×		-		
HWWTP DS	25 JUL 12	1200	×		-		×	×				
Y001	25 JUL 12	1503	×		-		×	×				
Clear Cr Ref	26 JUL 12	1300	×		_		×	×				
Crooked Cr US	26 JUL 12	1545	×		-		×	×				
Crooked Cr HWY 7	26 JUL 12	1600	×		-		×	×				
HWY 65	26 JUL 12	1610	×		-		×	×				
					•	Container Type	ypc					
	٠					Preservative	-	9				
G = Glass		ic acid pH	• Matrix:	W = Water V = VOA vials V = Nitric acid	: W = Water V = VOA vials N = Nitric acid pH2	S = Soil	4 = HC 3 = Na(1 0 = Other H = HCI to pH2 B = NaOH to pH12	T = Sodium Thie Z = Zinc acetate	T = Sodium Thiosulfate Z = Zinc acctate		
Relinquished By (Signature)	rint Nar		Date 27 Jul 12	L 4/4	Time R	Received By (Signature)	y (Signa	(nrc)	Print Name	amc	Date	Timc
Relinquished By (Signature)	Print Name		Date]	-	Received B	y Lab	ed By Laboratory Bignarang	Print Name	m. G. Bako	Date 7-37-12	Time // </td
Please email results to itm@ftn-assoc.com, pjd@ftn-assoc.com, and imr@ftn-assoc.com	ftn-assoc.com,	pjd@ftn-a	SSOC.CC	m, an		Labordiory Remarks	Regional Control)			
imr@ftn-assoc.com					<u>)</u>	\	2)	~			





FTN Associates, Ltd. ATTN: Mr. Jim Malcolm 3 Innwood Circle, Suite 220 Little Rock, AR 72211

This report contains the analytical results and supporting information for samples submitted on September 21, 2012. Attached please find a copy of the Chain of Custody and/or other documents received. Note that any remaining sample will be discarded two weeks from the original report date unless other arrangements are made.

This report is intended for the sole use of the client listed above. Assessment of the data requires access to the entire document.

This report has been reviewed by the Laboratory Director or a qualified designee.

Overbey oratory Director

This document has been distributed to the following:

PDF cc: FTN Associates, Ltd. ATTN: Mr. Jim Malcolm jtm@ftn-assoc.com





SAMPLE INFORMATION

Project Description:

Six (6) water sample(s) received on September 21, 2012 4315-050 Crooked Creek UAA

Receipt Details:

A Chain of Custody was provided. The samples were delivered in one (1) ice chest.

Each sample container was checked for proper labeling, including date and time sampled. Sample containers were reviewed for proper type, adequate volume, integrity, temperature, preservation, and holding times. Any exceptions are noted below:

Sample Identification:

Laboratory ID	Client Sample ID	Sampled Date/Time Notes
161161-1	Y001 19SEP12 1015	19-Sep-2012 1015
161161-2	CC-1 19SEP12 1930	19-Sep-2012 1930
161161-3	CC-0 20SEP12 1823	20-Sep-2012 1823
161161-4	H001 20SEP12 1908	20-Sep-2012 1908
161161-5	WR-0 20SEP12 2132	20-Sep-2012 2132
161161-6	WR-1 20SEP12 2213	20-Sep-2012 2213

Qualifiers:

D Result is from a secondary dilution factor

References:

[&]quot;Methods for Chemical Analysis of Water and Wastes", EPA/600/4-79-020 (Mar 1983) with updates and supplements EPA/600/5-91-010 (Jun 1991), EPA/600/R-92-129 (Aug 1992) and EPA/600/R-93-100 (Aug 1993).

[&]quot;Test Methods for Evaluating Solid Waste Physical/Chemical Methods (SW846)", Third Edition.

[&]quot;Standard Methods for the Examination of Water and Wastewaters", 21st edition.

[&]quot;American Society for Testing and Materials" (ASTM).

[&]quot;Association of Analytical Chemists" (AOAC).





ANALYTICAL RESULTS

AIC No. 161161-1

Sample Identification: Y001 19SEP12 1015

Analyte		Result	RL	Units	Qualifier
Total Kjeldahl Nitrogen EPA 351.2	Prep: 24-Sep-2012 1527 by 93	3.3 Analyzed: 26-Sep-2	1 2012 1310 by 93	mg/l Batch: W41131	
Total Dissolved Solids SM 2540 C	Prep: 24-Sep-2012 0931 by 285	340 Analyzed: 25-Sep-2	10 2012 1138 by 285	mg/l Batch: W41121	
Total Phosphorus SM 4500-P B,F	Prep: 25-Sep-2012 1444 by 306	1.2 Analyzed: 27-Sep-	0.1 2012 0932 by 306	mg/l Batch: W41138	D Dil: 5
Chloride EPA 300.0	Prep: 21-Sep-2012 1452 by 07	36 Analyzed: 21-Sep-	0.2 2012 1918 by 07	mg/l Batch: S33187	
Nitrate + Nitrite as N EPA 300.0	Prep: 21-Sep-2012 1452 by 07	< 0.5 Analyzed: 22-Sep-2	0.5 2012 0104 by 07	mg/l Batch: S33187	D Dil: 10
Sulfate EPA 300.0	Prep: 21-Sep-2012 1452 by 07	25 Analyzed: 21-Sep-	0.2 2012 1918 by 07	mg/l Batch: S33187	

AIC No. 161161-2

Sample Identification: CC-1 19SEP12 1930

Campio idonamodación					
Analyte		Result	RL	Units	Qualifier
Total Kjeldahl Nitrogen EPA 351.2	Prep: 24-Sep-2012 1527 by 93	1.7 Analyzed: 26-Sep-	1 2012 1324 by 93	mg/l Batch: W41131	_
Total Dissolved Solids SM 2540 C	Prep: 24-Sep-2012 0931 by 285	230 Analyzed: 25-Sep-	10 2012 1138 by 285	mg/l Batch: W41121	
Total Phosphorus SM 4500-P B,F	Prep: 25-Sep-2012 1444 by 306	0.27 Analyzed: 27-Sep-	0.02 2012 1036 by 306	mg/l Batch: W41138	
Chloride EPA 300.0	Prep: 21-Sep-2012 1452 by 07	13 Analyzed: 21-Sep-	0.2 2012 1944 by 07	mg/l Batch: S33187	
Nitrate + Nitrite as N EPA 300.0	Prep: 21-Sep-2012 1452 by 07	3.0 Analyzed: 22-Sep-	0.5 2012 0130 by 07	mg/l Batch: S33187	D Dil: 10
Sulfate EPA 300.0	Prep: 21-Sep-2012 1452 by 07	11 Analyzed: 21-Sep-	0.2 2012 1944 by 07	mg/l Batch: S33187	

AIC No. 161161-3

Sample Identification: CC-0 20SEP12 1823

Analyte		Result	RL	Units	Qualifier
Total Kjeldahl Nitrogen EPA 351.2	Prep: 24-Sep-2012 1527 by 93	< 1 Analyzed: 26-Sep	1 o-2012 1325 by 93	mg/l Batch: W41131	
Total Dissolved Solids SM 2540 C	Prep: 24-Sep-2012 0931 by 285	220 Analyzed: 25-Sep	10 5-2012 1138 by 285	mg/l Batch: W41121	
Total Phosphorus SM 4500-P B,F	Prep: 25-Sep-2012 1444 by 306	< 0.02 Analyzed: 27-Sep	0.02 5-2012 0853 by 306	mg/l Batch: W41138	
Chloride EPA 300.0	Prep: 21-Sep-2012 1452 by 07	8.3 Analyzed: 21-Sep	0.2 o-2012 2010 by 07	mg/l Batch: S33187	





ANALYTICAL RESULTS

AIC No. 161161-3 (Continued)

Sample Identification: CC-0 20SEP12 1823

Analyte		Result	RL	mg/l Batch: S33187 mg/l	Qualifier
Nitrate + Nitrite as N EPA 300.0	Prep: 21-Sep-2012 1452 by 07	1.1 Analyzed: 22-S	0.5 ep-2012 0156 by 07	0	D Dil: 10
Sulfate EPA 300.0	Prep: 21-Sep-2012 1452 by 07	5.6 Analyzed: 21-S	0.2 ep-2012 2010 by 07	mg/l Batch: S33187	

AIC No. 161161-4

Sample Identification: H001 20SEP12 1908

Analyte		Result	RL	Units	Qualifier
Total Kjeldahl Nitrogen EPA 351.2	Prep: 24-Sep-2012 1527 by 93	1.9 Analyzed: 26-Sep-2	1 2012 1326 by 93	mg/l Batch: W41131	-
Total Dissolved Solids SM 2540 C	Prep: 24-Sep-2012 0931 by 285	410 Analyzed: 25-Sep-2	10 2012 1138 by 285	mg/l Batch: W41121	
Total Phosphorus	Prep: 25-Sep-2012 1444 by 306	2.8	0.1	mg/l	D
SM 4500-P B,F		Analyzed: 27-Sep-2	2012 0933 by 306	Batch: W41138	Dil: 5
Chloride	Prep: 21-Sep-2012 1452 by 07	55	2	mg/l	D
EPA 300.0		Analyzed: 21-Sep-2	2012 2035 by 07	Batch: S33187	Dil: 10
Nitrate + Nitrite as N	Prep: 21-Sep-2012 1452 by 07	22	0.5	mg/l	D
EPA 300.0		Analyzed: 22-Sep-2	2012 0222 by 07	Batch: S33187	Dil: 10
Sulfate	Prep: 21-Sep-2012 1452 by 07	53	2	mg/l	D
EPA 300.0		Analyzed: 21-Sep-2	2012 2035 by 07	Batch: S33187	Dil: 10

AIC No. 161161-5

Sample Identification: WR-0 20SEP12 2132

Analyte		Result	RL	Units	Qualifier
Total Kjeldahl Nitrogen EPA 351.2	Prep: 24-Sep-2012 1527 by 93	< 1 Analyzed: 26-Sep	1 5-2012 1327 by 93	mg/l Batch: W41131	
Total Dissolved Solids SM 2540 C	Prep: 24-Sep-2012 0931 by 285	160 Analyzed: 25-Sep	10 5-2012 1138 by 285	mg/l Batch: W41121	
Total Phosphorus SM 4500-P B,F	Prep: 25-Sep-2012 1444 by 306	< 0.02 Analyzed: 27-Sep	0.02 o-2012 0857 by 306	mg/l Batch: W41138	
Chloride EPA 300.0	Prep: 21-Sep-2012 1452 by 07	5.5 Analyzed: 21-Se	0.2 o-2012 2127 by 07	mg/l Batch: S33187	
Nitrate + Nitrite as N EPA 300.0	Prep: 21-Sep-2012 1452 by 07	< 0.5 Analyzed: 22-Se	0.5 o-2012 0405 by 07	mg/l Batch: S33187	D Dil: 10
Sulfate EPA 300.0	Prep: 21-Sep-2012 1452 by 07	6.7 Analyzed: 21-Se	0.2 o-2012 2127 by 07	mg/l Batch: S33187	





ANALYTICAL RESULTS

AIC No. 161161-6

Sample Identification: WR-1 20SEP12 2213

Analyte		Result	RL	Units	Qualifier
Total Kjeldahl Nitrogen EPA 351.2	Prep: 24-Sep-2012 1527 by 93	< 1 Analyzed: 26-Sep-	1 2012 1329 by 93	mg/l Batch: W41131	
Total Dissolved Solids SM 2540 C	Prep: 24-Sep-2012 0931 by 285	150 Analyzed: 25-Sep-	10 2012 1138 by 285	mg/l Batch: W41121	
Total Phosphorus SM 4500-P B,F	Prep: 25-Sep-2012 1444 by 306	< 0.02 Analyzed: 27-Sep-	0.02 2012 0858 by 306	mg/l Batch: W41138	
Chloride EPA 300.0	Prep: 21-Sep-2012 1452 by 07	5.1 Analyzed: 21-Sep-	0.2 2012 2153 by 07	mg/l Batch: S33187	
Nitrate + Nitrite as N EPA 300.0	Prep: 21-Sep-2012 1452 by 07	< 0.5 Analyzed: 22-Sep-	0.5 2012 0431 by 07	mg/l Batch: S33187	D Dil: 10
Sulfate EPA 300.0	Prep: 21-Sep-2012 1452 by 07	6.5 Analyzed: 21-Sep-	0.2 2012 2153 by 07	mg/l Batch: S33187	





DUPLICATE RESULTS

					RPD				
Analyte		AIC No.	Result	RPD	Limit	Preparation Date	Analysis Date	Dil	Qual
Total Dissolved Solids		161118-1	1300 mg/l			24Sep12 0931 by 285	25Sep12 1138 by 285	-	
	Batch: W41121	Duplicate	1400 mg/l	0.592	10.0	24Sep12 0931 by 285	25Sep12 1138 by 285		
Total Dissolved Solids		161162-1	940 mg/l			24Sep12 0931 by 285	25Sep12 1138 by 285		
	Batch: W41121	Duplicate	950 mg/l	0.955	10.0	24Sep12 0931 by 285	25Sep12 1138 by 285		

LABORATORY CONTROL SAMPLE RESULTS

	Spike									
Analyte	Amount	%	Limits	RPD	Limit	Batch	Preparation Date	Analysis Date	Dil	Qual
Total Kjeldahl Nitrogen	5 mg/l	107	80.0-120			W41131	24Sep12 1528 by 93	26Sep12 1309 by 93		
Total Phosphorus	0.5 mg/l	107	85.0-115			W41138	25Sep12 1445 by 306	27Sep12 0832 by 306		
Chloride	20 mg/l	100	90.0-110			S33187	21Sep12 1452 by 07	21Sep12 1643 by 07		
Nitrate + Nitrite as N	8 mg/l	99.4	90.0-110			S33187	21Sep12 1452 by 07	21Sep12 1643 by 07		
Sulfate	20 mg/l	100	90.0-110			S33187	21Sep12 1452 by 07	21Sep12 1643 by 07		

MATRIX SPIKE SAMPLE RESULTS

Analyte	Spike Sample Amount	%	Limits	Batch	Preparation Date	Analysis Date	Dil	Qual
Total Kjeldahl Nitrogen	161161-1 5 mg/l 161161-1 5 mg/l Relative Percent Difference	111 110 0.787	80.0-120 80.0-120 25.0	W41131 W41131 W41131	24Sep12 1528 by 93 24Sep12 1528 by 93	26Sep12 1311 by 93 26Sep12 1313 by 93		
Total Phosphorus	161169-1 0.5 mg/l 161169-1 0.5 mg/l Relative Percent Difference	105 108 : 1.90	80.0-120 80.0-120 10.0	W41138 W41138 W41138	25Sep12 1445 by 306 25Sep12 1445 by 306	27Sep12 1037 by 306 27Sep12 1038 by 306		D D D
Chloride	161161-1 20 mg/l 161161-1 20 mg/l Relative Percent Difference	97.2 98.5 : 1.15	80.0-120 80.0-120 10.0	S33187 S33187 S33187	21Sep12 1452 by 07 21Sep12 1452 by 07	21Sep12 1800 by 07 21Sep12 1826 by 07		
Nitrate + Nitrite as N	161161-1 8 mg/l 161161-1 8 mg/l Relative Percent Difference	99.4 101 : 1.27	80.0-120 80.0-120 10.0	S33187 S33187 S33187	21Sep12 1452 by 07 21Sep12 1452 by 07	21Sep12 1800 by 07 21Sep12 1826 by 07		
Sulfate	161161-1 20 mg/l 161161-1 20 mg/l Relative Percent Difference	99.0 101 : 1.97	80.0-120 80.0-120 10.0	S33187 S33187 S33187	21Sep12 1452 by 07 21Sep12 1452 by 07	21Sep12 1800 by 07 21Sep12 1826 by 07		

LABORATORY BLANK RESULTS

				QC			
Analyte	Result	RL	PQL	Sample	Preparation Date	Analysis Date	Qual
Total Kjeldahl Nitrogen	< 1 mg/l	1	1	W41131-1	24Sep12 1528 by 93	26Sep12 1307 by 93	
Total Dissolved Solids	< 10 mg/l	10	10	W41121-1	24Sep12 0931 by 285	25Sep12 1138 by 285	
Total Phosphorus	< 0.02 mg/l	0.02	0.02	W41138-1	25Sep12 1445 by 306	27Sep12 0831 by 306	
Chloride	< 0.2 mg/l	0.2	0.2	S33187-1	21Sep12 1452 by 07	21Sep12 1517 by 07	
Nitrate + Nitrite as N	< 0.05 mg/l	0.05	0.05	S33187-1	21Sep12 1452 by 07	21Sep12 1517 by 07	
Sulfate	< 0.2 mg/l	0.2	0.2	S33187-1	21Sep12 1452 by 07	21Sep12 1517 by 07	



	Date Project Name Crooked Creek UAA	eek UAA			T. 4	Project No. 4315-050			Proj Jim	Project Manager (Print) Jim Malcolm	nager Im	(Print)		·	Page	ofl_
	me:		Submitted by:	 			-			Pg	rameter	(Methoc	Parameters (Method Number)	-	Lab Turn-	Lab Turn-Around-Time
		·	FTN Associates, Ltd. 3 Innwood Circle, Suite 220 Little Rock, AR 72211	ciates 1 Circ k, AR	s, Ltd. le, Su 7221	ite 220									24 Hours	ν ν
	Phone:		(501) 225-7779 • Fax (501) 225-6738	-7779	• Fa	ıx (501) 2	25-6738			qT,N					Normal	·
	Sampler Signature(s)	(Recorded By (Print) Jeremy Rigsby	y (Print,					CF	70N+					Other:	,
		SAMPLE DESCRIPTION	CRIPTION						' †O	EON			•		3	, , ,
				Σ	Matrix*			C	s 's	1 'N					1	- September 1
	Sample Identification	Date	Тітс	≥	0 S	No. of Containers	of ners duc	irab	ат	ТК					Laborat	Laboratory Indies
	Y001	19 SEP 12	1015	×		2		×	×	Х						
دے	CC-1	19 SEP 12	1930	×		2		×	×	Х						
حر	CC-0	20 SEP 12	.1823	×		2		×	×	×						
5	H001	20 SEP 12	1908	X		2		×	×	×						
\mathcal{N}	WR-0	20 SEP 12	2132	X		2		×	×	×						
٦	WR-1	20 SEP 12	2213	×		2	_	×	×	×						
								\perp								
					_											
							Container Type	r Type								
							Prese	Preservative								
	G = Glass			Matrix	*	* Matrix: W = Water V = VOA vials N = Nitric acid nH2	S = Soil	H=[O = Other H = HC to pH2 B = NaOH to pH12	O = Other to pH2 H to pH12		T = Sodium Thic	T = Sodium Thiosulfate	fate		
	Relinquished By (Signature)	rint Nar	200	Ğ	Date	Time	Received By (Signature)	By (Si	gnature)			Print Name	шe		Date	Time
1	Relinquished By (Signapare)	Print Name		al Xep 1.2. Date	- If -	Time	Received By Laboratory (Signature)	By La	boratory	y (Signatun	⊕ ,	Print Name	/	Horpton	Date 9-1/2-6	Time // 433
							Laboratory Remarks:	y Ren	arks:						٠	•





FTN Associates, Ltd. ATTN: Mr. Jim Malcolm 3 Innwood Circle, Suite 220 Little Rock, AR 72211

This report contains the analytical results and supporting information for samples submitted on November 29, 2012. Attached please find a copy of the Chain of Custody and/or other documents received. Note that any remaining sample will be discarded two weeks from the original report date unless other arrangements are made.

This report is intended for the sole use of the client listed above. Assessment of the data requires access to the entire document.

This report has been reviewed by the Laboratory Director or a qualified designee.

Jøhn Overbey Laboratory Directør

This document has been distributed to the following:

PDF cc: FTN A

FTN Associates, Ltd. ATTN: Mr. Jim Malcolm jtm@ftn-assoc.com

FTN Associates, Ltd. ATTN: Mr. Pat Downey pjd@ftn-assoc.com

FTN Associates, Ltd. ATTN: Mr. Jeremy Rigsby jmr@ftn-assoc.com





SAMPLE INFORMATION

Project Description:

Six (6) water sample(s) received on November 29, 2012 Crooked Creek UAA 4315-050

Receipt Details:

A Chain of Custody was provided. The samples were delivered in one (1) ice chest.

Each sample container was checked for proper labeling, including date and time sampled. Sample containers were reviewed for proper type, adequate volume, integrity, temperature, preservation, and holding times. Any exceptions are noted below:

Sample Identification:

Laboratory ID	Client Sample ID	Sampled Date/Time Notes
162806-1	WR-1 27NOV12 1655	27-Nov-2012 1655
162806-2	WR-0 27NOV12 1723	27-Nov-2012 1723
162806-3	CC-0 28NOV12 0840	28-Nov-2012 0840
162806-4	CC-1 28NOV12 1213	28-Nov-2012 1213
162806-5	H001 28NOV12 1600	28-Nov-2012 1600
162806-6	Y001 28NOV12 1710	28-Nov-2012 1710

Qualifiers:

D Result is from a secondary dilution factor

References:

[&]quot;Methods for Chemical Analysis of Water and Wastes", EPA/600/4-79-020 (Mar 1983) with updates and supplements EPA/600/5-91-010 (Jun 1991), EPA/600/R-92-129 (Aug 1992) and EPA/600/R-93-100 (Aug 1993).

[&]quot;Test Methods for Evaluating Solid Waste Physical/Chemical Methods (SW846)", Third Edition.

[&]quot;Standard Methods for the Examination of Water and Wastewaters", 21st edition.

[&]quot;American Society for Testing and Materials" (ASTM).

[&]quot;Association of Analytical Chemists" (AOAC).





ANALYTICAL RESULTS

AIC No. 162806-1

Sample Identification: WR-1 27NOV12 1655

Analyte		Result	RL	Units	Qualifier
Total Kjeldahl Nitrogen EPA 351.2	Prep: 29-Nov-2012 1545 by 93	< 1 Analyzed: 03-Dec-	1 2012 1654 by 93	mg/l Batch: W41814	
Total Dissolved Solids SM 2540 C	Prep: 29-Nov-2012 1500 by 306	170 Analyzed: 30-Nov-	10 2012 1406 by 306	mg/l Batch: W41812	
Total Phosphorus SM 4500-P B,F	Prep: 29-Nov-2012 1547 by 306	< 0.02 Analyzed: 03-Dec-	0.02 2012 1214 by 306	mg/l Batch: W41815	
Chloride EPA 300.0	Prep: 29-Nov-2012 1104 by 07	5.6 Analyzed: 29-Nov-	0.2 2012 1228 by 07	mg/l Batch: S33563	
Nitrate + Nitrite as N EPA 300.0	Prep: 29-Nov-2012 1104 by 07	0.59 Analyzed: 29-Nov-	0.5 2012 1510 by 07	mg/l Batch: S33563	D Dil: 10
Sulfate EPA 300.0	Prep: 29-Nov-2012 1104 by 07	6.5 Analyzed: 29-Nov-	0.2 2012 1228 by 07	mg/l Batch: S33563	

AIC No. 162806-2

Sample Identification: WR-0 27NOV12 1723

Sample Identification: WR	-0 2/NOV12 1/23				
Analyte		Result	RL	Units	Qualifier
Total Kjeldahl Nitrogen EPA 351.2	Prep: 29-Nov-2012 1545 by 93	< 1 Analyzed: 03-Dec	1 -2012 1659 by 93	mg/l Batch: W41814	
Total Dissolved Solids SM 2540 C	Prep: 29-Nov-2012 1500 by 306	150 Analyzed: 30-Nov	10 r-2012 1406 by 306	mg/l Batch: W41812	
Total Phosphorus SM 4500-P B,F	Prep: 29-Nov-2012 1547 by 306	< 0.02 Analyzed: 03-Dec	0.02 -2012 1356 by 306	mg/l Batch: W41815	
Chloride EPA 300.0	Prep: 29-Nov-2012 1104 by 07	6.1 Analyzed: 29-Nov	0.2 v-2012 1254 by 07	mg/l Batch: S33563	
Nitrate + Nitrite as N EPA 300.0	Prep: 29-Nov-2012 1104 by 07	< 0.5 Analyzed: 29-Nov	0.5 v-2012 1536 by 07	mg/l Batch: S33563	D Dil: 10
Sulfate EPA 300.0	Prep: 29-Nov-2012 1104 by 07	7.0 Analyzed: 29-Nov	0.2 v-2012 1254 by 07	mg/l Batch: S33563	

AIC No. 162806-3

Sample Identification: CC-0 28NOV12 0840

Analyte		Result	RL	Units	Qualifier
Total Kjeldahl Nitrogen EPA 351.2	Prep: 29-Nov-2012 1545 by 93	< 1 Analyzed: 03-Dec-	1 2012 1701 by 93	mg/l Batch: W41814	
Total Dissolved Solids SM 2540 C	Prep: 29-Nov-2012 1500 by 306	230 Analyzed: 30-Nov-	10 2012 1406 by 306	mg/l Batch: W41812	
Total Phosphorus SM 4500-P B,F	Prep: 29-Nov-2012 1547 by 306	< 0.02 Analyzed: 03-Dec-	0.02 2012 1217 by 306	mg/l Batch: W41815	
Chloride EPA 300.0	Prep: 29-Nov-2012 1104 by 07	8.9 Analyzed: 29-Nov-	0.2 2012 1320 by 07	mg/l Batch: S33563	



December 4, 2012 Control No. 162806 Page 4 of 6

FTN Associates, Ltd. 3 Innwood Circle, Suite 220 Little Rock, AR 72211

ANALYTICAL RESULTS

AIC No. 162806-3 (Continued)

Sample Identification: CC-0 28NOV12 0840

Analyte		Result	RL	Units	Qualifier
Nitrate + Nitrite as N EPA 300.0	Prep: 29-Nov-2012 1104 by 07	1.5 Analyzed: 29-N	0.5 ov-2012 1719 by 07	mg/l Batch: S33563	D Dil: 10
Sulfate EPA 300.0	Prep: 29-Nov-2012 1104 by 07	6.2 Analyzed: 29-N	0.2 ov-2012 1320 by 07	mg/l Batch: S33563	

AIC No. 162806-4

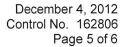
Sample Identification: CC-1 28NOV12 1213

outp.c.iu.out.u					
Analyte		Result	RL	Units	Qualifier
Total Kjeldahl Nitrogen EPA 351.2	Prep: 29-Nov-2012 1545 by 93	< 1 Analyzed: 03-Dec-	1 2012 1702 by 93	mg/l Batch: W41814	
Total Dissolved Solids SM 2540 C	Prep: 29-Nov-2012 1500 by 306	280 Analyzed: 30-Nov-	10 2012 1406 by 306	mg/l Batch: W41812	
Total Phosphorus SM 4500-P B,F	Prep: 29-Nov-2012 1547 by 306	0.58 Analyzed: 03-Dec-	0.02 -2012 1244 by 306	mg/l Batch: W41815	
Chloride EPA 300.0	Prep: 29-Nov-2012 1104 by 07	21 Analyzed: 29-Nov-	0.2 2012 1346 by 07	mg/l Batch: S33563	
Nitrate + Nitrite as N EPA 300.0	Prep: 29-Nov-2012 1104 by 07	4.9 Analyzed: 29-Nov-	0.5 -2012 1745 by 07	mg/l Batch: S33563	D Dil: 10
Sulfate EPA 300.0	Prep: 29-Nov-2012 1104 by 07	29 Analyzed: 29-Nov	0.2 -2012 1346 by 07	mg/l Batch: S33563	

AIC No. 162806-5

Sample Identification: H001 28NOV12 1600

Total Kjeldahl Nitrogen 2.3 1 mg/l EPA 351.2 Prep: 29-Nov-2012 1545 by 93 430 10 mg/l SM 2540 C Prep: 29-Nov-2012 1500 by 306 Analyzed: 30-Nov-2012 1406 by 306 Batch: W41812 Total Phosphorus 2.5 0.1 mg/l D SM 4500-P B,F Prep: 29-Nov-2012 1547 by 306 Analyzed: 03-Dec-2012 1245 by 306 Batch: W41815 Dil: 5 Chloride 65 2 mg/l D EPA 300.0 Prep: 29-Nov-2012 1104 by 07 Analyzed: 29-Nov-2012 1438 by 07 Batch: S33563 Dil: 10 Nitrate + Nitrite as N Prep: 29-Nov-2012 1104 by 07 Analyzed: 29-Nov-2012 1811 by 07 Batch: S33563 Dil: 10 Sulfate 110 2 mg/l D	oumpic lacitationation. Thos	20110112 1000				
## Prep: 29-Nov-2012 1545 by 93	Analyte		Result	RL	Units	Qualifier
SM 2540 C Prep: 29-Nov-2012 1500 by 306 Analyzed: 30-Nov-2012 1406 by 306 Batch: W41812 Total Phosphorus 2.5 0.1 mg/l D SM 4500-P B,F Prep: 29-Nov-2012 1547 by 306 Analyzed: 03-Dec-2012 1245 by 306 Batch: W41815 Dil: 5 Chloride 65 2 mg/l D EPA 300.0 Prep: 29-Nov-2012 1104 by 07 Analyzed: 29-Nov-2012 1438 by 07 Batch: S33563 Dil: 10 Nitrate + Nitrite as N Prep: 29-Nov-2012 1104 by 07 Analyzed: 29-Nov-2012 1811 by 07 Batch: S33563 Dil: 10 Sulfate 10 2 mg/l D		Prep: 29-Nov-2012 1545 by 93		1 2012 1703 by 93		
SM 4500-P B,F Prep: 29-Nov-2012 1547 by 306 Analyzed: 03-Dec-2012 1245 by 306 Batch: W41815 Dil: 5 Chloride EPA 300.0 65 2 mg/l D Nitrate + Nitrite as N EPA 300.0 Prep: 29-Nov-2012 1104 by 07 17 0.5 mg/l D Sulfate Prep: 29-Nov-2012 1104 by 07 Analyzed: 29-Nov-2012 1811 by 07 Batch: S33563 Dil: 10 Sulfate 10 2 mg/l D		Prep: 29-Nov-2012 1500 by 306				
EPA 300.0 Prep: 29-Nov-2012 1104 by 07 Analyzed: 29-Nov-2012 1438 by 07 Batch: S33563 Dil: 10 Nitrate + Nitrite as N 17 0.5 mg/l D EPA 300.0 Prep: 29-Nov-2012 1104 by 07 Analyzed: 29-Nov-2012 1811 by 07 Batch: S33563 Dil: 10 Sulfate 110 2 mg/l D		Prep: 29-Nov-2012 1547 by 306				
EPA 300.0 Prep: 29-Nov-2012 1104 by 07 Analyzed: 29-Nov-2012 1811 by 07 Batch: S33563 Dil: 10 Sulfate 110 2 mg/l D		Prep: 29-Nov-2012 1104 by 07		2 2012 1438 by 07		
Sunatog		Prep: 29-Nov-2012 1104 by 07	(3.05)	75.05		
2177,000.0	Sulfate EPA 300.0	Prep: 29-Nov-2012 1104 by 07		2 2012 1438 by 07	mg/l Batch: S33563	D Dil: 10







ANALYTICAL RESULTS

AIC No. 162806-6

Sample Identification: Y001 28NOV12 1710

Analyte		Result	RL	Units	Qualifier
Total Kjeldahl Nitrogen EPA 351.2	Prep: 29-Nov-2012 1545 by 93	< 1 Analyzed: 03-Dec-2	1 2012 1708 by 93	mg/l Batch: W41814	
Total Dissolved Solids SM 2540 C	Prep: 29-Nov-2012 1500 by 306	270 Analyzed: 30-Nov-2	10 2012 1406 by 306	mg/l Batch: W41812	
Total Phosphorus SM 4500-P B,F	Prep: 29-Nov-2012 1547 by 306	1.8 Analyzed: 03-Dec-2	0.1 2012 1246 by 306	mg/l Batch: W41815	D Dil: 5
Chloride EPA 300.0	Prep: 29-Nov-2012 1104 by 07	41 Analyzed: 29-Nov-2	0.2 2012 1503 by 07	mg/l Batch: S33563	
Nitrate + Nitrite as N EPA 300.0	Prep: 29-Nov-2012 1104 by 07	1.1 Analyzed: 29-Nov-2	0.5 2012 1837 by 07	mg/l Batch: S33563	D Dil: 10
Sulfate EPA 300.0	Prep: 29-Nov-2012 1104 by 07	21 Analyzed: 29-Nov-2	0.2 2012 1503 by 07	mg/l Batch: S33563	





December 4, 2012 Control No. 162806 Page 6 of 6

FTN Associates, Ltd. 3 Innwood Circle, Suite 220 Little Rock, AR 72211

DUPLICATE RESULTS

					RPD				
Analyte		AIC No.	Result	RPD	Limit	Preparation Date	Analysis Date	Dil	Qual
Total Dissolved Solids		162806-1	170 mg/l			29Nov12 1500 by 306	30Nov12 1406 by 306		
	Batch: W41812	Duplicate	160 mg/l	7.09	10.0	29Nov12 1500 by 306	30Nov12 1406 by 306		

LABORATORY CONTROL SAMPLE RESULTS

	Spike									
Analyte	Amount	%	Limits	RPD	Limit	Batch	Preparation Date	Analysis Date	Dil	Qual
Total Kjeldahl Nitrogen	5 mg/l	100	80.0-120			W41814	29Nov12 1546 by 93	03Dec12 1652 by 93		
Total Phosphorus	0.5 mg/l	103	85.0-115			W41815	29Nov12 1548 by 306	03Dec12 1207 by 306		
Chloride	20 mg/l	96.9	90.0-110			S33563	29Nov12 0946 by 07	29Nov12 1131 by 07		
Nitrate + Nitrite as N	8 mg/l	94.4	90.0-110			S33563	29Nov12 0946 by 07	29Nov12 1131 by 07		
Sulfate	20 mg/l	95.9	90.0-110			S33563	29Nov12 0946 by 07	29Nov12 1131 by 07		

MATRIX SPIKE SAMPLE RESULTS

Analyte	Spike Sample Amount	%	Limits	Batch	Preparation Date	Analysis Date	Dil	Qual
Total Kjeldahl Nitrogen	162806-1 5 mg/l 162806-1 5 mg/l Relative Percent Differe	99.8 97.4 nce: 2.28	80.0-120 80.0-120 25.0	W41814 W41814 W41814	AND DESCRIPTION OF THE PARTY OF	03Dec12 1655 by 93 03Dec12 1656 by 93		
Total Phosphorus	162825-1 0.5 mg/l 162825-1 0.5 mg/l Relative Percent Differe	108 113 nce: 2.29	80.0-120 80.0-120 10.0	W41815 W41815 W41815	29Nov12 1548 by 306 29Nov12 1548 by 306	03Dec12 1210 by 306 03Dec12 1211 by 306		D D D
Chloride	162797-1 20 mg/l 162797-1 20 mg/l Relative Percent Differe	94.3 96.8 nce: 2.31	80.0-120 80.0-120 10.0	S33563 S33563 S33563	29Nov12 0946 by 07 29Nov12 0946 by 07	29Nov12 1157 by 07 29Nov12 1327 by 07		
Nitrate + Nitrite as N	162797-1 8 mg/l 162797-1 8 mg/l Relative Percent Differe	92.6 96.3 nce: 3.89	80.0-120 80.0-120 10.0	S33563 S33563 S33563	29Nov12 0946 by 07 29Nov12 0946 by 07	29Nov12 1157 by 07 29Nov12 1327 by 07		
Sulfate	162797-1 20 mg/l 162797-1 20 mg/l Relative Percent Differe	92.8 94.3 nce: 1.56	80.0-120 80.0-120 10.0	S33563 S33563 S33563	29Nov12 0946 by 07 29Nov12 0946 by 07	29Nov12 1157 by 07 29Nov12 1327 by 07		

LABORATORY BLANK RESULTS

				QC			
Analyte	Result	RL	PQL	Sample	Preparation Date	Analysis Date	Qual
Total Kjeldahl Nitrogen	< 1 mg/l	1	1	W41814-1	29Nov12 1546 by 93	03Dec12 1651 by 93	
Total Dissolved Solids	< 10 mg/l	10	10	W41812-1	29Nov12 1500 by 306	30Nov12 1406 by 306	
Total Phosphorus	< 0.02 mg/l	0.02	0.02	W41815-1	29Nov12 1548 by 306	03Dec12 1206 by 306	
Chloride	< 0.2 mg/l	0.2	0.2	S33563-1	29Nov12 0946 by 07	29Nov12 1105 by 07	
Nitrate + Nitrite as N	< 0.05 mg/l	0.05	0.05	S33563-1	29Nov12 0946 by 07	29Nov12 1105 by 07	
Sulfate	< 0.2 mg/l	0.2	0.2	S33563-1	29Nov12 0946 by 07	29Nov12 1105 by 07	

. 1	V1111
11	
	eritir.

Onto Project Name				Proj	Project No.		F	roject N	Project Manager (Print)	2			
40V 12	ek UAA			431	4315-050		,	Jim M	Jim Malcolm			Pagel_	ofl_
Laboratory Name: American Interplex Laboratories		Submitted by:							Paramete	Parameters (Method Number)	mber)	Lab Tum-A	Lab Turn-Around-Time
		FTN Associates, Ltd. 3 Innwood Circle, Su	ciates,	Ltd.	tes, Ltd. ircle, Suite 220				d			24 Hours	Į.
Phone	•	Little Rock, AR 72211 (501) 225-7779 • Fax	k, AR	72211 Fax	Little Rock, AR 72211 (501) 225-7779 • Fax (501) 225-6738	6738			T, V.			☐ 48 Hours	'n
Sampler Signature(s)		Recorded By (Print)	(Print)				1	 CΓ				Normal E	_
***	SAMPLE DESCRIPTION	Jeremy Rigsby CRIPTION	igsby				-	' †O S	-EON			Due:	_/_/
	200	1	Matrix*	* XI	No. of	Comp	Grab	TDS, S	TKN,			Laborate	Laboratory Notes
WR-1	27 NOV 12	. 1655	+-	+-	2	_	×	×	×				
WR-0	27 NOV 12	1723	×		2		×	×	×				
3 CC-0	28 NOV 12	0840	×		2		X	X	×				
η CC-1	28 NOV 12	1213	×		2		×	×	×				
K H001	28 NOV 12	1600	×		2		×	×	×				
4 Y001	28 NOV 12	1710	×		2	•	×	×	×				
				4				-					
y													•
	. 1				5	Container Type	rype	Ь	Ь				
						Preservative		NO	S				
			* Matrix: W = Water	= M	Water	S = Soil		O = Other	ıcı	:			
G = Glass NO = None		P= Plastic S = Sulfuric acid pH2	- 2		V = VOA vials N = Nitric acid pH2		4 = HCI 3 = NaC	H = HCI to pH2 B = NaOH to pH12		I = Sodrum I hiosulfate Z = Zinc acctate	hiosulfate		
Relinquished By (Signature)	Print Name Jeremy Rigsby		Date 38 Mev 13	_	Time Re	Received By (Signature)	y (Signal	(urc)		Print Namo		Date	Time
Relinquished By (Signarue)	Print Name		Date	-	Time Re	ceived By	y Labor	Received By Laboratory (Signature)	gnature)	Print Name	2 Hampto	Date //-29-12	Time 1/004
Please email results to itm@ftn-assoc.com, pjd@ftn-assoc.com, and imr@ftn-assoc.com	fin-assoc.com, p	id@ftn-as	soc.cc	<u>m</u> , ar		Laboratory Remarks:	Remarks	8 ,					
						1	١						



April 8, 2013 Control No. 166277 Page 1 of 7

FTN Associates, Ltd. ATTN: Mr. Jim Malcolm 3 Innwood Circle, Suite 220 Little Rock, AR 72211

This report contains the analytical results and supporting information for samples submitted on April 4, 2013. Attached please find a copy of the Chain of Custody and/or other documents received. Note that any remaining sample will be discarded two weeks from the original report date unless other arrangements are made.

This report is intended for the sole use of the client listed above. Assessment of the data requires access to the entire document.

This report has been reviewed by the Laboratory Director or a qualified designee.

John Overbey
Laboratory Director

This document has been distributed to the following:

PDF cc:

FTN Associates, Ltd. ATTN: Mr. Jim Malcolm jtm@ftn-assoc.com

FTN Associates, Ltd. ATTN: Mr. Pat Downey pjd@ftn-assoc.com

FTN Associates, Ltd. ATTN: Mr. Jeremy Rigsby jmr@ftn-assoc.com



SAMPLE INFORMATION

Project Description:

Eight (8) water sample(s) received on April 4, 2013 04315-0002-001 Crooked Creek UAA

Receipt Details:

A Chain of Custody was provided. The samples were delivered in one (1) ice chest.

Each sample container was checked for proper labeling, including date and time sampled. Sample containers were reviewed for proper type, adequate volume, integrity, temperature, preservation, and holding times. Any exceptions are noted below:

Sample Identification:

Laboratory ID	Client Sample ID	Sampled Date/Time Notes
166277-1	H001 02APR13 1200	02-Apr-2013 1200
166277-2	CC-1 02APR13 1445	02-Apr-2013 1445
166277-3	CC-0 02APR13 1552	02-Apr-2013 1552
166277-4	WR-0 02APR13 2002	02-Apr-2013 2002
166277-5	WR-1 02APR13 2037	02-Apr-2013 2037
166277-6	Y001 03APR13 0826	03-Apr-2013 0826
166277-7	CC-2 03APR13 0907	03-Apr-2013 0907
166277-8	CC-3 03APR13 1149	03-Apr-2013 1149

Qualifiers:

- D Result is from a secondary dilution factor
- Q Analyte is not within quality control limits

Case Narrative:

The matrix spike recovery for Total Kjeldahl Nitrogen failed to meet acceptance criteria due to matrix interference.

References:

"Methods for Chemical Analysis of Water and Wastes", EPA/600/4-79-020 (Mar 1983) with updates and supplements EPA/600/5-91-010 (Jun 1991), EPA/600/R-92-129 (Aug 1992) and EPA/600/R-93-100 (Aug 1993).

"Test Methods for Evaluating Solid Waste Physical/Chemical Methods (SW846)", Third Edition.

[&]quot;Standard Methods for the Examination of Water and Wastewaters", 21st edition.

[&]quot;American Society for Testing and Materials" (ASTM).

[&]quot;Association of Analytical Chemists" (AOAC).



ANALYTICAL RESULTS

AIC No. 166277-1

Sample Identification: H001 02APR13 1200

Analyte		Result	RL	Units	Qualifier
Total Kjeldahl Nitrogen EPA 351.2	Prep: 04-Apr-2013 1507 by 93	1.6 Analyzed: 05-Apr-2	1 013 1652 by 93	mg/l Batch: W43108	
Total Dissolved Solids SM 2540 C	Prep: 04-Apr-2013 1509 by 302	340 Analyzed: 05-Apr-2	10 013 1609 by 302	mg/l Batch: W43109	
Phosphorus EPA 200.7	Prep: 04-Apr-2013 1023 by 271	0.76 Analyzed: 04-Apr-20	0.02 013 1628 by 305	mg/l Batch: S34349	
Chloride EPA 300.0	Prep: 04-Apr-2013 1551 by 270	51 Analyzed: 04-Apr-20	2 013 2333 by 270	mg/l Batch: S34355	D Dil: 10
Nitrate + Nitrite as N EPA 300.0	Prep: 04-Apr-2013 1551 by 270	12 Analyzed: 05-Apr-2	0.5 013 1410 by 270	mg/l Batch: S34355	D Dil: 10
Sulfate EPA 300.0	Prep: 04-Apr-2013 1551 by 270	66 Analyzed: 04-Apr-20	2 013 2333 by 270	mg/l Batch: S34355	D Dil: 10

AIC No. 166277-2

Sample Identification: CC-1 02APR13 1445

Analyte		Result	RL	Units	Qualifier
Total Kjeldahl Nitrogen EPA 351.2	Prep: 04-Apr-2013 1507 by 93	< 1 Analyzed: 05-Apr-2	1	mg/l Batch: W43108	<u> </u>
Total Dissolved Solids SM 2540 C	Prep: 04-Apr-2013 1509 by 302	200 Analyzed: 05-Apr-2	10 2013 1609 by 302	mg/l Batch: W43109	
Phosphorus EPA 200.7	Prep: 04-Apr-2013 1023 by 271	0.34 Analyzed: 04-Apr-2	0.02 2013 1633 by 305	mg/l Batch: S34349	
Chloride EPA 300.0	Prep: 04-Apr-2013 1551 by 270	7.8 Analyzed: 04-Apr-2	2 2013 2359 by 270	mg/l Batch: S34355	D Dil: 10
Nitrate + Nitrite as N EPA 300.0	Prep: 04-Apr-2013 1551 by 270	1.7 Analyzed: 05-Apr-2	0.5 2013 1619 by 270	mg/l Batch: S34355	D Dil: 10
Sulfate EPA 300.0	Prep: 04-Apr-2013 1551 by 270	8.8 Analyzed: 04-Apr-2	2 2013 2359 by 270	mg/l Batch: S34355	D Dil: 10

AIC No. 166277-3

Sample Identification: CC-0 02APR13 1552

Analyte		Result	RL	Units	Qualifier
Total Kjeldahl Nitrogen EPA 351.2	Prep: 04-Apr-2013 1507 by 93	< 1 Analyzed: 05-Ap	1 or-2013 1604 by 93	mg/l Batch: W43108	
Total Dissolved Solids SM 2540 C	Prep: 04-Apr-2013 1509 by 302	160 Analyzed: 05-Ap	10 or-2013 1609 by 302	mg/l Batch: W43109	
Phosphorus EPA 200.7	Prep: 04-Apr-2013 1023 by 271	0.33 Analyzed: 04-Ap	0.02 or-2013 1652 by 305	mg/l Batch: S34349	
Chloride EPA 300.0	Prep: 04-Apr-2013 1551 by 270	6.9 Analyzed: 05-Ap	2 or-2013 0025 by 270	mg/l Batch: S34355	D Dil: 10



April 8, 2013 Control No. 166277 Page 4 of 7

ANALYTICAL RESULTS

AIC No. 166277-3 (Continued)

Sample Identification: CC-0 02APR13 1552

Analyte		Result	RL	Units	Qualifier
Nitrate + Nitrite as N	Prep: 04-Apr-2013 1551 by 270	1.5	0.5	mg/l	D
EPA 300.0		Analyzed: 05-Ap	or-2013 1725 by 270	Batch: S34355	Dil: 10
Sulfate	Prep: 04-Apr-2013 1551 by 270	5.8	2	mg/l	D
EPA 300.0		Analyzed: 05-Ap	or-2013 0025 by 270	Batch: S34355	Dil: 10

AIC No. 166277-4

Sample Identification: WR-0 02APR13 2002

Campic facilitioation. VIII	02/11/11/02/02				
Analyte		Result	RL	Units	Qualifier
Total Kjeldahl Nitrogen EPA 351.2	Prep: 04-Apr-2013 1507 by 93	< 1 Analyzed: 05-Apr-2	1 013 1605 by 93	mg/l Batch: W43108	
Total Dissolved Solids SM 2540 C	Prep: 04-Apr-2013 1509 by 302	220 Analyzed: 05-Apr-2	10 013 1609 by 302	mg/l Batch: W43109	
Phosphorus EPA 200.7	Prep: 04-Apr-2013 1023 by 271	0.30 Analyzed: 04-Apr-2	0.02 013 1656 by 305	mg/l Batch: S34349	
Chloride EPA 300.0	Prep: 04-Apr-2013 1551 by 270	4.9 Analyzed: 05-Apr-2	2 013 0051 by 270	mg/l Batch: S34355	D Dil: 10
Nitrate + Nitrite as N EPA 300.0	Prep: 04-Apr-2013 1551 by 270	0.71 Analyzed: 05-Apr-2	0.5 013 1811 by 270	mg/l Batch: S34355	D Dil: 10
Sulfate EPA 300.0	Prep: 04-Apr-2013 1551 by 270	56 Analyzed: 05-Apr-2	2 013 0051 by 270	mg/l Batch: S34355	D Dil: 10

AIC No. 166277-5

Sample Identification: WR-1 02APR13 2037

oumpro raomamounom viv	() 02/() () 02/()				
Analyte		Result	RL	Units	Qualifier
Total Kjeldahl Nitrogen EPA 351.2	Prep: 04-Apr-2013 1507 by 93	< 1 Analyzed: 05-Apr-	1 2013 1606 by 93	mg/l Batch: W43108	
Total Dissolved Solids SM 2540 C	Prep: 04-Apr-2013 1509 by 302	78 Analyzed: 05-Apr-	10 2013 1609 by 302	mg/l Batch: W43109	
Phosphorus EPA 200.7	Prep: 04-Apr-2013 1023 by 271	0.26 Analyzed: 04-Apr-	0.02 2013 1700 by 305	mg/l Batch: S34349	
Chloride EPA 300.0	Prep: 04-Apr-2013 1551 by 270	4.7 Analyzed: 05-Apr-	2 2013 0117 by 270	mg/l Batch: S34355	D Dil: 10
Nitrate + Nitrite as N EPA 300.0	Prep: 04-Apr-2013 1551 by 270	< 0.5 Analyzed: 05-Apr-	0.5 2013 1834 by 270	mg/l Batch: S34355	D Dil: 10
Sulfate EPA 300.0	Prep: 04-Apr-2013 1551 by 270	7.7 Analyzed: 05-Apr-	2 2013 0117 by 270	mg/l Batch: S34355	D Dil: 10



ANALYTICAL RESULTS

AIC No. 166277-6

Sample Identification: Y001 03APR13 0826

Analyte		Result	RL	Units	Qualifier
Total Kjeldahl Nitrogen EPA 351.2	Prep: 04-Apr-2013 1507 by 93	< 1 Analyzed: 05-Apr-	1 2013 1608 by 93	mg/l Batch: W43108	
Total Dissolved Solids SM 2540 C	Prep: 04-Apr-2013 1509 by 302	320 Analyzed: 05-Apr-	10 2013 1609 by 302	mg/l Batch: W43109	
Phosphorus EPA 200.7	Prep: 04-Apr-2013 1023 by 271	1.1 Analyzed: 04-Apr-	0.02 2013 1703 by 305	mg/l Batch: S34349	
Chloride EPA 300.0	Prep: 04-Apr-2013 1551 by 270	23 Analyzed: 05-Apr-	2 2013 0143 by 270	mg/l Batch: S34355	D Dil: 10
Nitrate + Nitrite as N EPA 300.0	Prep: 04-Apr-2013 1551 by 270	0.54 Analyzed: 05-Apr-	0.5 2013 1856 by 270	mg/l Batch: S34355	D Dil: 10
Sulfate EPA 300.0	Prep: 04-Apr-2013 1551 by 270	25 Analyzed: 05-Apr-	2 2013 0143 by 270	mg/l Batch: S34355	D Dil: 10

AIC No. 166277-7

Sample Identification: CC-2 03APR13 0907

Analyte		Result	RL	Units	Qualifier
Total Kjeldahl Nitrogen EPA 351.2	Prep: 04-Apr-2013 1507 by 93	< 1 Analyzed: 05-Apr-2	1 2013 1612 by 93	mg/l Batch: W43108	
Total Dissolved Solids SM 2540 C	Prep: 04-Apr-2013 1509 by 302	190 Analyzed: 05-Apr-2	10 2013 1609 by 302	mg/l Batch: W43109	
Phosphorus EPA 200.7	Prep: 04-Apr-2013 1023 by 271	0.32 Analyzed: 04-Apr-:	0.02 2013 1708 by 305	mg/l Batch: S34349	
Chloride EPA 300.0	Prep: 04-Apr-2013 1551 by 270	5.3 Analyzed: 05-Apr-:	2 2013 0208 by 270	mg/l Batch: S34355	D Dil: 10
Nitrate + Nitrite as N EPA 300.0	Prep: 04-Apr-2013 1551 by 270	1.4 Analyzed: 05-Apr-	0.5 2013 1920 by 270	mg/l Batch: S34355	D Dil: 10
Sulfate EPA 300.0	Prep: 04-Apr-2013 1551 by 270	7.8 Analyzed: 05-Apr-	2 2013 0208 by 270	mg/l Batch: S34355	D Dil: 10

AIC No. 166277-8

Sample Identification: CC-3 03APR13 1149

Sample Identification. 00 0	00/11/10/11/10				
Analyte		Result	RL	Units	Qualifier
Total Kjeldahl Nitrogen EPA 351.2	Prep: 04-Apr-2013 1507 by 93	< 1 Analyzed: 05-Apr-2	1 013 1613 by 93	mg/l Batch: W43108	
Total Dissolved Solids SM 2540 C	Prep: 04-Apr-2013 1509 by 302	240 Analyzed: 05-Apr-2	10 013 1609 by 302	mg/l Batch: W43109	
Phosphorus EPA 200.7	Prep: 04-Apr-2013 1023 by 271	0.32 Analyzed: 04-Apr-2	0.02 013 1712 by 305	mg/l Batch: S34349	
Chloride EPA 300.0	Prep: 04-Apr-2013 1551 by 270	5.7 Analyzed: 05-Apr-2	2 013 0234 by 270	mg/l Batch: S34355	D Dil: 10



April 8, 2013 Control No. 166277 Page 6 of 7

ANALYTICAL RESULTS

AIC No. 166277-8 (Continued)

Sample Identification: CC-3 03APR13 1149

Analyte		Result	RL	Units	Qualifier
Nitrate + Nitrite as N		1.1	0.5	mg/l	D
EPA 300.0	Prep: 04-Apr-2013 1551 by 270	Analyzed: 05-Apr-2	2013 2104 by 270	Batch: S34355	Dil: 10
Sulfate		7.0	2	mg/l	D
EPA 300.0	Prep: 04-Apr-2013 1551 by 270	Analyzed: 05-Apr-2	2013 0234 by 270	Batch: S34355	Dil: 10



April 8, 2013 Control No. 166277 Page 7 of 7

DUPLICATE RESULTS

					RPD				
Analyte		AIC No.	Result	RPD	Limit	Preparation Date	Analysis Date	Dil	Qual
Total Dissolved Solids		166277-1	340 mg/l			04Apr13 1509 by 302	05Apr13 1609 by 302		
	Batch: W43109	Duplicate	350 mg/l	2.90	10.0	04Apr13 1509 by 302	05Apr13 1609 by 302		

LABORATORY CONTROL SAMPLE RESULTS

	Spike									
Analyte	Amount	%	Limits	RPD	Limit	Batch	Preparation Date	Analysis Date	Dil	Qual
Total Kjeldahl Nitrogen	5 mg/l	110	80.0-120			W43108	04Apr13 1509 by 93	05Apr13 1557 by 93		
Phosphorus	5 mg/l	105	85.0-115			S34349	04Apr13 1024 by 271	04Apr13 1515 by 305		
Chloride	20 mg/l	96.8	90.0-110			S34355	04Apr13 1552 by 270	04Apr13 1828 by 270		
Nitrate + Nitrite as N	8 mg/l	99.8	90.0-110			S34355	04Apr13 1552 by 270	04Apr13 1828 by 270		
Sulfate	20 mg/l	95.4	90.0-110			S34355	04Apr13 1552 by 270	04Apr13 1828 by 270		

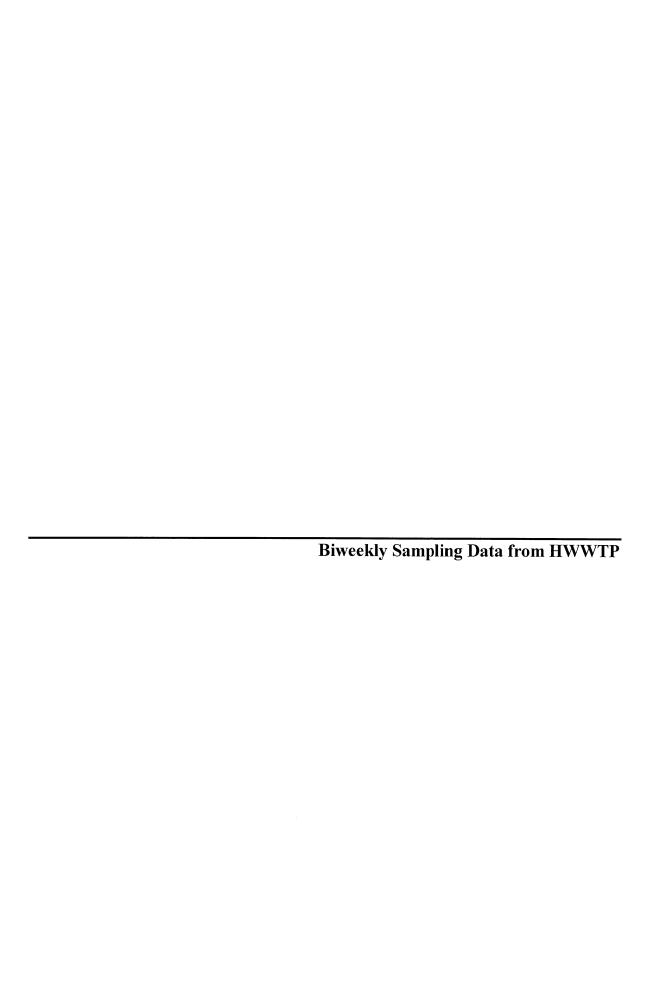
MATRIX SPIKE SAMPLE RESULTS

Analyte	Spike Sample Amount	%	Limits	Batch	Preparation Date	Analysis Date	Dil	Oual
Total Kjeldahl Nitrogen	166277-1 5 mg/l 166277-1 5 mg/l Relative Percent Difference:	72.2 77.9	80.0-120 80.0-120 25.0	W43108 W43108 W43108	04Apr13 1509 by 93 04Apr13 1509 by 93	05Apr13 1654 by 93 05Apr13 1654 by 93	<u>DII</u>	Qual Q Q
Phosphorus	166259-1 5 mg/l 166259-1 5 mg/l Relative Percent Difference:	102 102 0.468	75.0-125 75.0-125 20.0	S34349 S34349 S34349	04Apr13 1024 by 271 04Apr13 1024 by 271	04Apr13 1519 by 305 04Apr13 1522 by 305		
Chloride	166292-1 20 mg/l 166292-1 20 mg/l Relative Percent Difference:	96.7 96.6 0.0501	80.0-120 80.0-120 10.0	S34355 S34355 S34355	04Apr13 1552 by 270 04Apr13 1552 by 270	04Apr13 1853 by 270 04Apr13 1919 by 270		
Nitrate + Nitrite as N	166292-1 8 mg/l 166292-1 8 mg/l Relative Percent Difference:	99.2 99.2 0.00	80.0-120 80.0-120 10.0	S34355 S34355 S34355	04Apr13 1552 by 270 04Apr13 1552 by 270	04Apr13 1853 by 270 04Apr13 1919 by 270		
Sulfate	166292-1 20 mg/l 166292-1 20 mg/l Relative Percent Difference:	97.2 97.3 0.0299	80.0-120 80.0-120 10.0	S34355 S34355 S34355	04Apr13 1552 by 270 04Apr13 1552 by 270	04Apr13 1853 by 270 04Apr13 1919 by 270		

LABORATORY BLANK RESULTS

				QC			
Analyte	Result	RL	PQL	Sample	Preparation Date	Analysis Date	Qual
Total Kjeldahl Nitrogen	< 1 mg/l	1	1	W43108-1	04Apr13 1509 by 93	05Apr13 1555 by 93	
Total Dissolved Solids	< 10 mg/l	10	10	W43109-1	04Apr13 1509 by 302	05Apr13 1609 by 302	
Phosphorus	< 0.02 mg/l	0.02	0.02	S34349-1	04Apr13 1024 by 271	04Apr13 1534 by 305	
Chloride	< 0.2 mg/l	0.2	0.2	S34355-1	04Apr13 1552 by 270	04Apr13 1804 by 270	
Nitrate + Nitrite as N	< 0.05 mg/l	0.05	0.05	S34355-1	04Apr13 1552 by 270	04Apr13 1804 by 270	
Sulfate	< 0.2 mg/l	0.2	0.2	S34355-1	04Apr13 1552 by 270	04Apr13 1804 by 270	

	,											7	しし しょうしょ
Date Project Name 04 APR 13 Crooked C	Project Name Crooked Creek UAA			Project No. 04315-0002-001	002-001		Project Jim N	Project Manager (Print) Jim Malcolm	rint)			, d	Page1_ of
H C:		Submitted by:						Param	eters (Mei	Parameters (Method Number)	er)		Lab Turn-Around-Time
American interpreta caporatorios		A 2-1-1	4						2012		 - -	1	
	_	r IN Associates, Ltd. 3 Innwood Circle, Suite 220	rates, Lit Circle, S	a. Juite 220				ЧТ			<u>-</u>		☐ 24 Hours
		Little Rock, AR 72211	AR 727	211 Say (501)	8229366			'NZ					☐ 48 Hours
, FIIORC:		1-077 (100)		(10C) vp	0010-077		,	ON				<u> </u>	Normal
Sampler Signature(s)	1	Recorded By (Print) Jeremy Rigsby	Print)				r' CF	+NE] Other:
	SAMPLE DESCRIPTION	CRIPTION					os	ON					Duc:/
		_	Matrix*			G	·'so	'NZ					
Sample Identification	Date	Time	∞	Cont.	No. of dwg	irab	1 1	TF.					Laboratory Notes
H001	02 APR 13	1200	×		2	×	×	×					
CC-1	02 APR 13	1445	×		2	×	×	×					
0-22	02 APR 13	1552	×		2	×	×	×					
WR-0	02 APR 13	2002	*		2	×	×	×					
WR-1	02 APR 13	2037			2	X	×	×					-
Y001	03 APR 13	0826	×		2	×	×	×					
CC-2	03 APR 13	0907	×		2	×	×	×		-			
CC-3	03 APR 13	1149	×		2	×	×	X					
					Container Type	r Type	Ь	Ь	-				
ļ					Prese	Preservative	9N	S					
			* Matrix: W = Water	= Water	S = Soil		0 = Other	her					
= ON .	G = Glass $P = PlasticNO = None$ $S = Sulfur$	P= Plastic S = Sulfuric acid pH2	∥ ∥ > Z	V = VOA vials N = Nitric acid pH2	pH2	H = H B = N ₃	H = HCI to pH2 B = NaOH to pH12	112	T = So Z = Zir	T = Sodium Thiosulfate Z = Zinc acetate	sulfate		
Relinquished By (Signature)	Print Name Ieremy Riosby		Datc 62/ 402/2	Time	Received By (Signature)	By (Sign	ature)		Print	Print Name		<u> </u> -	Date Time
Relinquished By (Signature)	Print Name		Datc		Received By Laboratory (Signature)	By Lab	ratory (S	ignature)	ir.	Print Name	yo Ce	7	Date Time
Please email results to jun@fin-assoc.com, pid@fin-assoc.com, and	@ftn-assoc.com, p	id@ftn-ass	oc.com.	and	Laboratory Remarks:	y Remai	ks:					· 	
jmr(a)ttn-assoc.com													i
													, 2.6





2790 Whitten Road

Memphis Tennessee 38133

(901) 213-2400

5/21/2012

Harrison Wastewater Treatment Plant Ms. Kathryn Catlin PO Box 1715 Harrison, AR, 72601

Ref:

Analytical Testing

ETC Report Number: 12-132-0213

Client Project Description: Bi-weekly Sampling

Dear Ms. Kathryn Catlin:

Environmental Testing and Consulting, Inc. received 3 sample(s) on 5/11/2012 for the analyses presented in the following report.

The above referenced project has been analyzed per your instructions. The analyses were performed in accordance with the applicable analytical method.

The analytical data has been validated using standard quality control measures performed as required by the analytical method. Quality Assurance, method validations, instrumentation maintenance and calibration for all parameters (NELAP and non-NELAP) were performed in accordance with guidelines established by the USEPA and NELAC unless otherwise indicated. Any parameter for which the laboratory is not officially NELAP accredited is indicated by a '~' symbol. These are not included in the scope because NELAP accreditation is either not available or has not been applied for. Additional certifications may be held/are available for parameters, where NELAP accreditation is not required or applicable. A full list of certifications is available upon request.

The results are shown on the attached Report of Analysis(s). Results for solid matrices are reported on an asreceived basis unless otherwise indicated. This report shall not be reproduced except in full and relates only to the samples included in this report.

Please do not hesitate to contact me or client services if you have any questions or need additional information.

Sincerely,

Randy Thomas

Project Manager

Rendell H. Thomas

Laboratory's liability in any claim relating to analyses performed shall be limited to, at laboratory's option, repeating the analysis in question at laboratory's expense, or the refund of the charges paid for performance of said analysis.

#9311

Mississippi Kentucky



2790 Whitten Road

"A Laboratory Management Partner"

03322

Harrison Wastewater Treatment Plant

Ms. Kathryn Catlin

PO Box 1715

Harrison, AR 72601

Project

Bi-weekly Sampling

Information:

Report Date: 5/21/2012

Report Number: 12-132-0213

REPORT OF ANALYSIS

Received: 5/11/2012

Lab No:

93305

Sample ID: Silver Valley Bridge (Downstream)

Matrix: Aqueous

Sampled: 5/10/2012 8:20

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Alkalinity (as CaCO3)	173	mg/L	- 1	1	05/17/12 09:12	EWB	2320B
Chloride	10.7	mg/L	0.400	1	05/19/12 01:15	RQE	EPA-300.0
Total Dissolved Solids	242	mg/L	10	1	05/15/12 08:30	NRT	2540C
Total Calcium	69.2	mg/L	0.100	1	05/15/12 02:42	BKN	EPA-200.7
Total Magnesium	1.80	mg/L	0.100	1	05/15/12 02:42	BKN	EPA-200.7
Total Potassium	1.68	mg/L	0.100	1	05/15/12 02:42	BKN	EPA-200.7
Total Sodium	6.05	mg/L	0.500	1	05/15/12 02:42	BKN	EPA-200.7
Total Sulfate (SO4)	8.51	mg/L	1.00	1	05/19/12 01:15	RQE	EPA-300.0

Lab No:

93306

Sample ID: Hwy 62/65 Bridge (Upstream)

Matrix: Aqueous

Sampled: 5/10/2012 8:05

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Alkalinity (as CaCO3)	177	mg/L	1	1	05/17/12 09:12	EWB	2320B
Chloride	7.44	mg/L	0.400	1	05/19/12 01:32	RQE	EPA-300.0
Total Dissolved Solids	266	mg/L	10	1	05/15/12 08:30	NRT	2540C
Total Calcium	71.6	mg/L	0.100	1	05/15/12 03:09	BKN	EPA-200.7
Total Magnesium	1.76	mg/L	0.100	1	05/15/12 03:09	BKN	EPA-200.7
Total Potassium	1.24	mg/L	0.100	1	05/15/12 03:09	BKN	EPA-200.7
Total Sodium	3.41	mg/L	0.500	1	05/15/12 03:09	BKN	EPA-200.7
Total Sulfate (SO4)	4.41	mg/L	1.00	1	05/19/12 01:32	RQE	EPA-300.0

Qualifiers/ **Definitions**

MQL

Outside QC limit

Method Quantitation Limit

DF

Dilution Factor



2790 Whitten Road

Memphis, Tennessee 38133

"A Laboratory Management Partner"

03322

Harrison Wastewater Treatment Plant

Ms. Kathryn Catlin

PO Box 1715 Harrison, AR 72601 Project

Bi-weekly Sampling

Information:

Report Date : 5/21/2012

Report Number : 12-132-0213

REPORT OF ANALYSIS

Received: 5/11/2012

Lab No: 93307

Sample ID: WWTP Discharge Point

Matrix: Aqueous

Sampled: 5/10/2012 8:30

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Alkalinity (as CaCO3)	174	mg/L	1	1	05/17/12 09:12	EWB	2320B
Chloride	9.03	mg/L	0.400	1	05/19/12 00:57	RQE	EPA-300.0
Total Dissolved Solids	294	mg/L	10	1	05/15/12 08:30	NRT	2540C
Total Calcium	71.6	mg/L	0.100	1	05/15/12 03:16	BKN	EPA-200.7
Total Magnesium	1.77	mg/L	0.100	1	05/15/12 03:16	BKN	EPA-200.7
Total Potassium	1.31	mg/L	0.100	1	05/15/12 03:16	BKN	EPA-200.7
Total Sodium	3.89	mg/L	0.500	1	05/15/12 03:16	BKN	EPA-200.7
Total Sulfate (SO4)	6.31	mg/L	1.00	1	05/19/12 00:57	RQE	EPA-300.0

Qualifiers/ **Definitions**

MQL

Outside QC limit

Method Quantitation Limit

DF

Dilution Factor



2790 Whitten Road

Memphis, Tennessee 38133

(901) 213-24

Fax (901) 213-2440

"A Laboratory Management Partner"

Cooler Receipt Form

Customer Number:	03322
Customer Name:	Harrison Wastewater Treatment Plant
Report Number:	12-132-0213
	Shipping Method

○ Fed Ex ● UPS ○ US Postal Clien	t C Lab	Ourier (Other:
Shipping container/cooler uncompromised?	Yes	○ No	
Custody seals intact on shipping container/cooler?	? O Yes	○ No	Not Required
Custody seals intact on sample bottles?	O Yes	○ No	Not Required
Chain of Custody (COC) present?	Yes	○ No	
COC agrees with sample label(s)?	Yes	○ No	
COC properly completed	Yes	○ No	
Samples in proper containers?	Yes	○ No	
Sample containers intact?	Yes	○ No	
Sufficient sample volume for indicated test(s)?	Yes	○ No	
All samples received within holding time?	Yes	○ No	
Cooler temperature in compliance?	Yes	○ No	
Cooler/Samples arrived at the laboratory on ice. Samples were considered acceptable as cooling process had begun.	Yes	○ No	
Water - Sample containers properly preserved	Yes	○ No	○ N/A
Water - VOA vials free of headspace	O Yes	○ No	● N/A
Trip Blanks received with VOAs	O Yes	○ No	N/A
Soil VOA method 5035 – compliance criteria met	O Yes	○ No	N/A
High concentration container (48 hr)	Low	concentration EnCo	ore samplers (48 hr)
High concentration pre-weighed (methanol -14	d) Low	conc pre-weighed v	vials (Sod Bis -14 d)
Special precautions or instructions included?	O Yes	No	,
Comments:			
			* *

Any regulatory non-compliance issues will be recorded on non-compliance report.

Signature: Rebekah Ross

Date & Time: 05/11/2012 09:55:12

City	, Of	City Of Harrison	nc	I i	rison Waste	Harrison Wastevater Treatment Plant	Wastevrater Treatment Plant			12-132-0213 03322 2012-05-11 09:54-51		Ö	lail	0 4	Chain of Custody	stc	dy	
Client	11/1/ 12/1/ 1/1/ 12/1/ 12/1/ 12/1/ 12/1/ 12/1/ 12/1/ 12/1/ 12/1/ 12/1/ 12/1/ 1	City of Harrison	Son			ļ į	,	-			1	ted			100 mm m	-		
Address		1508 Silver Valley Road	Road															*****
		Harriosn, AR 72601	_										-					
email address		hwwtp2@windstreem.net	eam.net			1110		-				OT						
Phone No.		870-741-4426		#B								TAL		~				
FAX No.		870-741-5022		Purchas	Purchase Order #	**		(C				, DI		то				
Project:		CROOKED CREEK SAMPLING	K SAMPLING					i)rat	_			SSO		TAL				
Project Manager		Tím Holt						ort	PO	_	-	LVI	(. AL		***************************************		
Type of Event:	ıt:						+5	**************	ATC	CA	GN	SU.		KAI				
Single Daily	Company of the last	Monthly Quart	Monthly Quarterly Semi-Annual				. M			LCI	-	-	-	LIN				
Date	Time	Sample	Sample Identification	Matrix	Type	No	Pres.	UM		UМ				ITY				
\$/10/2012	8:20AM	Silver Valley	Silver Valley Bridge (Downstream)	water	plastic	1	NONE	9	_			×	×	×				
5/10/2012	8:20AM	Silver Valley	Silver Valley Bridge (Downstream)	water	piastic	-	J	9	×	×	×	\dashv	-			1	E9	
	3						20.000	(4			-	>	Þ		-		
5/10/2012	8:05AM	HWY 62-6.	HWY 62-65 Bridge (Upstream)	water	plastic	-	NONE	פ	_		1	<	+	<	1	+		T
5/10/2012	8:05AM	HWY 62-6:	HWY 62-65 Bridge (Upstream)	water	plastic	_	-	0	×	×	×				1			
							. 11	1	+	_	1	+	+					
5/10/2012	8:30AM	WWTP DI	WWTP DISCHARGE POINT	water	plastic	-	NONE	Ö	+			×	×	×	1	+		T
5/10/2012	8:30AM	WWTP DI	WWTP DISCHARGE POINT	water	plastic	-	W est	O	×	×	×		+					
									-	-		+					100	
									-				, N				1 . 1	
							ile.		_									
Preservatives (3) Sodium T	s: (1) Nitric	c Acid(NH03) (2)Hy	Preservatives: (1) Nitric Acid(NH03) (2) Hydrochloric Acid(HCL) (3) Sodium Thiosulfate(Na2S203) (4) Sodium Hydroxide(Na03)	Client R	emarks/C	Client Remarks/Comments:												
Relin	Relinguished By (Sign)	By (Sign)	Print Name / Company	ampan		•	Date / Time		*****	J.	Series .	Week By (Sign	Sign)		Pripri	'ame'	Print Name / Company	ĵ,
1	John Williams		Tim Holt/City of Harrison	f Harri	nos	5-10-	5-10-2012/9:00AM	00AM		0	0	Q	(U)		0-1	4	
										-					-			
									-		ľ							
Rec'd at Lab By:	By:		8	Rec'd D.	Rec'd Date / Time		PX.				Ĭ	Comments	uts:					
Shipped Via	Sdn	ICED	NEXT DAY AIR										ÿ					

ري (ب



"A Laboratory Management Partner

2790 Whitten Road

Memphis, Tennessee 38133

(901) 213-2400

5/24/2012

Harrison Wastewater Treatment Plant Ms. Kathryn Catlin PO Box 1715 Harrison, AR, 72601

Ref:

Analytical Testing

ETC Report Number: 12-143-0208

Client Project Description: Bi-weekly Sampling

Dear Ms. Kathryn Catlin:

Environmental Testing and Consulting, Inc. received 3 sample(s) on 5/22/2012 for the analyses presented in the following report.

The above referenced project has been analyzed per your instructions. The analyses were performed in accordance with the applicable analytical method.

The analytical data has been validated using standard quality control measures performed as required by the analytical method. Quality Assurance, method validations, instrumentation maintenance and calibration for all parameters (NELAP and non-NELAP) were performed in accordance with guidelines established by the USEPA and NELAC unless otherwise indicated. Any parameter for which the laboratory is not officially NELAP accredited is indicated by a '~' symbol. These are not included in the scope because NELAP accreditation is either not available or has not been applied for. Additional certifications may be held/are available for parameters, where NELAP accreditation is not required or applicable. A full list of certifications is available upon request.

The results are shown on the attached Report of Analysis(s). Results for solid matrices are reported on an asreceived basis unless otherwise indicated. This report shall not be reproduced except in full and relates only to the samples included in this report.

Please do not hesitate to contact me or client services if you have any questions or need additional information.

Sincerely,

Randy Thomas Project Manager

Rendell H. Thomas

Laboratory's liability in any claim relating to analyses performed shall be limited to, at laboratory's option, repeating the analysis in question at laboratory's expense, or the refund of the charges paid for performance of said analysis.



2790 Whitten Road

Memphis, Tennessee 38133

"A Laboratory Management Partner"

03322

Harrison Wastewater Treatment Plant

Ms. Kathryn Catlin

PO Box 1715 Harrison, AR 72601 Project Bi-weekly Sampling

Information:

Report Date: 5/24/2012

Report Number: 12-143-0208

REPORT OF ANALYSIS

Received: 5/22/2012

Lab No:

95030

Matrix: Aqueous

Sample ID: Silver Valley Bridge (Downstream)

Sampled: 5/21/2012 9:10

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Chloride	9.44	mg/L	0.400	1	05/23/12 13:04	RQE	EPA-300.0
Total Dissolved Solids	230	mg/L	10	1	05/23/12 07:00	NRT	2540C
Total Sulfate (SO4)	7.14	mg/L	1.00	1	05/23/12 13:04	RQE	EPA-300.0

Lab No:

95031

Sample ID: Hwy 62/65 Bridge (Upstream)

Matrix: Aqueous

Sampled: 5/21/2012 9:00

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Chloride	6.45	mg/L	0.400	1	05/23/12 13:22	RQE	EPA-300.0
Total Dissolved Solids	207	mg/L	10	1	05/23/12 07:00	NRT	2540C
Total Sulfate (SO4)	3.97	mg/L	1.00	1	05/23/12 13:22	RQE	EPA-300.0

Lab No:

95032

Sample ID: WWTP Effluent

Matrix: Aqueous

Sampled: 5/21/2012 9:20

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Chloride	6.71	mg/L	0.400	1	05/23/12 13:39	RQE	EPA-300.0
Total Dissolved Solids	220	mg/L	10	1	05/23/12 07:00	NRT	2540C
Total Sulfate (SO4)	4.10	mg/L	1.00	1	05/23/12 13:39	RQE	EPA-300.0

Qualifiers/ **Definitions**

Outside QC limit

MQL

Method Quantitation Limit

DF

Dilution Factor



Fax (901) 213-2440

A Laboratory Management Partner

Cooler Receipt Form

tustomer Name: Harrison Wastewater Treatm deport Number: 12-143-0208 Shippir Fed Ex UPS US Postal Client	nent Plant ng Method		
Shippir	ng Method		
	ig Metrica		
)Fed Ex 🌑 UPS ()US Posta()Client			
	t C Lab	Courier	Other:
nipping container/cooler uncompromised?	Yes	○ No	
ustody seals intact on shipping container/cooler?	Yes	○ No	Not Required
ustody seals intact on sample bottles?	O Yes	○ No	Not Required
hain of Custody (COC) present?	Yes	○ No	
OC agrees with sample label(s)?	Yes	○ No	
OC properly completed	Yes	○ No	
amples in proper containers?	Yes	○ No	
ample containers intact?	Yes	○ No	
ufficient sample volume for indicated test(s)?	Yes	○ No	
Il samples received within holding time?	Yes	○ No	
ooler temperature in compliance?	Yes	○ No	
ooler/Samples arrived at the laboratory on ice. amples were considered acceptable as cooling rocess had begun.	Yes	○ No	
/ater - Sample containers properly preserved	Yes	○ No	○ N/A
/ater - VOA vials free of headspace	O Yes	○ No	● N/A
rip Blanks received with VOAs	O Yes	○ No	N/A
oil VOA method 5035 – compliance criteria met	O Yes	○ No	● N/A
High concentration container (48 hr)	Low c	oncentration EnC	Core samplers (48 hr)
High concentration pre-weighed (methanol -14	d) Low c	onc pre-weighed	vials (Sod Bis -14 d)
pecial precautions or instructions included?	O Yes	No	
Comments:			

Any regulatory non-compliance issues will be recorded on non-compliance report.

Signature: Brooke Shoup

Date & Time: 05/22/2012 10:22:08

City Of Harrison



2790 Whitten Road

Memphis, Tennessee 38133

(901) 213-2400

6/13/2012

Harrison Wastewater Treatment Plant Ms. Kathryn Catlin PO Box 1715 Harrison, AR, 72601

Ref:

Analytical Testing

ETC Report Number: 12-158-0231

Client Project Description: Crooked Creek Sampling

Dear Ms. Kathryn Catlin:

Environmental Testing and Consulting, Inc. received sample(s) on 6/6/2012 for the analyses presented in the following report.

The above referenced project has been analyzed per your instructions. The analyses were performed in accordance with the applicable analytical method.

The analytical data has been validated using standard quality control measures performed as required by the analytical method. Quality Assurance, method validations, instrumentation maintenance and calibration for all parameters (NELAP and non-NELAP) were performed in accordance with guidelines established by the USEPA and NELAC unless otherwise indicated. Any parameter for which the laboratory is not officially NELAP accredited is indicated by a '~' symbol. These are not included in the scope because NELAP accreditation is either not available or has not been applied for. Additional certifications may be held/are available for parameters, where NELAP accreditation is not required or applicable. A full list of certifications is available upon request.

The results are shown on the attached Report of Analysis(s). Results for solid matrices are reported on an asreceived basis unless otherwise indicated. This report shall not be reproduced except in full and relates only to the samples included in this report.

Please do not hesitate to contact me or client services if you have any questions or need additional information.

Sincerely,

Randy Thomas Project Manager

Rendell H. Thomas

Laboratory's liability in any claim relating to analyses performed shall be limited to, at laboratory's option, repeating the analysis in question at laboratory's expense, or the refund of the charges paid for performance of said analysis.



2790 Whitten Road

Memphis, Tennessee 38133

"A Laboratory Management Partner"

03322

Harrison Wastewater Treatment Plant

Ms. Kathryn Catlin

PO Box 1715 Harrison, AR 72601 Project

Crooked Creek Sampling

Information:

Report Date: 6/13/2012

Report Number: 12-158-0231

REPORT OF ANALYSIS

Received: 6/6/2012

Lab No:

97483

Matrix: Aqueous

Sampled: 6/5/2012 9:35

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Chloride	10.9	mg/L	0.400	1	06/13/12 04:15	RQE	EPA-300.0
Total Dissolved Solids	268	mg/L	10	1	06/08/12 07:30	NRT	2540C
Total Sulfate (SO4)	7.62	ma/l	1.00	1	06/13/12 04:15	POF	FPA-300.0

Lab No:

97484

Sample ID: Hwy 62/65 Bridge (Upstream)

Sample ID: Silver Valley Bridge (Downstream)

Matrix: Aqueous

Sampled: 6/5/2012 9:50

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Chloride	6.52	mg/L	0.400	1	06/13/12 04:32	RQE	EPA-300.0
Total Dissolved Solids	242	mg/L	10	1	06/08/12 07:30	NRT	2540C
Total Sulfate (SO4)	3.95	mg/L	1.00	1	06/13/12 04:32	RQE	EPA-300.0

Lab No:

97485

Sample ID: WWTP Discharge Point

Matrix: Aqueous

Sampled: 6/5/2012 9:20

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Chloride	7.46	mg/L	0.400	1	06/13/12 04:50	RQE	EPA-300.0
Total Dissolved Solids	263	mg/L	10	1	06/08/12 07:30	NRT	2540C
Total Sulfate (SO4)	4.51	mg/L	1.00	1	06/13/12 04:50	RQE	EPA-300.0

Qualifiers/ **Definitions**

MQL

Outside QC limit

Method Quantitation Limit

DF

Dilution Factor



*A Laboratory Management Partner

Fax (901) 213-2440

Not Required Not Required

N/A

N/A

N/A

N/A

No

No

O No

Yes

Yes

Yes

	Cooler R	eceipt Form		
Customer Number: 033	22			
	rison Wastewater Treatm 158-0231	ent Plant		
	Shippin	g Method		
○ Fed Ex ● UPS	○ US Postal○ Client	○ Lab	O Courier	Other:
Shipping container/coole	er uncompromised?	Yes	○ No	
Custody seals intact on	shipping container/cooler?	O Yes	○ No	Not
Custody seals intact on	sample bottles?	O Yes	○ No	Not
Chain of Custody (COC) present?	Yes	○ No	
COC agrees with sample	e label(s)?	Yes	○ No	
COC properly complete	d	Yes	○ No	
Samples in proper conta	ainers?	Yes	○ No	
Sample containers intac	t?	Yes	○ No	
Sufficient sample volum	e for indicated test(s)?	Yes	○ No	
All samples received with	thin holding time?	Yes	○ No	
Cooler temperature in c	ompliance?	Yes	○ No	78 - C
	at the laboratory on ice. ed acceptable as cooling	Yes	○ No	
Water - Sample contain	ers properly preserved	Yes	○ No	○ N/A
Samples were consider process had begun.	ed acceptable as cooling			○ N/

High concentration container (48 hr) Low concentration EnCore samplers (48 hr) High concentration pre-weighed (methanol -14 d) Low conc pre-weighed vials (Sod Bis -14 d) Yes Special precautions or instructions included? No Comments:

Any regulatory non-compliance issues will be recorded on non-compliance report.

Signature: Brooke Shoup

Date & Time: 06/06/2012 10:02:27

Water - VOA vials free of headspace

Soil VOA method 5035 - compliance criteria met

Trip Blanks received with VOAs

City Of Harrison

Chain of Custody

12-158-0231 03322 2012-06-06 10:01:53 Print Name / Company COS 6-5- 100 P Harrison Wastevaler Treatment Plant Bi-veokly Sampling REF &/ DATE NEY DAY AIR A.K.S. TRACKING NUMBER 12 373 E20 27 1030 1.863 Received By (Sign) Comments: Analysis F CHLORIDE 1.60 × × TOTAL DISSOLVED SOLIDS × × S 6/5/2012 10:05am O g Ö 0 (G)rab or (C)omposite Date / Time 6-6-12 NONE NONE NONE Pres Project Number Client Remarks/Comments: Ş Purchase Order # Rec'd Date / Time: plastic plastic plastic Type Tim Holt/City of Harrison Print Name / Company Matrix 世世 water wafer water Silver Valley Bridge (Downstream) Preservatives: (1) Nitric Acid(NH03) (2) Hydrochioric Acid(HCL) NEXT DAY AIR HWY 62-65 Bridge (Upstream) (3) Sodium Thiosulfate(Na2S203) (4) Sodium Hydroxide(Na03) WWTP DISCHARGE POINT Monthly Quarterly Semi-Annual Sample Identification CROOKED CREEK SAMPLING hwwtp2@windstream.net 1508 Silver Valley Road City of Harrison Harriosn, AR 72601 870-741-4426 870-741-5022 ICED Refinguished By (Sign) Tim Holt 9:.35am 9:50am 9:20am Time OPS Project Manager Rec'd at Lab By: email address ype of Event: Shipped Via Single Daily 6/5/2012 6/5/2012 6/5/2012 Phone No. Date FAX No. Address Project: Client



"A Laboratory Management Partner

Memphis, Tennessee 38133

(901) 213-2400

6/28/2012

Harrison Wastewater Treatment Plant Ms. Kathryn Catlin PO Box 1715 Harrison, AR, 72601

Ref:

Analytical Testing

ETC Report Number: 12-174-0218

Client Project Description: Crooked Creek Sampling

Dear Ms. Kathryn Catlin:

Environmental Testing and Consulting, Inc. received sample(s) on 6/22/2012 for the analyses presented in the following report.

The above referenced project has been analyzed per your instructions. The analyses were performed in accordance with the applicable analytical method.

The analytical data has been validated using standard quality control measures performed as required by the analytical method. Quality Assurance, method validations, instrumentation maintenance and calibration for all parameters (NELAP and non-NELAP) were performed in accordance with guidelines established by the USEPA and NELAC unless otherwise indicated. Any parameter for which the laboratory is not officially NELAP accredited is indicated by a '~' symbol. These are not included in the scope because NELAP accreditation is either not available or has not been applied for. Additional certifications may be held/are available for parameters, where NELAP accreditation is not required or applicable. A full list of certifications is available upon request.

The results are shown on the attached Report of Analysis(s). Results for solid matrices are reported on an asreceived basis unless otherwise indicated. This report shall not be reproduced except in full and relates only to the samples included in this report.

Please do not hesitate to contact me or client services if you have any questions or need additional information.

Sincerely,

Randy Thomas

Rendell H. Thomas

Project Manager

Laboratory's liability in any claim relating to analyses performed shall be limited to, at laboratory's option, repeating the analysis in question at laboratory's expense, or the refund of the charges paid for performance of said analysis.

Texas



2790 Whitten Road

Memphis, Tennessee 38133

(901) 213-2400

Fax (901) 213-244

"A Laboratory Management Partner"

03322

Harrison Wastewater Treatment Plant

Ms. Kathryn Catlin

Pro

PO Box 1715

Harrison, AR 72601

Project Crooked Creek Sampling

Information:

Report Date: 6/28/2012

Report Number: 12-174-0218

REPORT OF ANALYSIS

Received: 6/22/2012

Lab No:

89914

Sample ID : Silver Valley Bridge (Downstream)

Matrix: Aqueous

Sampled: 6/21/2012 7:05

				A COUNTY OF THE PARTY OF THE PA			
Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Chloride	9.50	mg/L	0.400	1	06/25/12 09:16	RQE	EPA-300.0
Total Dissolved Solids	243	mg/L	10	1	06/26/12 14:00	NRT	2540C
Sulfate	8.05	mg/L	1.00	1	06/25/12 09:16	RQE	EPA-300.0

Lab No:

89915

Sample ID : Hwy 62/65 Bridge (Upstream)

Matrix: Aqueous

Sampled: 6/21/2012 7:13

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Chloride	6.54	mg/L	0.400	1	06/25/12 09:33	RQE	EPA-300.0
Total Dissolved Solids	250	mg/L	10	1	06/26/12 14:00	NRT	2540C
Sulfate	4.08	mg/L	1.00	1	06/25/12 09:33	RQE	EPA-300.0

Lab No:

89916

Sample ID: WWTP Discharge Point

Matrix: Aqueous

Sampled: 6/21/2012 6:54

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Chloride	6.97	mg/L	0.400	1	06/25/12 09:51	RQE	EPA-300.0
Total Dissolved Solids	242	mg/L	10	1	06/26/12 14:00	NRT	2540C
Sulfate	4.52	mg/L	1.00	1	06/25/12 09:51	RQE	EPA-300.0

Qualifiers/ Definitions

* MQL Outside QC limit

Method Quantitation Limit

DF





2790 Whitten Road

Memphis, Tennessee 38133

(901) 213-2400

Fax (901) 213-2440

A Laboratory Management Partner

Cooler Receipt Form

	astewater Treatm	ent Plant		
Report Number: 12-174-0218				
	Shippin	g Method		
Fed Ex UPS U	S Postal Client	◯ Lab	Ourier (Other:
Shipping container/cooler uncom	promised?	Yes	○ No	
Custody seals intact on shipping	container/cooler?	O Yes	○ No	Not Required
Custody seals intact on sample b	ottles?	O Yes	○ No	Not Required
Chain of Custody (COC) present	?	Yes	○ No	
COC agrees with sample label(s	?	Yes	○ No	
COC properly completed		Yes	○ No	
Samples in proper containers?		Yes	○ No	
Sample containers intact?		Yes	○ No	
Sufficient sample volume for indi	cated test(s)?	Yes	○ No	
All samples received within holdi	ng time?	Yes	○ No	
Cooler temperature in complianc	e?	Yes	○ No	
Cooler/Samples arrived at the lat Samples were considered accep process had begun.		Yes	○ No	
Water - Sample containers prope	rly preserved	Yes	○ No	○ N/A
Water - VOA vials free of headsp	ace	O Yes	○ No	N/A
Trip Blanks received with VOAs		O Yes	○ No	N/A
Soil VOA method 5035 – complia	nce criteria met	Yes	○ No	● N/A
High concentration container	(48 hr)	Low	concentration EnCo	ore samplers (48 hr)
High concentration pre-weigh	ed (methanol -14 o	d) Low o	conc pre-weighed v	rials (Sod Bis -14 d)
Special precautions or instruction	ns included?	O Yes	No	
Comments:				

Any regulatory non-compliance issues will be recorded on non-compliance report.

Signature: Brooke Shoup

Date & Time: 06/22/2012 10:34:27

City Of Harrison



ain of Custody

Client		City of Harrison	7 (1) 1 (1) 2 (1) 2 (1)							•	1111					11.11
Address		1508 Silver Valley Road					ha.									<i></i>
	_	Натіоѕп, АК 72601				el	à.									
email address		hwwtp2@windstream.net		10.11	**************************************			TC								
Phone No.	~	870-741-4426	FID#)TA]					-			
FAX No.	***	870-741-5022	Purcha	Purchase Order #	**	aon-ain	((L DI								
Project:	٦	CROOKED CREEK SAMPLING	1	1			3)ral	SSC			-	*********				
Project Manager		Tim Holt		1			or or)LV								
Type of Event:							(C)o	ED S	CHL		*************					
Single Daily		Monthly Quarterly Semi-Annual					-									
(((23)	Time	Sample Identification	Matrix	Type	No.	Pres	a fee l	ATE								
6/21/2012 7:0	7:05am	Silver Valley Bridge (Downstream)	water	plastic	Ĩ	NONE	9	×	×	X						ā
													-		\dashv	-
																_
6/21/2012 7:	7:13am	HWY 62-65 Bridge (Upstream)	water	plastic	1	NONE	O	×	X	×			-		1	
									-				-			P 1
													-			2
6/21/2012 6::	6:54am	WWTP DISCHARGE POINT	water	plastic	-	NONE	Ö	×	×	×		1	\dashv		+	
									-				-		-	-
						PR										
								_					\dashv		-	
									-	*			_			-
Preservatives: (1) (3) Sodium Thios.	1) Nitric	Preservatives: (1) Nitric Acid(NH03) (2)Hydrochloric Acid(HCL) (3) Sodium Thiosulfate(Na2S203) (4) Sodium Hydroxide(Na03)	Client R	Client Remarks/Comments:	omments:											
Relinquished By (Sign)	ished B	9	Company		ã	Date / Time	9			Received By (Sign)	(uBi		Print	Print Name / Company	Com	Aupa
N	A-1 (1991)	Tim Holt/City of Harrison	of Harri	son	9	6/21/2012	2		Ø	とのにイナ						
								+		2		+				
A STATE OF THE PARTY OF THE PAR	C		4	į	C,	-	ľ	-{	Č	2		1				
2	4	架	Kec'd D	Rec'd Date / Time:	50	4-14		7	P	Comments	ES:					
Shipped Via	UPS	ICED NEXT DAY AIR														

201 200



A Laboratory Management Partner

Memphis, Tennessee 38133

(901) 213-2400

7/17/2012

Harrison Wastewater Treatment Plant Ms. Kathryn Catlin PO Box 1715 Harrison, AR, 72601

Ref:

Analytical Testing

ETC Report Number: 12-188-0220

Client Project Description: Crooked Creek Sampling

Dear Ms. Kathryn Catlin:

Environmental Testing and Consulting, Inc. received sample(s) on 7/6/2012 for the analyses presented in the following report.

The above referenced project has been analyzed per your instructions. The analyses were performed in accordance with the applicable analytical method.

The analytical data has been validated using standard quality control measures performed as required by the analytical method. Quality Assurance, method validations, instrumentation maintenance and calibration for all parameters (NELAP and non-NELAP) were performed in accordance with guidelines established by the USEPA and NELAC unless otherwise indicated. Any parameter for which the laboratory is not officially NELAP accredited is indicated by a '~' symbol. These are not included in the scope because NELAP accreditation is either not available or has not been applied for. Additional certifications may be held/are available for parameters, where NELAP accreditation is not required or applicable. A full list of certifications is available upon request.

The results are shown on the attached Report of Analysis(s). Results for solid matrices are reported on an asreceived basis unless otherwise indicated. This report shall not be reproduced except in full and relates only to the samples included in this report.

Please do not hesitate to contact me or client services if you have any questions or need additional information.

Sincerely,

Randy Thomas **Project Manager**

Rendell H. Thomas

Laboratory's liability in any claim relating to analyses performed shall be limited to, at laboratory's option, repeating the analysis in question at laboratory's expense, or the refund of the charges paid for performance of said analysis.

#9311



2790 Whitten Road

Memphis, Tennessee 38133

(901) 213-2400

Fax (901) 213-2440

"A Laboratory Management Partner" 03322

Harrison Wastewater Treatment Plant

Ms. Kathryn Catlin

PO Box 1715 Harrison, AR 72601 Project

Crooked Creek Sampling

Information:

Report Date: 7/17/2012

Report Number : 12-188-0220

REPORT OF ANALYSIS

Received: 7/6/2012

Lab No:

92478 Sample ID : Silver Valley Bridge

Matrix: Aqueous

Sampled: 7/5/2012 7:55

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Chloride	10.1	mg/L	0.400	1	07/11/12 11:00	RQE	EPA-300.0
Total Dissolved Solids	227	mg/L	10	1	07/12/12 15:00	NRT	2540C
Sulfate	9.27	mg/L	1.00	1	07/11/12 11:00	RQE	EPA-300.0

Lab No:

92479

Sample ID: Hwy 62/65 Bridge

Matrix: Aqueous

Sampled: 7/5/2012 8:10

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Chloride	7.07	mg/L	0.400	1	07/09/12 11:30	RQE	EPA-300.0
Total Dissolved Solids	232	mg/L	10	1	07/12/12 15:00	NRT	2540C
Sulfate	4.43	mg/L	1.00	1	07/11/12 10:26	RQE	EPA-300.0

Lab No:

92480

Sample ID: WWTP Discharge Point

Matrix: Aqueous

Sampled: 7/5/2012 7:45

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Chloride	7.50	mg/L	0.400	1	07/09/12 11:47	RQE	EPA-300.0
Total Dissolved Solids	216	mg/L	10	1	07/12/12 15:00	NRT	2540C
Sulfate	4.92	mg/L	1.00	1	07/11/12 10:43	RQE	EPA-300.0

Qualifiers/ Definitions

MQL

Outside QC limit

Method Quantitation Limit

DF



2790 Whitten Road

Memphis, Tennessee 38133

(901) 213-2400

ax (901) 213-2440

"A Laboratory Management Partner"

Cooler Receipt Form

	ng Method	O 2	O 211
Fed Ex UPS US Postal Client	Lab	O Courier	Other:
Shipping container/cooler uncompromised?	Yes	○ No	
Custody seals intact on shipping container/cooler?	O Yes	○ No	Not Required
Custody seals intact on sample bottles?	O Yes	○ No	Not Required
Chain of Custody (COC) present?	Yes	○ No	
COC agrees with sample label(s)?	Yes	○ No	
COC properly completed	Yes	○ No	
Samples in proper containers?	Yes	○ No	
Sample containers intact?	Yes	○ No	
Sufficient sample volume for indicated test(s)?	Yes	○ No	
All samples received within holding time?	Yes	○ No	
Cooler temperature in compliance?	Yes	○ No	
Cooler/Samples arrived at the laboratory on ice. Samples were considered acceptable as cooling process had begun.	Yes	○ No	
Water - Sample containers properly preserved	Yes	○ No	○ N/A
Water - VOA vials free of headspace	O Yes	○ No	N/A
Trip Blanks received with VOAs	O Yes	○ No	N/A
Soil VOA method 5035 – compliance criteria met	O Yes	○ No	● N/A
High concentration container (48 hr)	Low	concentration EnC	ore samplers (48 hr)
High concentration pre-weighed (methanol -14	d) Low	conc pre-weighed	vials (Sod Bis -14 d)
Special precautions or instructions included?	O Yes	No	
Comments:			

Any regulatory non-compliance issues will be recorded on non-compliance report.

Signature: Rebekah Ross

Date & Time: 07/06/2012 10:10:21



2790 Whitten Road

Memphis, Tennessee 38133 (901) 213-2400 Fax (901) 213-2440



Harrison Wastewater Treatment Plant Crooked Creek Samoling

03322 2012-07-06 10 10:10

Company Name			C	ustomer Numb	er	Telephone	RUSH	ICE
Harrison Wastewater Trea	ntment Plant		0	3322		(870) 741-5527		
Site Name		Project C Every 2 We		ent	•		FID No	ımber
Project Harrison • Bi-weekly		Project N		r PO Nui	mber			
Project Manager / C Mr. Tim Holt	Contact			-mail wwtp2@windstream	net			
Sample ID	Container Type	Collected Date /	# Cont	Preservative	Grab / Comp	Matrix	Analyses	.am
Silver Valley Bridge	Plastic - Pint	7-5-12 7:55	1	NONE		Aqueous	SO4/TDS/C	1
Hwy 62-65 Bridge	Plastic - Pint	7-5-12 8:10	1	NONE		Aqueous	SO4/TDS/C	I
WWTP Effluent	Plastic - Pint	7-5-12 7:45	1	NONE		Aqueous	SO4/TDS/C	I

Sampled By	Method of Shipment	Blank / Cooler Temperature	
Relinquished By (sign)	Date / Time	Received By (sign)	Date / Time
Relinquished By (sign)	Date / Time	Received By (sign)	Date / Time
Relinquished By (sign)	Date / Time	Received by Lab (sign)	Date / Time 2012-0940



"A Laboratory Management Partner

Memphis, Tennessee 38133

(901) 213-2400

7/26/2012

Harrison Wastewater Treatment Plant Ms. Kathryn Catlin PO Box 1715 Harrison, AR, 72601

Ref:

Analytical Testing

ETC Report Number: 12-200-0214 Client Project Description: Bi-monthly

Dear Ms. Kathryn Catlin:

Environmental Testing and Consulting, Inc. received sample(s) on 7/18/2012 for the analyses presented in the following report.

The above referenced project has been analyzed per your instructions. The analyses were performed in accordance with the applicable analytical method.

The analytical data has been validated using standard quality control measures performed as required by the analytical method. Quality Assurance, method validations, instrumentation maintenance and calibration for all parameters (NELAP and non-NELAP) were performed in accordance with guidelines established by the USEPA and NELAC unless otherwise indicated. Any parameter for which the laboratory is not officially NELAP accredited is indicated by a '~' symbol. These are not included in the scope because NELAP accreditation is either not available or has not been applied for. Additional certifications may be held/are available for parameters, where NELAP accreditation is not required or applicable. A full list of certifications is available upon request.

The results are shown on the attached Report of Analysis(s). Results for solid matrices are reported on an asreceived basis unless otherwise indicated. This report shall not be reproduced except in full and relates only to the samples included in this report.

Please do not hesitate to contact me or client services if you have any questions or need additional information.

Sincerely,

Randy Thomas

Rendell H. Thomas

Project Manager

Laboratory's liability in any claim relating to analyses performed shall be limited to, at laboratory's option, repeating the analysis in question at laboratory's expense, or the refund of the charges paid for performance of said analysis.

Kentucky UST #41



2790 Whitten Road

Memphis, Tennessee 38133

(901) 213-2400

Fax (901) 213-2440

"A Laboratory Management Partner"

03322

Harrison Wastewater Treatment Plant

Ms. Kathryn Catlin

Project

Information:

PO Box 1715

Harrison, AR 72601

Report Date: 7/26/2012

Report Number: 12-200-0214

REPORT OF ANALYSIS

Bi-monthly

Received: 7/18/2012

Lab No:

94872

Matrix: Aqueous

Sample ID: Silver Valley Bridge (Downstream)

Sampled: 7/17/2012 8:30

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Alkalinity (as CaCO3)	148	mg/L	1	1	07/25/12 09:30	EWB	2320B
Chloride	9.56	mg/L	0.400	1	07/20/12 11:10	RQE	EPA-300.0
Total Dissolved Solids	255	mg/L	10	1	07/24/12 10:30	NRT	2540C
Total Calcium	63.1	mg/L	0.100	1	07/23/12 22:03	BKN	EPA-200.7
Total Magnesium	1.94	mg/L	0.100	1	07/22/12 22:30	BKN	EPA-200.7
Total Potassium	2.22	mg/L	0.100	1	07/23/12 22:03	BKN	EPA-200.7
Total Sodium	7.44	mg/L	0.500	1	07/22/12 22:30	BKN	EPA-200.7
Sulfate	7.42	mg/L	1.00	1	07/20/12 11:10	RQE	EPA-300.0
Carbonate	<2	mg/L	2	1	07/25/12 09:30	EWB	2320B
Bicarbonate (as CaCO3)	148	mg/L	1	1	07/25/12 09:30	EWB	2320B

Lab No:

94873

Sample ID: Hwy 62-65 Bridge (Upstream)

Matrix: Aqueous

Sampled: 7/17/2012 8:15

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Alkalinity (as CaCO3)	160	mg/L	1	1	07/25/12 09:30	EWB	2320B
Chloride	6.45	mg/L	0.400	1	07/20/12 11:28	RQE	EPA-300.0
Total Dissolved Solids	244	mg/L	10	1	07/24/12 10:30	NRT	2540C
Total Calcium	67.2	mg/L	0.100	1	07/23/12 22:10	BKN	EPA-200.7
Total Magnesium	1.84	mg/L	0.100	1	07/22/12 22:51	BKN	EPA-200.7
Total Potassium	1.36	mg/L	0.100	1	07/23/12 22:10	BKN	EPA-200.7
Total Sodium	3.14	mg/L	0.500	1	07/24/12 11:10	BKN	EPA-200.7
Sulfate	4.08	mg/L	1.00	1	07/20/12 11:28	RQE	EPA-300.0
Carbonate	<2	mg/L	2	1	07/25/12 09:30	EWB	2320B
Bicarbonate (as CaCO3)	160	mg/L	1	1	07/25/12 09:30	EWB	2320B

Qualifiers/ **Definitions**

MQL

Outside QC limit

Method Quantitation Limit

DF



2790 Whitten Road

Memphis, Tennessee 38133

(901) 213-2400

Fax (901) 213-2440

A Laboratory Management Partner

03322

Harrison Wastewater Treatment Plant

Ms. Kathryn Catlin

Project

Information:

Bi-monthly

PO Box 1715

Harrison, AR 72601

Report Date: 7/26/2012

Report Number: 12-200-0214

REPORT OF ANALYSIS

Received: 7/18/2012

Lab No:

94874

Sample ID : WWTP Discharge Point

Matrix: Aqueous

Sampled: 7/17/2012 8:40

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Alkalinity (as CaCO3)	155	mg/L	1	1	07/25/12 09:30	EWB	2320B
Chloride	6.81	mg/L	0.400	1	07/24/12 00:50	RQE	EPA-300.0
Total Dissolved Solids	244	mg/L	10	1	07/24/12 10:30	NRT	2540C
Total Calcium	65.4	mg/L	0.100	1	07/23/12 22:17	BKN	EPA-200.7
Total Magnesium	1.79	mg/L	0.100	1	07/22/12 22:58	BKN	EPA-200.7
Total Potassium	1.46	mg/L	0.100	1	07/23/12 22:17	BKN	EPA-200.7
Total Sodium	3.71	mg/L	0.500	1	07/24/12 11:17	BKN	EPA-200.7
Sulfate	4.46	mg/L	1.00	1	07/24/12 00:50	RQE	EPA-300.0
Carbonate	<2	mg/L	2	1	07/25/12 09:30	EWB	2320B
Bicarbonate (as CaCO3)	155	mg/L	1	1	07/25/12 09:30	EWB	2320B



2790 Whitten Road

Memphis, Tennessee 38133

(901) 213-24

Fax (901) 213-2440

A Laboratory Management Partner

Cooler Receipt Form

Customer Nu Customer Na		ent Plant		
Report Numb		oner lane		
	Shippin	ng Method		
○ Fed Ex	UPS US Postal Client	Lab	O Courier	Other:
Shipping cont	ainer/cooler uncompromised?	Yes	○ No	
Custody seals	intact on shipping container/cooler?	O Yes	○ No	Not Required
Custody seals	s intact on sample bottles?	O Yes	○ No	Not Required
Chain of Cust	ody (COC) present?	Yes	○ No	
COC agrees v	with sample label(s)?	Yes	○ No	
COC properly	completed	Yes	○ No	
Samples in pr	oper containers?	Yes	○ No	1
Sample conta	iners intact?	Yes	○ No	
Sufficient sam	pple volume for indicated test(s)?	Yes	○ No	
All samples re	eceived within holding time?	Yes	○ No	
Cooler tempe	rature in compliance?	Yes	○ No	
	es arrived at the laboratory on ice. e considered acceptable as cooling begun.	Yes	○ No	
Water - Samp	le containers properly preserved	Yes	○ No	○ N/A
Water - VOA	vials free of headspace	O Yes	○ No	N/A
Trip Blanks re	eceived with VOAs	O Yes	○ No	N/A
Soil VOA met	hod 5035 – compliance criteria met	O Yes	○ No	N/A
High conc	entration container (48 hr)	Low c	oncentration EnC	ore samplers (48 hr)
High conce	entration pre-weighed (methanol -14 o	d) Low c	onc pre-weighed	vials (Sod Bis -14 d)
Special preca	utions or instructions included?	O Yes	No	
Comments:				
				_

Date & Time: 07/18/2012 09:48:25

Signature: Rebekah Ross

Any regulatory non-compliance issues will be recorded on non-compliance report.

City Of Harrison

TOTAL ALKALINITY × × × ×	Cit	y Of	City Of Harrison							H darries	on Was	Harrison Waslewater Treatment Plan		F Pan		12-200-0214 03322 2012-07-18	12-200-0214 03322 2012-07-18	_>
1508 Silve Valley Road	Client		City of Harrison		roject	Numb	16		1		Auth					72:60	9	111
Harricon, AN 72601 Harrico	Address		1508 Silver Valley Road						1	_		_		-				
St. 0-741-426			Harriosn, AR 72601									-					-	_
STO-741-4126	email addre	SS	hwwtp2@windstream,net		111111111111111111111111111111111111111								7					
St.041-5002 CROOKED CREEK SAMPLING	Phone No.		870-741-4426	世出									ОТ					
11 12 13 14 14 15 15 15 15 15 15	FAX No.		870-741-5022	Purchas	e Order	#							AL.					
Bi-Weekly	Project:		CROOKED CREEK SAMPLING					(G)ra	~~~	*****			DISS	*********	OT	******		
Bi-Weeky Ouarcet'ty Semi-Annual Nestrix Type No. Pres. Ouarcet'ty Semi-Annual Nestrix Type No. Ouarcet'ty Semi-Annual No. Ouarcet'ty Semi-Annual Ouarcet'ty Semi-Ann	Project Man	ager	Tim Holt					ab o			N		SOL	***************************************	AL.			
Bi-Weeky Quarterly Semi-Annual	Type of Eve	II.							-			S	VEE		ALK			
River Sample identification Watrix Type No. Pres. 25 25 25 25 25 25 25 2	Single Daily	Bi-Weekl										ÜL	SC	***************************************	AL			
8:30AM Silver Valley Bridge (Downstream) water plastic 1 1 6 X X X X X X X X X	Dafe	Time	Sar	Matrix	Type	Mo	Pres	***************************************				FAT	I.ID	-	NIT			
8:15AM HWY 62-65 Bridge (Upstream) water plastic 1 1 G X X X X X X X X X X X X X X X X X	7/17/2012	8:30AM			plastic		NONE	-	+	+	1	×	s ×	1	v ×	1	+	+
8:15AM HWY 62-65 Bridge (Upstream) water plastic 1 NONE G X X X X X X X X X X X X X X X X X X	7/17/2012	8:30AM	Silver Valley Bridge (Downstream)		plastic	-	-	O	-	+	+			4			+	1
8:15AM HWY 62-65 Bridge (Upstream) water plastic 1 NONE G X X X X X X X X X X X X X X X X X X									\vdash	\vdash	+			T	-	t	+	1
8:40AM WWTP DISCHARGE POINT water plastic 1 1 G X X X X X X X X X X X X X X X X X	7/17/2012	8:15AM	HWY 62-65 Bridge (Upstream)		plastic	1	NONE	υ	\vdash	+	+	×	×	×	×		+	
8:40AM WWTP DISCHARGE POINT water plastic 1 NONE G X X X X X X X X X X X X X X X X X X	7/17/2012	8:15AM	HWY 62-65 Bridge (Upstream)		plastic	-	-	O	-	+	+				:		+	
8:40AM WWTP DISCHARGE POINT water plastic 1 NONE G X X X X X X X X X X X X X X X X X X									_	-	_			T	-		-	
8:40AM WWTP DISCHARGE POINT water plastic 1 1 G X X X X X X X X X X X X X X X X X	7/17/2012	8:40AM	WWTP DISCHARGE POINT		plastic	_	NONE	D	-	\vdash	-	×	×	>	>	1	100	
(1) Nitric Acid(NH03) (2)Hydrochloric Acid(HCL) Client Remarks/Comments:	7/17/2012	8:40AM			plastic	-	-	-	-	-	╁			+	-			
itosulfate(Ne25203) (4) Sodium Hydrochloric Acid(HCL) ilosulfate(Ne25203) (4) Sodium Hydrochloric Acid(HCL) quished By (Sign) quished By (Sign) Tim Holt/City of Harrison T-17-2012/9:00AM Rec'd Date / Time: Comments:										-	-			_				ļ
quished By (Sign) Tim Holt/City of Harrison 7-17-2012/9:00AM Print Name Company									7		_				-			
inoculfate/Na22203 (4) Sodium Hydroxide(Na03) quished By (Sign) Tim Holt/City of Harrison T-17-2012/9:00AM Rec'd Date / Time: Comments: Comments: Rec'd Date / Time: Comments:					1			\dashv	-							2 A		
quished By (Sign) Tim Holt/City of Harrison 7-17-2012/9:00AM Print Name Company Date Time Received By (Sign) Print Holt/City of Harrison P-17-2012/9:00AM P-17-2012/9:00AM	Preservatives	: (1) Nitric	Acid(NH03) (2)Hydrochloric Acid(HC1)	Client Re	marke/Co	- manager			-	-	4							
Print Name Company Date / Time Received By Gign)	(3) Sodium TI	iosulfate(N	a2S203) (4) Sodium Hydroxide(Na03)		and and and	muneans.												
Tim Holt/City of Harrison 7-17-2012/9:00AM Comments:	Relim	daished E	3y (Sign) Print Name / C	ompany		Pa	te / Time		3100		eceiv	od By	(Sign		P	Int No	me/c	omnan
7): Rec'd Date / Time: Comments:	1	Most	Tim Holt/City o	Harris	uo	7-17-2	012/9:00	OAM			1							
77.									2	K	S				14 B	0	3	35
DPC ICED NEVT DAV AID 1.00	Rec'd at Lab B	.;.		Rec'd Date	g / Time:				-			6			_			
	Shinnod Via	JOL	1	7 2 3								Comm	enis.					
					1													



"A Laboratory Management Partner

Memphis, Tennessee 38133

(901) 213-2400

8/10/2012

Harrison Wastewater Treatment Plant Ms. Kathryn Catlin PO Box 1715 Harrison, AR, 72601

Ref:

Analytical Testing

ETC Report Number: 12-214-0210

Client Project Description: Crooked Creek Sampling

Dear Ms. Kathryn Catlin:

Environmental Testing and Consulting, Inc. received sample(s) on 8/1/2012 for the analyses presented in the following report.

The above referenced project has been analyzed per your instructions. The analyses were performed in accordance with the applicable analytical method.

The analytical data has been validated using standard quality control measures performed as required by the analytical method. Quality Assurance, method validations, instrumentation maintenance and calibration for all parameters (NELAP and non-NELAP) were performed in accordance with guidelines established by the USEPA and NELAC unless otherwise indicated. Any parameter for which the laboratory is not officially NELAP accredited is indicated by a '~' symbol. These are not included in the scope because NELAP accreditation is either not available or has not been applied for. Additional certifications may be held/are available for parameters, where NELAP accreditation is not required or applicable. A full list of certifications is available upon request.

The results are shown on the attached Report of Analysis(s). Results for solid matrices are reported on an asreceived basis unless otherwise indicated. This report shall not be reproduced except in full and relates only to the samples included in this report.

Please do not hesitate to contact me or client services if you have any questions or need additional information.

Sincerely,

Randy Thomas

Rendell H. Thomas

Project Manager

Laboratory's liability in any claim relating to analyses performed shall be limited to, at laboratory's option, repeating the analysis in question at laboratory's expense, or the refund of the charges paid for performance of said analysis.



2790 Whitten Road

Memphis, Tennessee 38133

"A Laboratory Management Partner"

03322

Harrison Wastewater Treatment Plant

Ms. Kathryn Catlin

Harrison, AR 72601

PO Box 1715

Project

Crooked Creek Sampling

Information:

Report Date: 8/10/2012

Report Number: 12-214-0210

REPORT OF ANALYSIS

Received: 8/1/2012

97429 Lab No:

Sample ID: Silver Valley Bridge (Downstream)

Matrix: Aqueous

Sampled: 7/31/2012 12:30

Test	Results	Units	MQL	DF	Date / Time	Ву	Analytical
Chloride	15.7	mg/L	0.400	1	Analyzed 08/09/12 12:13	ROF	Method EPA-300.0
Total Dissolved Solids	252	mg/L	10		08/09/12 13:15		2540C
Sulfate	14.4	mg/L	1.00	1	08/09/12 12:13	RQE	EPA-300.0

Lab No:

97430

Sample ID: Hwy 62/65 Bridge (Upstream)

Matrix: Aqueous

Sampled: 7/31/2012 12:20

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Chloride	6.82	mg/L	0.400	1	08/09/12 12:30	RQE	EPA-300.0
Total Dissolved Solids	213	mg/L	10	1	08/09/12 13:15	NRT	2540C
Sulfate	4.62	mg/L	1.00	1	08/09/12 12:30	RQE	EPA-300.0

Lab No:

97431

Sample ID: WWTP Discharge Point

Matrix: Aqueous

Sampled: 7/31/2012 12:40

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Chloride	54.2	mg/L	2.00	5	08/09/12 13:26	RQE	EPA-300.0
Total Dissolved Solids	411	mg/L	10	1	08/09/12 13:15	NRT	2540C
Sulfate	59.7	mg/L	5.00	5	08/09/12 13:26	RQE	EPA-300.0

Qualifiers/ **Definitions**

MQL

Outside QC limit

Method Quantitation Limit

DF



2790 Whitten Road

Memphis, Tennessee 38133

(901) 213-240

Fax (901) 213-2440

"A Laboratory Management Partner"

Cooler Receipt Form

Customer Number: 03322 Customer Name: Harrison Wastewater Treatm	ent Plant		
Report Number: 12-214-0210	g Method		
Fed Ex UPS US Postal Client	C Lab	Ourier Courier	Other:
Shipping container/cooler uncompromised?	Yes	○ No	
Custody seals intact on shipping container/cooler?	O Yes	○ No	Not Required
Custody seals intact on sample bottles?	O Yes	○ No	Not Required
Chain of Custody (COC) present?	Yes	○ No	
COC agrees with sample label(s)?	Yes	○ No	
COC properly completed	Yes	○ No	
Samples in proper containers?	Yes	○ No	
Sample containers intact?	Yes	○ No	
Sufficient sample volume for indicated test(s)?	Yes	○ No	
All samples received within holding time?	Yes	○ No	
Cooler temperature in compliance?	Yes	○ No	
Cooler/Samples arrived at the laboratory on ice. Samples were considered acceptable as cooling process had begun.	Yes	○ No	
Water - Sample containers properly preserved	Yes	○ No	○ N/A
Water - VOA vials free of headspace	O Yes	○ No	● N/A
Trip Blanks received with VOAs	O Yes	○ No	N/A
Soil VOA method 5035 – compliance criteria met	O Yes	○ No	N/A
High concentration container (48 hr)	Low	concentration EnC	ore samplers (48 hr)
High concentration pre-weighed (methanol -14 of	d) Low	conc pre-weighed	vials (Sod Bis -14 d)
Special precautions or instructions included?	O Yes	No	
Comments:			

Any regulatory non-compliance issues will be recorded on non-compliance report.

Signature: Rebekah Ross

Date & Time: 08/01/2012 10:32:32

Chain of Custody

City Of Harrison

100 Silver Valley Rand 100 Silver Valley Rand Ranger 100 Silver Valley Bridge (Upstream) 100 None 1			200								-							
Harricon, AR 72601 Harrico	Address		1508 Silver Valley	Road													12.21	A 0210
Sinchard Stream Det Purchase Order # Purchase	T		Harriosn, AR 7260	11					P								03322	03322
Fig.	email address		hwwtp2@windstn	eam.net	Total Control					10	TO	Harm	son Waste	ewaler Trea	atment Plant	_	10:32	60:
Reserve Received By: (Signt) Received B	Phone No.		870-741-4426		FID#					4 ML	r.i.	5	ved cleek	Sellicing				
CROOKED CREEK SAMPLING	FAX No.		870-741-5022		Purcha	se Order #	**		(G	. DE	Die	-	-	-	-		_	_
Sarpie Identification Sarpie Identification Sarpie Identification Sarpie Identification Matrix Type Was Press. Pr	Project:	· ·	CROOKED CREE	IK SAMPLING)rab	JOU	sen		************					
Monthly Quarterly Semi-Annual Trine Samples Identification Silver Valley Bridge (Downstream) Water plastic 1 NONE G X X X X Supplementary Comments: 1.20pm HWY 62-65 Bridge (Upstream) WWTP DISCHARGE POINT water plastic 1 NONE G X X X X Subplementary Comments: 1.20pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X X Subplementary Comments: 1.20pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X X Subplementary Computing Transfer Comments: 1.20pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X X Subplementary Computing Transfer Comments: 1.20pm Reced Date / Time: 1.20pm Reced Date / Time: 1.20pm Comments: 1.20pm Comment	Project Manag	A STATE OF THE PARTY OF THE PAR	Tim Holt			1111111111			or (IJ Y £								
Monthly Quarterly Semi-Annual Monthly Quarterly Semi-Annual Monthly Quarterly Semi-Annual Monthly Greek Propest Pr	Type of Event		214						C)o		ens'ini	יועי						
Time Sample Intentification Matrix Type Wo. Pres. 2 2 2 2 2 2 2 2 2	Single Daily	1年20日本	Monthly Quarte	erly Semi-Annual					mpc			OPI						
water plastic 1 NONE G X X X water plastic 1 NONE G X X X water plastic 1 NONE G X X X client Remarks/Comments: City of Harrison 7-31-2012/1:00pm Received By (Signi) City of Harrison 7-31-2012/1:00pm Comments:		Time	Sample	s Identification	Matrix	Type	8	Pres	site			DE			110			
water plastic 1 NONE G X X X X water plastic 1 NONE G X X X X Client Remarks/Comments: City of Harrison 7-31-2012/1:00pm Rec'd Date / Time: Comments: Com	7/31/2012	12:30pm	Silver Valley	Bridge (Downstream)	water	plastic	-	NONE		×	×	×	\dashv	1 II 2 3 14				
water plastic 1 NONE G X X X water plastic 1 NONE G X X X Client Remarks/Comments: City of Harrison 7-31-2012/1:00pm Rec'd Date / Time: Comments:	73 (A.A						45	T	+		+					
water plastic 1 NONE G X X X water plastic 1 NONE G X X X Client Remarks/Comments: City of Harrison 7-31-2012/1:00pm Rec'd Date / Time Comments:									+		+	1					-	
water plastic 1 NONE G X X X Client Remarks/Comments: City of Harrison 7-31-2012/1:00pm Rec'd Date / Time: Comments:	7/31/2012	12:20pm	HWY 62-6:	5 Bridge (Upstream)	water	plastic	-	NONE		×	×	×	1					
water plastic 1 NONE G X X X Client Remarks/Comments: City of Harrison 7-31-2012/1:00pm Rec'd Date / Time: Comments:																		
City of Harrison 7-31-2012/1:00pm				Transa river in the		of the control of	-	NON		>	>	 ×	-		-			11.0
City of Harrison 7-31-2012/1:00pm	7/31/2012	12:40pm	WWIFDI	INCHARGE POINT	walci	piasur	-		-		+		-	L				
Client Remarks/Comments: Client Remarks/Comments: City of Harrison 7-31-2012/1:00pm Rec'd Date / Time: Comments:											T							
City of Harrison 7-31-2012/1:00pm											1	F				V		
City of Harrison 7-31-2012/1:00pm								-						1				
City of Harrison 7-31-2012/1:00pm												30	-					ą.
NCity of Harrison 7-31-2012/1:00pm	Preservatives	: (1) Nitric	c Acid(NH03) (2)Hy	rdrochloric Acid(HCL)	Client	Remarks/C	omment	133						uk.				
Randy Reese/City of Harrison 7-31-2012/1:00pm	A Social		BuitStem	1000	Compa			Date / Ti	me	111111		Receive	8) (8)	(kg)	8	ini Nai	16/C	Supday
Rec'd Date / Time:	The state of the s	1		Randy Reese/City	v of Hz	ırrison	7-31	-2012/1	000	E		(- /	-			
Rec'd Date / Time:	Lord	ACON		many transit							()	3	X	当	2	70		
Rec'd Date / Time:	3									i i				1	-	1		7
	Rec'd at Lab E	iš.		1 100	Rec'd !	Date / Time.			100			-	Соттеля	fs:				
NEVT DAV AID			0200	NEXT DAV AID					The second									



"A Laboratory Manager

2790 Whitten Road

Memphis, Tennessee 38133

(901) 213-2400

8/24/2012

Harrison Wastewater Treatment Plant Ms. Kathryn Catlin PO Box 1715 Harrison, AR, 72601

Ref:

Analytical Testing

ETC Report Number: 12-230-0212

Client Project Description: Crooked Creek Sampling

Dear Ms. Kathryn Catlin:

Environmental Testing and Consulting, Inc. received sample(s) on 8/17/2012 for the analyses presented in the following report.

The above referenced project has been analyzed per your instructions. The analyses were performed in accordance with the applicable analytical method.

The analytical data has been validated using standard quality control measures performed as required by the analytical method. Quality Assurance, method validations, instrumentation maintenance and calibration for all parameters (NELAP and non-NELAP) were performed in accordance with guidelines established by the USEPA and NELAC unless otherwise indicated. Any parameter for which the laboratory is not officially NELAP accredited is indicated by a '~' symbol. These are not included in the scope because NELAP accreditation is either not available or has not been applied for. Additional certifications may be held/are available for parameters, where NELAP accreditation is not required or applicable. A full list of certifications is available upon request.

The results are shown on the attached Report of Analysis(s). Results for solid matrices are reported on an asreceived basis unless otherwise indicated. This report shall not be reproduced except in full and relates only to the samples included in this report.

Please do not hesitate to contact me or client services if you have any questions or need additional information.

Sincerely,

Randy Thomas **Project Manager**

Rendell H. Thomas

Laboratory's liability in any claim relating to analyses performed shall be limited to, at laboratory's option, repeating the analysis in question at laboratory's expense, or the refund of the charges paid for performance of said analysis.



2790 Whitten Road

Memphis, Tennessee 38133

(901) 213-240

ax (901) 213-2440

"A Laboratory Management Partner"

03322

Harrison Wastewater Treatment Plant

Ms. Kathryn Catlin

PO Box 1715

Harrison , AR 72601

Project

Crooked Creek Sampling

Information:

Report Date: 8/24/2012

Report Number: 12-230-0212

REPORT OF ANALYSIS

Received: 8/17/2012

Lab No:

90174

Sample ID: Silver Valley Bridge (Downstream)

Matrix: Aqueous

Sampled: 8/16/2012 13:15

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Chloride	16.8	mg/L	0.400	1	08/21/12 01:19	RQE	EPA-300.0
Total Dissolved Solids	232	mg/L	10	1	08/22/12 07:15	NRT	2540C
Sulfate	14.9	mg/L	1.00	1	08/21/12 01:19	RQE	EPA-300.0

Lab No:

90175

Sample ID: Hwy 62/65 Bridge (Upstream)

Matrix: Aqueous

Sampled: 8/16/2012 13:00

		the second secon					
Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Chloride	7.55	mg/L	0.400	1	08/21/12 19:19	RQE	EPA-300.0
Total Dissolved Solids	197	mg/L	10	1	08/22/12 07:15	NRT	2540C
Sulfate	4.74	mg/L	1.00	1	08/21/12 19:19	RQE	EPA-300.0

Lab No:

90176

Sample ID: WWTP Discharge Point

Matrix: Aqueous

Sampled: 8/16/2012 13:25

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Chloride	59.0	mg/L	2.00	5	08/23/12 19:39	RQE	EPA-300.0
Total Dissolved Solids	373	mg/L	10	1	08/22/12 07:15	NRT	2540C
Sulfate	63.3	mg/L	5.00	5	08/23/12 19:39	RQE	EPA-300.0

Qualifiers/ Definitions

* MQL Outside QC limit

Method Quantitation Limit

DF



Chain of Custody (COC) present?

COC agrees with sample label(s)?

Environmental Testing & Consulting, Inc.

Fax (901) 213-2440

Ourier Other:

Not Required

Not Required

O No

O No O No

O No

"A Laboratory Management Partner"

Yes

Yes

m

		Co	ooler Red	ceipt For
Customer Number	: 03322			
Customer Name:	Harriso	n Wastewater ⁻	Treatmer	nt Plant
Report Number:	12-230-	0212		
		8	Shipping	Method
Fed Ex U	PS (US Postal	Client	○ Lab
Shipping container	/cooler ur	ncompromised?		Yes
Custody seals intac	ct on ship	ping container/c	ooler? (Yes
Custody seals intag	ct on sam	ple bottles?	(Yes

COC properly con	mpleted	Yes	○ No		
Samples in prope	er containers?	Yes	○ No		
Sample container	rs intact?	Yes	○ No		
Sufficient sample	volume for indicated test(s)?	Yes	O No		
All samples recei	ved within holding time?	Yes	○ No	=	
Cooler temperatu	re in compliance?	Yes	○ No		
	arrived at the laboratory on ice. insidered acceptable as cooling un.	Yes	○ No		
Water - Sample o	containers properly preserved	Yes	○ No	○ N/A	
Water - VOA vial	s free of headspace	O Yes	○ No	● N/A	
Trip Blanks recei	ved with VOAs	O Yes	○ No	● N/A	
Soil VOA method	5035 – compliance criteria met	O Yes	○ No	● N/A	
High concent	ration container (48 hr)	Low c	oncentration EnC	ore samplers (48 h	r)
High concentr	ation pre-weighed (methanol -14	d) Low c	onc pre-weighed	vials (Sod Bis -14 d	(k
Special precaution	ons or instructions included?	○ Yes	● No		
Comments:					

Any regulatory non-compliance issues will be recorded on non-compliance report.

Signature: Rebekah Ross

Date & Time: 08/17/2012 09:33:13

City Of Harrison

Address 1508 Silver Valley Road email address Harriosn, AR 72601 Phone No. 870-741-4426 FID# FAX No. 870-741-4426 FID# FAX No. R70-741-402 FID# FAX No. R70-741-4026 FID# Project: CROCKED CREEK SAMFLING Purchase Order # Project Manager Tim Holt Monthly Quarterly Semi-Annual Type of Event: Simple Daily Matrix Type No. No. 6 Single Daily Sample identification Matrix Type No. No. 6 8/16/2012 I:15pm Silver Valley Bridge (Upstream) water plastic 1 8/16/2012 I:25pm WWTP DISCHARGE POINT water plastic 1 N	CHLORIDE × × TOTAL DISSOLVED SOLIDS × × SULFATE × × (G)rab or (C)omposite 0 0 0
Harriozn, AR 72601	TOTAL DISSOLVED SOLIDS × × × SULFATE × × (G)rab or (C)omposite © Ø
North Nort	TOTAL DISSOLVED SOLIDS × × × SULFATE × × (G)rab or (C)omposite © Ø
870-741-426 FID#	OTAL DISSOLVED SOLIDS × × × SULFATE × × (G)rab or (C)omposite © ©
Purchase Order # CROOKED CREEK SAMPLING Tim Holt Monthly Quarterly Semi-Annual Matrix Type No. 15pm Silver Valley Bridge (Downstream) water plastic 1 15pm WWTP DISCHARGE POINT water plastic 1 25pm WWTP DISCHARGE POINT water plastic 1	SULFATE × × (G)rab or (C)omposite © Ø
Tim Holt Tim Holt Monthly Quartetly Semi-Annual Sartple Identification 15pm Salver Valley Bridge (Downstream) water plastic 1 16pm HWY 62-65 Bridge (Upstream) water plastic 1 25pm WWTP DISCHARGE POINT water plastic 1	SULFATE × × G)rab or (C)omposite © ©
Monthly Quarterly Semi-Annual Sample Identification Matrix Type Mo. 15pm Silver Valley Bridge (Downstream) water plastic 1 00pm HWY 62-65 Bridge (Upstream) water plastic 1 25pm WWTP DISCHARGE POINT water plastic 1	OLVED SOLIDS × × × SULFATE × × ob or (C)omposite © Ø
Monthly Quarterly Semi-Annual Silver Valley Bridge (Downstream) water plastic 1 [:00pm HWY 62-65 Bridge (Upstream) water plastic 1 [:25pm WWTP DISCHARGE POINT water plastic 1	/ED SOLIDS × × SULFATE × × (C)omposite © ©
Monthly Quarterly Semi-Annual Time Sample Identification Water plastic I 1:15pm Silver Valley Bridge (Downstream) water plastic I 1:00pm HWY 62-65 Bridge (Upstream) water plastic I 1:25pm WWTP DISCHARGE POINT water plastic I	SOLIDS × × × ULFATE × × omposite © Ø
Fitne Semple (dentification Matrix Type Mo. 1:15pm Silver Valley Bridge (Downstream) water plastic 1 1:00pm HWY 62-65 Bridge (Upstream) water plastic 1 1:25pm WWTP DISCHARGE POINT water plastic 1	LIDS × × × nosite o o
1:15pm Silver Valley Bridge (Downstream) water plastic I 1:00pm HWY 62-65 Bridge (Upstream) water plastic I 1:25pm WWTP DISCHARGE POINT water plastic I	× × × × × · · · · · · · · · · · · · · ·
1:00pm HWY 62-65 Bridge (Upstream) water plastic 1 1:25pm WWTP DISCHARGE POINT water plastic 1	× × · · · · · · · · · · · · · · · · · ·
1:00pm HWY 62-65 Bridge (Upstream) water plastic 1 1:25pm WWTP DISCHARGE POINT water plastic 1	× × v
1:00pm HWY 62-65 Bridge (Upstream) water plastic 1 1:25pm WWTP DISCHARGE POINT water plastic 1	× × v
1:25pm WWTP DISCHARGE POINT water plastic 1	
1:25pm WWTP DISCHARGE POINT water plastic 1	
	× × × × × × × × × × × × × × × × × × ×
Preservatives: (1) Nitric Acid(NH03) (2) Hydrochloric Acid(HCL) Client Remarks/Comments: (3) Sodium Thiosulfate(Na2S203) (4) Sodium Hydroxide(Na03)	
ue / Company	Date / Time Received By Gign! Print Now.
u	
Rec'd of Lab By:	Comments: 10



"A Laboratory Management Partner

Memphis, Tennessee 38133

(901) 213-2400

9/10/2012

Harrison Wastewater Treatment Plant Ms. Kathryn Catlin PO Box 1715 Harrison, AR, 72601

Ref:

Analytical Testing

ETC Report Number: 12-244-0221

Client Project Description: Crooked Creek Sampling

Dear Ms. Kathryn Catlin:

Environmental Testing and Consulting, Inc. received sample(s) on 8/31/2012 for the analyses presented in the following report.

The above referenced project has been analyzed per your instructions. The analyses were performed in accordance with the applicable analytical method.

The analytical data has been validated using standard quality control measures performed as required by the analytical method. Quality Assurance, method validations, instrumentation maintenance and calibration for all parameters (NELAP and non-NELAP) were performed in accordance with guidelines established by the USEPA and NELAC unless otherwise indicated. Any parameter for which the laboratory is not officially NELAP accredited is indicated by a '~' symbol. These are not included in the scope because NELAP accreditation is either not available or has not been applied for. Additional certifications may be held/are available for parameters, where NELAP accreditation is not required or applicable. A full list of certifications is available upon request.

The results are shown on the attached Report of Analysis(s). Results for solid matrices are reported on an asreceived basis unless otherwise indicated. This report shall not be reproduced except in full and relates only to the samples included in this report.

Please do not hesitate to contact me or client services if you have any questions or need additional information.

Sincerely,

Rendell H. Thomas

Randy Thomas Project Manager

Laboratory's liability in any claim relating to analyses performed shall be limited to, at laboratory's option, repeating the analysis in question at laboratory's expense, or the refund of the charges paid for performance of said analysis.

#TN00012

Kentucky UST #41



2790 Whitten Road

Memphis, Tennessee 38133

(901) 213-2400

Fax (901) 213-2440

"A Laboratory Management Partner"

03322

Harrison Wastewater Treatment Plant

Ms. Kathryn Catlin

Project

Information:

Crooked Creek Sampling

PO Box 1715

Harrison, AR 72601

Report Date: 9/10/2012

Report Number: 12-244-0221

REPORT OF ANALYSIS

Received: 8/31/2012

Lab No:

92503

Matrix: Aqueous

Sampled: 8/30/2012 12:25

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Chloride	19.2	mg/L	0.400	1	08/31/12 14:22	RQE	EPA-300.0
Total Dissolved Solids	228	mg/L	10	1	09/05/12 14:15	NRT	2540C
Sulfate	18.6	mg/L	1.00	1	08/31/12 14:22	RQE	EPA-300.0

Lab No:

92504

Sample ID: Hwy 62/65 Bridge (Upstream)

Sample ID: Silver Valley Bridge (Downstream)

Matrix: Aqueous

Sampled: 8/30/2012 12:15

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Chloride	7.89	mg/L	0.400	1	08/31/12 14:39	RQE	EPA-300.0
Total Dissolved Solids	182	mg/L	10	1	09/05/12 14:15	NRT	2540C
Sulfate	4.81	mg/L	1.00	1	08/31/12 14:39	RQE	EPA-300.0

Lab No:

92505

Sample ID: WWTP Discharge Point

Matrix: Aqueous

Sampled: 8/30/2012 12:35

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Chloride	68.0	mg/L	2.00	5	09/04/12 15:23	RQE	EPA-300.0
Total Dissolved Solids	387	mg/L	10	1	09/05/12 14:15	NRT	2540C
Sulfate	77.8	mg/L	5.00	5	09/04/12 15:23	RQE	EPA-300.0

Qualifiers/ Definitions

^ MQL Outside QC limit

Method Quantitation Limit

DF



2790 Whitten Road

Memphis, Tennessee 38133 *A Laboratory Management Partner*

(901) 213-2400

Fax (901) 213-2440

Cooler Receipt Form

Customer Number: 03322

Customer Name: Harrison Wastewater Treatment Plant

Report Number:

12-244-0221

Shipping Method

Cinppi	3		
Fed Ex UPS US Postal Client	t Cab	Ourier (Other:
Shipping container/cooler uncompromised?	Yes	○ No	
Custody seals intact on shipping container/cooler?	Yes	○ No	Not Required
Custody seals intact on sample bottles?	O Yes	○ No	Not Required
Chain of Custody (COC) present?	Yes	○ No	
COC agrees with sample label(s)?	Yes	○ No	
COC properly completed	Yes	○ No	
Samples in proper containers?	Yes	○ No	
Sample containers intact?	Yes	○ No	
Sufficient sample volume for indicated test(s)?	Yes	○ No	
All samples received within holding time?	Yes	○ No	
Cooler temperature in compliance?	Yes	○ No	
Cooler/Samples arrived at the laboratory on ice. Samples were considered acceptable as cooling process had begun.	Yes	○ No	
Water - Sample containers properly preserved	Yes	○ No	○ N/A
Water - VOA vials free of headspace	O Yes	○ No	● N/A
Trip Blanks received with VOAs	O Yes	○ No	N/A
Soil VOA method 5035 – compliance criteria met	O Yes	○ No	N/A
High concentration container (48 hr)	Low	concentration EnCo	re samplers (48 hr)
High concentration pre-weighed (methanol -14	d) Low o	conc pre-weighed v	ials (Sod Bis -14 d)
Special precautions or instructions included?	O Yes	● No	
Comments:			

Signature: Brooke Shoup

Date & Time: 08/31/2012 10:39:00

City Of Harrison

Chain of Custody

1506 Siven Valley Road	Cflent	(A) (A)	City of Harrison		Proje	Project Number	Jer	10,000	Am	Analysis F			おきさ かくのと 様に出出 シボボバ 小田田	
Figure Harricon, AR 72601 Figure Harricon, AR 72601 Figure Harricon, AR 72601 Figure Harricon, AR 72601 Figure	Address		1508 Silver Valley Road	1			4							
STO-741-426			Harriosn, AR 72601								Harrison W. Crooked Cp.	lastewater Tre sek Samollon	atment Plant	
Sto-741-4426	email addres.		hwwfp2@windstream.net	744474 241747 241747 241747 241747 241747 241747						To				
STO-741-5022 Purchase Order # Durchase Order #	Phone No.		870-741-4426	FID#	37	Ą	i i			OTA	J		-	
CROOKED CREEK SAMPLING Ger Tim Holt Monthly Quarterly Semi-Annual Time Sample Identification water plastic 1 NONE G X X X 12:15pm Sliver Valley Bridge (Upstream) water plastic 1 NONE G X X X 12:15pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X X 12:15pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X X 12:15pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X X 12:15pm Time Aciditheta (2) Sedum friedwards) Time Aciditheta (2) Sedum friedwards) Time Holt/City of Harrison 8/30/2012/1:00pm Time Holt/City of Harrison Received By (Sign)	FAX No.	12	870-741-5022	Purch	ase Orde	# 10		(L D				
12.15pm Sample Identification Water Plastic 1 NONE G X X X 12.15pm Silver Valley Bridge (Downstream) Water plastic 1 NONE G X X X 12.15pm HWY 62-65 Bridge (Upstream) Water plastic 1 NONE G X X X 12.15pm HWY 62-65 Bridge (Upstream) Water plastic 1 NONE G X X X 12.15pm WWTP DISCHARGE FOINT Water plastic 1 NONE G X X X 12.15pm WWTP DISCHARGE FOINT Water plastic 1 NONE G X X X 12.15pm WWTP DISCHARGE FOINT Water plastic 1 NONE G X X X 12.15pm Tim Holt/City of Harrison Bate Time Received By (Sign)	Project:		CROOKED CREEK SAMPLING			_		G)ra		ISS	•			
Monthly Quarterly Semi-Annual Fine Sample Identification 12:25pm Silver Valley Bridge (Downstream) water plastic 1 NONE G X X X X 12:15pm HWY 62-65 Bridge (Upstream) water plastic 1 NONE G X X X X 12:15pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X X 12:35pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X X 12:35pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X X 14:45pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X X 14:45pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X X 15:35pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X X 16:45pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X X 16:45pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X X 16:45pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X X 16:45pm WWTP DISCHARGE POINT Water plastic 1 NONE G X X X X 16:45pm WWTP DISCHARGE POINT Water Plastic 1 NONE G X X X X 16:45pm WWTP DISCHARGE POINT Water Plastic 1 NONE G X X X X 16:45pm WWTP DISCHARGE POINT Water Plastic 1 NONE G X X X X 16:45pm WWTP DISCHARGE POINT Water Plastic 1 NONE G X X X X 16:45pm WWTP DISCHARGE POINT Water Plastic 1 NONE G X X X X 16:45pm WWTP DISCHARGE POINT WATER PLASTIC 1 NONE G X X X X 16:45pm WWTP DISCHARGE POINT WATER PLASTIC 1 NONE G X X X X 16:45pm WWTP DISCHARGE POINT WATER PLASTIC 1 NONE G X X X X 16:45pm WWTP DISCHARGE POINT WATER PLASTIC 1 NONE G X X X X 16:45pm WWTP DISCHARGE POINT WATER PLASTIC 1 NONE G X X X X 16:45pm WWTP DISCHARGE POINT WATER PLASTIC 1 NONE G X X X X 16:45pm WWTP DISCHARGE POINT WATER PLASTIC 1 NONE G X X X X 16:45pm WWTP DISCHARGE POINT WATER PLASTIC 1 NONE G X X X X X X X X X X X X X X X X X X	Project Mana	ger	Tim Holt		٥			b or)i.v			***************************************	
Monthly Quarterly Semi-Annual Time Sample Identification Matrix Type No. Pres. Comments: 12:25pm Silver Valley Bridge (Downstream) water plastic 1 NONE G X X X X 12:15pm HWY 62-65 Bridge (Upstream) water plastic 1 NONE G X X X X 12:35pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X X 12:35pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X X 12:35pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X X 12:35pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X X 14:35pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X X 14:35pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X X 15:35pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X X 16:35pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X X 16:35pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X X 16:35pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X X 16:35pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X X 16:35pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X X 16:35pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X X 16:35pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X X 16:35pm WWTP DISCHARGE POINT Water Plastic 1 NONE G X X X X 16:35pm WWTP DISCHARGE POINT Water Plastic 1 NONE G X X X X 16:35pm WWTP DISCHARGE POINT Water Plastic 1 NONE G X X X X 16:35pm WWTP DISCHARGE POINT WATER PLASTIC 1 NONE G X X X X 16:35pm WWTP DISCHARGE POINT WATER PLASTIC 1 NONE G X X X X 16:35pm WWTP DISCHARGE POINT WATER PLASTIC 1 NONE G X X X X 16:35pm WWTP DISCHARGE POINT WATER PLASTIC 1 NONE G X X X X 16:35pm WWTP DISCHARGE POINT WATER PLASTIC 1 NONE G X X X X 16:35pm WWTP DISCHARGE POINT WATER PLASTIC 1 NONE G X X X X 16:35pm WWTP DISCHARGE POINT WATER PLASTIC 1 NONE G X X X X 16:35pm WWTP DISCHARGE POINT WATER PLASTIC 1 NONE G X X X X X X X X X X X X X X X X X X	Type of Even	t						(C)	-					
Firms Sample Identification Water plastic 1 NONE G X X X 12.25pm Silver Valley Bridge (Downstream) water plastic 1 NONE G X X X 12.15pm HWY 62-65 Bridge (Upstream) water plastic 1 NONE G X X X 12.35pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X 12.35pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X 12.35pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X 12.35pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X 12.35pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X 12.35pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X 12.35pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X 12.35pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X 12.35pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X 12.35pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X 12.35pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X 12.35pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X 12.35pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X 12.35pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X 12.35pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X 12.35pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X 12.35pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X 12.35pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X 12.35pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X 12.35pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X 12.35pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X 12.35pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X 12.35pm WTP	Single Daily		Monthly Quarterly Semi-Annual					omp	4.5					
12:15pm HWY 62-65 Bridge (Upstream) water plastic 1 NONE G X X X 12:15pm HWY 62-65 Bridge (Upstream) water plastic 1 NONE G X X X 12:35pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X X 12:35pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X X 12:35pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X X 12:35pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X X 12:35pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X X 12:35pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X X 12:35pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X X 12:35pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X X 12:35pm WWTP DISCHARGE POINT Water Plastic 1 NONE G X X X X 12:35pm WWTP DISCHARGE POINT Water Plastic 1 NONE G X X X X 13:35pm WWTP DISCHARGE POINT Water Plastic 1 NONE G X X X X 14:25pm WWTP DISCHARGE POINT Water Plastic 1 NONE G X X X X 15:25pm WWTP DISCHARGE POINT Water Plastic 1 NONE G X X X X X X X X X X X X X X X X X X	Date	Time	Sample Identification	Matrix			Press	osite						
12:15pm HWY 62-65 Bridge (Upstream) water plastic 1 NONE G X X X X 12:35pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X X 12:35pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X X (1) Nitric acia(NH03) (2) Hydrochloric Acid(HCL) (2) Nitric acia(NH03) (2) Hydrochloric Acid(HCL) (3) Nitric acia(NH03) (2) Hydrochloric Acid(HCL) (4) Nitric acia(NH03) (2) Hydrochloric Acid(HCL) (5) Nitric acia(NH03) (2) Hydrochloric Acid(HCL) (6) Nitric acia(NH03) (2) Hydrochloric Acid(HCL) (7) Nitric acia(NH03) (2) Hydrochloric Acid(HCL) (6) Nitric acia(NH03) (2) Hydrochloric Acid(HCL) (7) Nitric acia(NH03) (2) Hydrochloric Acid(HCL) (8) Nitric acia(NH03) (2) Hydrochloric Acid(HCL) (8) Nitric acia(NH03) (2) Hydrochloric Acid(HCL) (9) Nitric acia(NH03) (2) Hydrochloric Acid(HCL) (1) Nitric acia(NH03) (2) Hydrochloric Acid(HCL) (2) Nitric acia(NH03) (2) Hydrochloric Acid(HCL) (3) Nitric acia(NH03) (2) Hydrochloric Acid(HCL) (4) Nitric acia(NH03) (2) Hydrochloric Acid(HCL) (5) Nitric acia(NH03) (2) Hydrochloric Acid(HCL) (6) Nitric acia(NH03) (2) Hydrochloric Acid(HCL) (7) Nitric acia(NH03) (2) Hydrochloric Acid(HCL) (7) Nitric acia(NH03) (2) Hydrochloric Acid(HCL) (8) Nitric acia(NH03) (2) Hydrochloric Acid(HCL) (6) Nitric acia(NH03) (2) Hydrochloric Acid(HCL) (7) Nitric acia(NH03) (2) Hydrochloric Acid(HCL) (7) Nitric acia(NH03) (2) Hydrochloric Acid(HCL) (7) Nitric acia(NH03) (2) Hydrochloric Acid(HCL) (8) Nitric acia(NH03) (2) Hydrochloric Acid(HCL) (7) Nitric acia(NH03) (2) Hydrochloric Acid(HCL) (8) Nitric acia(NH03) (2) Hydrochloric Acid(HCL) (8) Nitric acia(NH03) (2) Hydrochloric Acid(HCL) (9) Nitric acia(NH03) (2) Hydrochloric Acid(HCL) (1) Ni	8/30/2012	12:25рт	Silver Valley Bridge (Downstream)	water	plastic	_	NONE	-	—					
12:15pm HWY 62-65 Bridge (Upstream) water plastic I NONE G X X X X 12:35pm WWTP DISCHARGE POINT water plastic I NONE G X X X X (1) Nitric Acid(NH03) (2)Hydrochloric Acid(HCL) (2) Nitric Acid(NH03) (2)Hydrochloric Acid(HCL) (3) Nitric Acid(NH03) (2)Hydrochloric Acid(HCL) (4) Nitric Acid(NH03) (2)Hydrochloric Acid(HCL) (5) Nitric Acid(NH03) (2)Hydrochloric Acid(HCL) (6) Nitric Acid(NH03) (2)Hydrochloric Acid(HCL) (7) Nitric Acid(NH03) (2)Hydrochloric Acid(HCL) (8) Nitric Acid(NH03) (2)Hydrochloric Acid(HCL) (1) Nitric Acid(HCL) (2) Nitric Acid(HCL) (3) Nitric Acid(HCL) (4) Nitric Acid(HCL) (4) Nitric Acid(HCL) (5) Nitric Acid(HCL) (6) Nitric Acid(HCL) (7) Nitric Acid(HCL) (7) Nitric Acid(HCL) (8) Nitric Acid(HCL) (1) Nitric Acid(HCL				-									2	
12:15pm														
12:35pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X (1) Nitric Acid(WiO3) (2) Hydrochloric Acid(HCL) Client Remarks/Comments: (1) Nitric Acid(WiO3) (2) Hydrochloric Acid(HCL) Client Remarks/Comments: (2) Nitric Acid(WiO3) (2) Hydrochloric Acid(HCL) Client Remarks/Comments: (3) Nitric Acid(WiO3) (2) Hydrochloric Acid(HCL) Client Remarks/Comments: (4) Nitric Acid(WiO3) (2) Hydrochloric Acid(HCL) Client Remarks/Comments: (5) Nitric Acid(WiO3) (2) Hydrochloric Acid(HCL) Client Remarks/Comments: (6) Nitric Acid(WiO3) (2) Hydrochloric Acid(HCL) Client Remarks/Comments: (7) Nitric Acid(WiO3) (2) Hydrochloric Acid(HCL) Client Remarks/Comments: (8) Nitric Acid(WiO3) (2) Hydrochloric Acid(HCL) Client Remarks/Comments: (9) Nitric Acid(WiO3) (2) Hydrochloric Acid(HCL) Client Remarks/Comments: (1) Nitric Acid(WiO3) (2) Hydrochloric Acid(HCL) Client Remarks/Comments: (2) Nitric Acid(HCL) Client Remarks/Comments: (3) Nitric Acid(HCL) Client Remarks/Comments: (4) Nitric Acid(HCL) Client Remarks/Comments: (4) Nitric Acid(HCL) Client Remarks/Comments: (5) Nitric Acid(HCL) Client Remarks/Comments: (6) Nitric Acid(HCL) Client Remarks/Comments: (7) Nitric Acid(HCL) Client Remarks/Comments: (7) Nitric Acid(HCL) Client Remarks/Comments: (8) Nitric Acid(HCL) Client Remarks/Comments: (8) Nitric Acid(HCL) Client Remarks/Comments: (9) Nitric Acid(HCL) Client Remarks/Comments: (1) Nitric Acid(HCL) Client Remarks/Comments: (1) Nitric Acid(HCL) Client R	8/30/2012	12:15pm	HWY 62-65 Bridge (Upstream)	water	plastic	-	NONE	O	×	-				
12:35pm WWTP DISCHARGE POINT water plastic I NONE G X X X X (1) Nitric Acid(NH03) (2) Hydrochloric Acid(HCL) Glient Remarks/Comments: (1) Nitric Acid(NH03) (2) Hydrochloric Acid(HCL) (2) Tim Holt/City of Harrison (2) Rec'd Date (Time: X S - C) (2) Comments: (2) Comments: (3) Comments: (4) Comments: (4) Comments: (5) Comments: (6) Comments: (6) Comments: (7) Comments: (7) Comments: (8) Comments: (7) Comments: (8) Comments: (8) Comments: (9) Comments: (9) Comments: (1) Comments: (2) Comments: (3) Comments: (4) Comments: (4) Comments: (5) Comments: (6) Comments: (7) Comments: (8) Comments: (8) Comments: (8) Comments: (9) Comments: (1) Comments: (1) Comments: (1) Comments: (1) Comments: (1) Comments: (2) Comments: (1) Comments: (2) Comments: (3) Comments: (4) Com				-		-			n de	1			S	
(1) Nitric Acid(NH03) (2)Hydrochloric Acid(HCL) Sosuthate(Na25203) (4) Sodium Hydroxide(Na03) quished By (Sign) Tim Holt/City of Harrison Rec'd Date Time: S Comments: S Comments: S	C10C/05/8	13.35mm	WATER DISCHARGE BOILE		-	1	110013	,	1	+	+	1		
(1) Nitric Acid(NH03) (2)Hydrochloric Acid(HCL) iosulfate(Na2S203) (4) Sodium Hydroxide(Na03) julished By (Sign) Tim Holt/City of Harrison 8/30/2012/1:00pm Rec'd Date Time: S Comments: S Comments: S	2102000	mdec.21	WWIT DISCHARGE FOUNT	Waler	piastic	1	NONE	5	×	+-				
instruct Acid(NH03) (2)Hydrochloric Acid(HCL) Client Remarks/Comments: Juished Br. (Sign) Tim Holt/City of Harrison Rec'd Date Time: Standard Br. (Sign)												1		
iosulfate(Na2S203) (4) Sodium Hydroxide(Na03) quished By (Sign) Tim Holt/City of Harrison 8/30/2012/1:00pm Rec'd Date Time: State Comments: State Comments: State Sta									t		+	1		
iosulfate(Nat2S203) (2) Hydrochloric Acid(NCL) Glient Remarks/Comments: Julshed By (Sign) Tim Holt/City of Harrison 8/30/2012/1:00pm Tim Holt/City of Harrison Rec'd Date Time: Standard Stan														
iosulfate(Na2S203) (4) Sodium Hydroxide(Na03) quished By (Sign) Tim Holt/City of Harrison 8/30/2012/1:00pm Rec'd Date Time: State Comments: State Comments: State Sta				A T										
Tim Holt/City of Harrison 8/30/2012/1:00pm Tim Holt/City of Harrison 8/30/2012/1:00pm Rec'd Date Time: S Comments: S	Preservatives (3) Sodium Th	iosulfate(N	Acid(NH03) (2)Hydrochloric Acid(HCL, a2S203) (4) Sodium Hydroxide(Na03)	Client	Remarks	/Comment	iń				-			
Tim Holt/City of Harrison 8/30/2012/1:00pm W. S. M. O. C. M. Rec'd Date Time: R. S. O. O. S. Comments: 1.	Retin	quished B	200 - 40	e/Compa	ŝ		Date / Tu	9		Rec	eived By (S)	(uži	Primi Nui	ne / Compan
v. BROTEL Rec'd Date Time: R SI - OF 133 Comments:)\	2 6	Tim Holt/C	ty of Har	rison	8/30	/2015/1	00pm						
V. S. S. O. C. S. Rec'd Date Time: R. S D. C. S. Comments: 1				24					+		lex.			
The state of the s	Rec'd at Lab B	T.	MOT.	Rec'd !	Date / Tim	Y	1		V	5	Commonts	-		
	Of the said 1/30		1			1	11	1	1	4		+		



2790 Whitten Road

Memphis Tennessee 38133

(901) 213-2400

9/21/2012

Harrison Wastewater Treatment Plant Ms. Kathryn Catlin PO Box 1715 Harrison, AR, 72601

Ref:

Analytical Testing

ETC Report Number: 12-256-0252

Client Project Description: Crooked Creek Sampling

Dear Ms. Kathryn Catlin:

Environmental Testing and Consulting, Inc. received sample(s) on 9/12/2012 for the analyses presented in the following report.

The above referenced project has been analyzed per your instructions. The analyses were performed in accordance with the applicable analytical method.

The analytical data has been validated using standard quality control measures performed as required by the analytical method. Quality Assurance, method validations, instrumentation maintenance and calibration for all parameters (NELAP and non-NELAP) were performed in accordance with guidelines established by the USEPA and NELAC unless otherwise indicated. Any parameter for which the laboratory is not officially NELAP accredited is indicated by a '~' symbol. These are not included in the scope because NELAP accreditation is either not available or has not been applied for. Additional certifications may be held/are available for parameters, where NELAP accreditation is not required or applicable. A full list of certifications is available upon request.

The results are shown on the attached Report of Analysis(s). Results for solid matrices are reported on an asreceived basis unless otherwise indicated. This report shall not be reproduced except in full and relates only to the samples included in this report.

Please do not hesitate to contact me or client services if you have any questions or need additional information.

Sincerely,

Randy Thomas

Rendell H. Thomas

Project Manager

Laboratory's liability in any claim relating to analyses performed shall be limited to, at laboratory's option, repeating the analysis in question at laboratory's expense, or the refund of the charges paid for performance of said analysis.

#TN00012

#415

#09267CA NC

Kentucky UST #41

Kansas



2790 Whitten Road

Memphis, Tennessee 38133

"A Laboratory Management Partner"

03322

Harrison Wastewater Treatment Plant

Ms. Kathryn Catlin

PO Box 1715

Harrison, AR 72601

Project

Crooked Creek Sampling

Information:

Report Date: 9/21/2012

Report Number: 12-256-0252

REPORT OF ANALYSIS

Received: 9/12/2012

Lab No:

94539

Sample ID: Silver Valley Bridge (Downstream) Plus

Matrix: Aqueous

Sampled: 9/11/2012 9:00

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Alkalinity (as CaCO3)	149	mg/L	1	1	09/18/12 10:43	EWB	2320B
Chloride	10.6	mg/L	0.400	1	09/14/12 11:43	RQE	EPA-300.0
Total Dissolved Solids	213	mg/L	10	1	09/17/12 13:40	NRT	2540C
Total Calcium	63.5	mg/L	0.100	1	09/18/12 18:07	JTR	EPA-200.7
Total Magnesium	1.99	mg/L	0.100	1	09/18/12 18:07	JTR	EPA-200.7
Total Potassium	2.07	mg/L	0.100	1	09/18/12 18:07	BKN	EPA-200.7
Total Sodium	6.32	mg/L	0.500	1	09/18/12 18:07	BKN	EPA-200.7
Sulfate	7.63	mg/L	1.00	1	09/14/12 11:43	RQE	EPA-300.0

Lab No:

94540

Sample ID: Hwy 62/65 Bridge (Upstream) plus

Matrix: Aqueous

Sampled: 9/11/2012 8:40

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Alkalinity (as CaCO3)	159	mg/L	1	1	09/18/12 10:43	EWB	2320B
Chloride	6.89	mg/L	0.400	1	09/14/12 12:01	RQE	EPA-300.0
Total Dissolved Solids	179	mg/L	10	1	09/17/12 13:40	NRT	2540C
Total Calcium	66.8	mg/L	0.100	1	09/18/12 18:27	JTR	EPA-200.7
Total Magnesium	1.97	mg/L	0.100	1	09/18/12 18:27	JTR	EPA-200.7
Total Potassium	1.27	mg/L	0.100	1	09/18/12 18:27	BKN	EPA-200.7
Total Sodium	3.47	mg/L	0.500	1	09/18/12 18:27	BKN	EPA-200.7
Sulfate	4.84	mg/L	1.00	1	09/14/12 12:01	RQE	EPA-300.0

Qualifiers/ Definitions

MQL

Outside QC limit

Method Quantitation Limit

DF



2790 Whitten Road

Memphis, Tennessee 38133

A Laboratory Management Partner

03322

Harrison Wastewater Treatment Plant

Ms. Kathryn Catlin

Project

Crooked Creek Sampling

PO Box 1715

Harrison, AR 72601

Information:

Report Date: 9/21/2012

Report Number : 12-256-0252

REPORT OF ANALYSIS

Received: 9/12/2012

Lab No:

94541

Matrix: Aqueous

Sample ID: WWTP Discharge Point

Sampled: 9/11/2012 9:10

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Alkalinity (as CaCO3)	40	mg/L	1	1	09/18/12 10:43	EWB	2320B
Chloride	57.6	mg/L	2.00	5	09/14/12 14:20	RQE	EPA-300.0
Total Dissolved Solids	338	mg/L	10	1	09/17/12 13:40	NRT	2540C
Total Calcium	42.9	mg/L	0.100	1	09/18/12 18:33	JTR	EPA-200.7
Total Magnesium	2.84	mg/L	0.100	1	09/18/12 18:33	JTR	EPA-200.7
Total Potassium	13.5	mg/L	0.100	1	09/18/12 18:33	BKN	EPA-200.7
Total Sodium	40.7	mg/L	0.500	1	09/18/12 18:33	BKN	EPA-200.7
Sulfate	42.8	mg/L	1.00	1	09/14/12 12:18	RQE	EPA-300.0



2790 Whitten Road

Memphis, Tennessee 38133

(901) 213-240

Fax (901) 213-2440

A Laboratory Management Partner

Cooler Receipt Form

Customer Number: 03322 Customer Name: Harrison Wastewater Treatm	nent Plant		
Report Number: 12-256-0252			
Shippir	ng Method		
Fed Ex UPS US Postal Client	t Cab	Ourier (Other:
Shipping container/cooler uncompromised?	Yes	○ No	
Custody seals intact on shipping container/cooler?	O Yes	○ No	Not Required
Custody seals intact on sample bottles?	O Yes	○ No	Not Required
Chain of Custody (COC) present?	Yes	○ No	
COC agrees with sample label(s)?	Yes	○ No	
COC properly completed	Yes	○ No	
Samples in proper containers?	Yes	○ No	
Sample containers intact?	Yes	○ No	
Sufficient sample volume for indicated test(s)?	Yes	○ No	r.
All samples received within holding time?	Yes	○ No	
Cooler temperature in compliance?	Yes	○ No	
Cooler/Samples arrived at the laboratory on ice. Samples were considered acceptable as cooling process had begun.	Yes	○ No	
Water - Sample containers properly preserved	Yes	○ No	○ N/A
Water - VOA vials free of headspace	O Yes	○ No	N/A
Trip Blanks received with VOAs	O Yes	○ No	N/A
Soil VOA method 5035 – compliance criteria met	O Yes	○ No	N/A
High concentration container (48 hr)	Low	concentration EnCo	re samplers (48 hr)
High concentration pre-weighed (methanol -14	d) Low	conc pre-weighed v	ials (Sod Bis -14 d)
Special precautions or instructions included?	O Yes	No	
Comments:			
			-

Any regulatory non-compliance issues will be recorded on non-compliance report.

Signature: Brooke Shoup

Date & Time: 09/12/2012 13:01:16

Continuent		1 236	Other of Housings		Decident	Merenha		747	ΰ	Crooked Creek Sampling	reek Sa	mpling				12 55.17	t-	121311	
Harrison, Ark 7280	Hent		City of frattison		יחלפת	TATE OF THE PARTY		***		.1								1_	
Harrison, AR 7260 Havingon, AR 7260 Storial-1426	Address		1508 Silver Valley Road							ļ.				_	_		_	1	
Style="background-style="bac	Annual Control of the		Harriosn, AR 72601				3 3 4 5 5	н	-	,									
STO-741-426 STO-741-426 STO-741-426 STO-741-426 STO-741-426 STO-741-5022 STO-741-5022 Purchase Order # STO-741-5022 Purchase Order # STO-741-5022 STO-741-5022 STO-741-5022 STO-741-7426 S	smail addres:	100	hwwtp2@windstream.net				A TO	Test	*****				то					-	
Sample (Description of Harrison Purchase Order # 1 1 1 1 1 1 1 1 1	Phone No.		870-741-4426	曹正									TA						
Fig. CROOKED CREEK SAMPLING	FAX No.		870-741-5022	Purcha	se Order	#		((ry.			1907	L DI	10	ma			-	
Fig. Fine Counterly Semi-Annual Fine Fin	Project:	.55	CROOKED CREEK SAMPLING					3)ral			`		s ISSC	TAL	7.41				
Stronger	Project Mana	ger	Tim Holt		1			or	PO	100	MA	>	-		Al	-			
Fig. 2 Fig. 2 Fig. 3 Fig. 4 F	Type of Even	ı.				1					\GN	su			V 4	110 · · · · · ·			,
Sample (dentification Matrix Type No. Pres. Sample (dentification Matrix Type No. Pres. Sample (dentification Mater plastic 1 1 6 X X X X X X X X X	Single Daily	Bi-Weekly		N 20 1							ESI	LF	-		i is				
water plastic 1 NONE G X	Date	Time	San	Matrix	Type	Me,	Pres.				UM	ATE	-		TTV				\dashv
water plastic 1 1 6 X X X X X X X X X X X X X X X X X	9/11/2012	9:00am	Silver Valley Bridge (Downstream)	water	plastic	1	NONE	G				×	×	×	×				
water plastic 1 G X <th< td=""><td>9/11/2012</td><td>9:00am</td><td>Silver Valley Bridge (Downstream)</td><td>water</td><td>plastic</td><td>1</td><td>l</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>+</td></th<>	9/11/2012	9:00am	Silver Valley Bridge (Downstream)	water	plastic	1	l												+
water plastic 1 none G X										2									
water plastic 1 1 G X X X X X X X X X	9/11/2012	8:40am	HWY 62-65 Bridge (Upstream)	water	plastic	1	NONE	9		- 1		×	×	×	×				
water plastic 1 NONE G X X X X X X X X X X X X X X X X X X	9/11/2012	8:40am	HWY 62-65 Bridge (Upstream)	water	plastic		-			-	\dashv								
water plastic 1 1 G X X X X X X X X X									1					Ħ	III			+	+
Cilent Remarks/Comments: Company by of Harrison Company Dime Time Received By (Sign) Print Name Company	9/11/2012	9:10am	WWTP DISCHARGE POINT	water	plastic	-	NONE	Ð	No.		-	×	×	×	×	_			+
Client Remarks/Comments: Company Dime / Time Received By (Sign) Print Name ty of Harrison 9-11-2012/9:30am Print Name	9/11/2012	9:10am	WWTP DISCHARGE POINT	water	plastic	-	-	_	+		-			1	+	4			Naje Naje
Client Remarks/Comments: c / Company Dime / Time Received By (Sign) Print Name ty of Harrison 9-11-2012/9:30am							À.		-	+	1			+	+	1		1	
Client Remarks/Comments: \$\int Company Daire Time Received By (Sign) Print Name ty of Harrison 9-11-2012/9:30am BACC OCCUPANION				Ų.				1	-	+	-			1	-	\downarrow		+	+
Client Remarks/Comments: S. Company Dime / Time Received By (Sign) Print Name ty of Harrison 9-11-2012/9:30am B. H. O. J.									+	-				†	+	\downarrow	1		+
ty of Harrison 9-11-2012/9;30am BAOC 9 9-13	Preservatives	· (1) Nitrio	Acid(NH03) (2)Hydrochloric Acid(HCL)	Client	Remarks/C	omments	<u>.</u>		\dashv	\dashv	4				\dashv			1	
ned By (Sign) Print Name / Company Dane / Time Received By (Sign) Print Name ((3) Sadium Ti	iosuffate(A	Va2S203) (4) Sodium Hydroxide(Na03)		_ E											200			
Tim Holt/City of Harrison 9-11-2012/9;30am BAC	Rellyn	quished.		Compa	9	T	ate / Th	ar.			recei	ed B	Sis)	2		Print	Vame	Col	updu
	(m)	Mall	Tim Holt/Ci	of Han	ison	9-11	-2012/9	:30an		9	A	B	4	$\overline{}$	9	1	d	-	
Contract Con	4 4 5 7 10 4			L. Carol		O	Ç	C	6	10		1			0				



"A Laboratory Management Partner

Memphis, Tennessee 38133

(901) 213-2400

10/1/2012

Harrison Wastewater Treatment Plant Ms. Kathryn Catlin PO Box 1715 Harrison, AR, 72601

Ref:

Analytical Testing

ETC Report Number: 12-269-0230

Client Project Description: Crooked Creek Sampling

Dear Ms. Kathryn Catlin:

Environmental Testing and Consulting, Inc. received sample(s) on 9/25/2012 for the analyses presented in the following report.

The above referenced project has been analyzed per your instructions. The analyses were performed in accordance with the applicable analytical method.

The analytical data has been validated using standard quality control measures performed as required by the analytical method. Quality Assurance, method validations, instrumentation maintenance and calibration for all parameters (NELAP and non-NELAP) were performed in accordance with guidelines established by the USEPA and NELAC unless otherwise indicated. Any parameter for which the laboratory is not officially NELAP accredited is indicated by a '~' symbol. These are not included in the scope because NELAP accreditation is either not available or has not been applied for. Additional certifications may be held/are available for parameters, where NELAP accreditation is not required or applicable. A full list of certifications is available upon request.

The results are shown on the attached Report of Analysis(s). Results for solid matrices are reported on an asreceived basis unless otherwise indicated. This report shall not be reproduced except in full and relates only to the samples included in this report.

Please do not hesitate to contact me or client services if you have any questions or need additional information.

Sincerely,

Randy Thomas **Project Manager**

Rendell H. Thomas

Laboratory's liability in any claim relating to analyses performed shall be limited to, at laboratory's option, repeating the analysis in question at laboratory's expense, or the refund of the charges paid for performance of said analysis.



2790 Whitten Road

Memphis, Tennessee 38133

(901) 213-2400

Fax (901) 213-2440

"A Laboratory Management Partner"

03322

Harrison Wastewater Treatment Plant

Ms. Kathryn Catlin

PO Box 1715

Harrison, AR 72601

Project

Crooked Creek Sampling

Information:

Report Date: 10/1/2012

Report Number: 12-269-0230

REPORT OF ANALYSIS

Received: 9/25/2012

Lab No:

97265

Sample ID: Silver Valley Bridge (Downstream)

Matrix: Aqueous

Sampled: 9/24/2012 12:15

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Chloride	18.1	mg/L	0.400	1	09/25/12 20:57	RQE	EPA-300.0
Total Dissolved Solids	249	mg/L	10	1	09/28/12 14:00	NRT	2540C
Sulfate	15.7	mg/L	1.00	1	09/25/12 20:57	RQE	EPA-300.0

Lab No:

97266

Sample ID: Hwy 62/65 Bridge (Upstream)

Matrix: Aqueous

Sampled: 9/24/2012 12:25

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Chloride	7.59	mg/L	0.400	1	09/25/12 21:14	RQE	EPA-300.0
Total Dissolved Solids	207	mg/L	10	1	09/28/12 14:00	NRT	2540C
Sulfate	5.93	mg/L	1.00	1	09/25/12 21:14	RQE	EPA-300.0

Lab No:

97267

Sample ID: WWTP Discharge Point

Matrix: Aqueous

Sampled: 9/24/2012 12:35

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Chloride	59.9	mg/L	2.00	5	09/26/12 10:37	RQE	EPA-300.0
Total Dissolved Solids	417	mg/L	10	1	09/28/12 14:00	NRT	2540C
Sulfate	54.0	mg/L	5.00	5	09/26/12 10:37	RQE	EPA-300.0

Qualifiers/ **Definitions**

MQL

Outside QC limit

Method Quantitation Limit

DF



2790 Whitten Road

Memphis, Tennessee 38133

(901) 213-24

Fax (901) 213-2440

A Laboratory Management Partner

Cooler Receipt Form

Customer Number: 03322		
Customer Name: Harrison Wastewater Treatm Report Number: 12-269-0230	ent Plant	
a nee Tare is now continuous too	ng Method	
Fed Ex UPS US Postal Client		Courier Other:
Shipping container/cooler uncompromised?	Yes	○ No
Custody seals intact on shipping container/cooler?	Yes	○ No Not Require
Custody seals intact on sample bottles?	O Yes	○ No Not Require
Chain of Custody (COC) present?	Yes	○ No
COC agrees with sample label(s)?	Yes	○ No
COC properly completed	Yes	○ No
Samples in proper containers?	Yes	○ No
Sample containers intact?	Yes	○ No
Sufficient sample volume for indicated test(s)?	Yes	○ No
All samples received within holding time?	Yes	○ No
Cooler temperature in compliance?	Yes	○ No
Cooler/Samples arrived at the laboratory on ice. Samples were considered acceptable as cooling process had begun.	Yes	○ No
Water - Sample containers properly preserved	Yes	○ No ○ N/A
Water - VOA vials free of headspace	O Yes	○ No N/A
Trip Blanks received with VOAs	O Yes	○ No N/A
Soil VOA method 5035 – compliance criteria met	O Yes	○ No N/A
High concentration container (48 hr)	Lov	w concentration EnCore samplers (48 hr)
High concentration pre-weighed (methanol -14	d) Lov	w conc pre-weighed vials (Sod Bis -14 d)
Special precautions or instructions included?	O Yes	No
Comments:		

Any regulatory non-compliance issues will be recorded on non-compliance report.

Signature: Brooke Shoup

Date & Time: 09/25/2012 10:19:31

City Of Harrison

1508 Silver Valley Road Harriosn, AR 72601 Harriosn, AR 72602 Ha	1508 Silver Valley Road Purchase Order # Structures	Client		City of Harrison		Projec	+ Mercan								1-25
Harriosa, AR 7260 Safe-Yal-4236	Harrison, AR 7260 Start	Address		1508 Silver Valley Road				Ď		100	<u>-</u>	Crooked Creek	sampling	10 18-4	
### Sand Processor Fig. Purchase Order ##	### STOP TO THE PROPERTY OF TH			Harriosn, AR 72601											
12.25pm	STO-741-4426	email addre.	33	hwwtp2@windstream.net					100					fraces	
CROOKED CREEK SAMPLING	CROONED CREEK SAMPLING	Phone No.		870-741-4426	2					TO					
Perit Monthly Ottarterly Semi-Annual Water Time Sample Identification Time Monthly Ottarterly Semi-Annual Time Monthly Ottarterly Semi-Annual Matrix Type No. Press and an annual and annual	Pager Tim Holt Time Mouthly Ottarcety Semi-Annual Time Sample identification Matrix Type Mo. Press all and an instance of X X X X in the plastic in NONE G X X X X in the plastic in NONE G X X X X in the plastic in NONE G X X X X X in the plastic in NONE G X X X X X in the plastic in NONE G X X X X X in the plastic in NONE G X X X X X in the plastic in NONE G X X X X X X X X X X X X X X X X X X	FAX NO.		870-741-5022	T	Order C	7			TAL					
Northly Quarterly Semi-Annual Time Sample Identification Metrix Type No. Pres. 12:25pm Silver Valley Bridge (Downstream) water plastic I NONE G X X X X X X X X X X X X X X X X X X	12.15pm WWTP DISCHARGE POINT Water plastic 1 NONE G × × ×	Project:		CROOKED CREEK SAMPLING		ian io ac	ŧ		(G	DIS		7.0			
12.35pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X X X X X X X X X X X X X X X X	12.25pm HWV 62-65 Bridge (Upstream) water plastic 1 NONE G X X X X 12.25pm HWV 62-65 Bridge (Upstream) water plastic 1 NONE G X X X X 12.25pm HWV 62-65 Bridge (Upstream) water plastic 1 NONE G X X X X 12.25pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X X 12.25pm TWV 62-65 Bridge (Upstream) water plastic 1 NONE G X X X X 12.25pm TWV 62-65 Bridge (Upstream) water plastic 1 NONE G X X X X 12.25pm TWV 62-65 Bridge (Upstream) water plastic 1 NONE G X X X X 12.25pm TWV 62-65 Bridge (Upstream) water plastic 1 NONE G X X X X 12.25pm TWV 62-65 Bridge (Upstream) water plastic 1 NONE G X X X X 12.25pm TWV 62-65 Bridge (Upstream) water plastic 1 NONE G X X X X 12.25pm TWV 62-65 Bridge (Upstream) water plastic 1 NONE G X X X X 12.25pm TWV 62-65 Bridge (Upstream) water plastic 1 NONE G X X X X 12.25pm TWV 62-65 Bridge (Upstream) water plastic 1 NONE G X X X X 12.25pm TWV 62-65 Bridge (Upstream) water plastic 1 NONE G X X X X 12.25pm TWV 62-65 Bridge (Upstream) water plastic 1 NONE G X X X X 12.25pm TWV 62-65 Bridge (Upstream) water plastic 1 NONE G X X X X X X X X X X X X X X X X X X	Project Man.	ager	Тіт Ной	-)rab	SSO	-				***************************************
12.35pm HWY 62-65 Bridge (Upstream) water plastic 1 NONE G X X X X 12.35pm HWY 62-65 Bridge (Upstream) water plastic 1 NONE G X X X X 12.35pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X X 12.35pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X X 12.35pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X X 12.35pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X X 12.35pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X X 12.35pm WWTP DISCHARGE POINT Water plastic 1 NONE G X X X X 12.35pm WWTP DISCHARGE POINT Water plastic 1 NONE G X X X X 12.35pm WWTP DISCHARGE POINT Water plastic 1 NONE G X X X X 12.35pm WWTP DISCHARGE POINT Water plastic 1 NONE G X X X X 12.35pm WWTP DISCHARGE POINT Water plastic 1 NONE G X X X X 12.35pm WWTP DISCHARGE POINT Water plastic 1 NONE G X X X X 12.35pm WWTP DISCHARGE POINT Water plastic 1 NONE G X X X X 12.35pm WWTP DISCHARGE POINT Water plastic 1 NONE G X X X X 12.35pm WWTP DISCHARGE POINT Water plastic 1 NONE G X X X X 12.35pm WWTP DISCHARGE POINT Water plastic 1 NONE G X X X X 12.35pm WWTP DISCHARGE POINT Water plastic 1 NONE G X X X X 12.35pm WWTP DISCHARGE POINT Water plastic 1 NONE G X X X X 12.35pm WWTP DISCHARGE POINT Water plastic 1 NONE G X X X X 12.35pm WWTP DISCHARGE POINT Water plastic 1 NONE G X X X X 12.35pm WWTP DISCHARGE POINT WATER Plastic 1 NONE G X X X X 12.35pm WWTP DISCHARGE POINT WATER Plastic 1 NONE G X X X X 12.35pm WWTP DISCHARGE POINT WATER Plastic 1 NONE G X X X X 12.35pm WWTP DISCHARGE POINT WATER Plastic 1 NONE G X X X X 12.35pm WWTP DISCHARGE POINT WATER Plastic 1 NONE G X X X X X X X X X X X X X X X X X X	12:15pm Sample Identification Matrix Type No. Pres. 1917 1918 1	Type of Ever	ıt.		+				or (LVE					
12:15pm Silver Valley Bridge (Downstream) water plastic 1 NONE G X X X X 12:25pm HWY 62-65 Bridge (Upstream) water plastic 1 NONE G X X X X 12:35pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X X 12:35pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X X 12:35pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X X 14ushfeed By (Signt)	12:15pm Silver Valley Bridge (Downstream) water plastic 1 NONE G X X X X X X X X X X X X X X X X X X	Single Daily	19. 12. 12. 12.	Monthly Quarterly Semi-Annual											
12:15pm Silver Valley Bridge (Dovorstream) water plastic 1 NONE G X X X X 12:25pm HWY 62-65 Bridge (Upstream) water plastic 1 NONE G X X X X 12:35pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X X X X X X X X X X X X X X X X	12.25pm HWY 62-65 Bridge (Upstream) water plastic 1 NONE G X X X X 12.25pm HWY 62-65 Bridge (Upstream) water plastic 1 NONE G X X X X 12.25pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X X 12.25pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X X Thirty water plastic 1 NONE G X X X X Thirty water plastic 1 NONE G X X X X Thirty water plastic 1 NONE G X X X X Thirty water plastic 1 NONE G X X X X Thirty water plastic 1 NONE G X X X X Thirty water plastic 1 NONE G X X X X Thirty water plastic 1 NONE G X X X X Thirty water plastic 1 NONE G X X X X Thirty water plastic 1 NONE G X X X X Thirty water plastic 1 NONE G X X X X Thirty water plastic 1 NONE G X X X X Thirty water plastic 1 NONE G X X X X Thirty water plastic 1 NONE G X X X X Thirty water plastic 1 NONE G X X X X Thirty water plastic 1 NONE G X X X X Thirty water plastic 1 NONE G X X X X Thirty water plastic 1 NONE G X X X X X Thirty water plastic 1 NONE G X X X X X X X X X X X Thirty water plastic 1 NONE G X X X X X X X X X X X X X X X X X X	Date	1		A 241.1	Timo	ALC		-	-	-				
12:35pm HWY 62-65 Bridge (Upstream) water plastic 1 NONE G X X X 12:35pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X X 12:35pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X X 12:35pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X X 12:35pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X X 12:35pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X X 12:35pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X X 12:35pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X X 12:35pm WWTP DISCHARGE POINT Water Plastic 1 NONE G X X X X 12:35pm WWTP DISCHARGE POINT Water Plastic 1 NONE G X X X X 12:35pm WWTP DISCHARGE POINT Water Plastic 1 NONE G X X X X 13:45pm WWTP DISCHARGE POINT Water Plastic 1 NONE G X X X X 14:45pm WWTP DISCHARGE POINT Water Plastic 1 NONE G X X X X 15:45pm WWTP DISCHARGE POINT Water Plastic 1 NONE G X X X X 16:45pm WWTP DISCHARGE POINT WATER Plastic 1 NONE G X X X X 16:45pm WWTP DISCHARGE POINT WATER PLASTIC 1 NONE G X X X X X X X X X X X X X X X X X X	12.35pm	9/24/2012	12:15pm			ads	3	ries	-	-	-				
12:35pm WWTP DISCHARGE POINT water plastic I NONE G X X X X 12:35pm WWTP DISCHARGE POINT water plastic I NONE G X X X X i: (1) Nitric Acid(NH03) (2) Hydrochloric Acid(HCL) incsulfate(Na25203) (4) Sodium Hydroxibe(Na33) quished By (Sign) Tim Holt/City of Harrison 9-24/2012/1:00pm Rec'd Date / Time: (4-) School Commune Commune	12:35pm					piastic	-	NONE			-				
12:35pm HWY 62-65 Bridge (Upstream) water plastic 1 NONE G X X X 12:35pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X X 12:35pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X X 13:35pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X X 15: (1) Nitric Acid(NH03) (2Hydrochloric Acid(HCL) client Remarks/Comments: 16: (1) Nitric Acid(NH03) (2Hydrochloric Acid(HCL) client Remarks/Comments: 16: (1) Nitric Acid(NH03) (2Hydroxhochloric Acid(HCL) client Remarks/Comments: 17: (1) Nitric Acid(NH03) (2Hydroxhochloric Acid(HCL) client Remarks/Comments: 18: (1) Nitric Acid(NH03) (2Hydroxhochloric Acid(HCL) client Remarks/Comments: 19: (2) Nitric Acid(NH03) (2Hydroxhochloric Acid(HCL) client Remarks/Comments: 10: (2) Nitric Acid(NH03) (2Hydroxhochloric Acid(HCL) client Remarks/Comments: 10: (3) Nitric Acid(NH03) (2Hydroxhochloric Acid(HCL) client Remarks/Comments: 10: (4) Nitric Acid(NH03) (2Hydroxhochloric Acid(HCL) client Remarks/Comments: 10: (5) Nitric Acid(NH03) (2Hydroxhochloric Acid(HCL) client Remarks/Comments: 10: (5) Nitric Acid(NH03) (2Hydroxhochloric Acid(HCL) client Remarks/Comments: 10: (6) Nitric Acid(NH03) (2Hydroxhochloric Acid(HCL) client Remarks/Comments: 10: (7) Nitric Acid(NH03) (2Hydroxhochloric Acid(HCL) client Remarks/Comments: 10: (7) Nitric Acid(NH03) (2Hydroxhochloric Acid(HCL) client Remarks/Comments: 10: (7) Nitric Acid(NH03) (2Hydroxhochloric Acid(HCL) client Remarks/Comments: 10: (1) Nitric Acid(HCL) client Remarks/Com	12.25pm								1	+	1	+			_
12.35pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X X (1) Nitric Acid(NH03) (2)Hydrochloric Acid(HCL) iniosulfate(Na2S203) (4) Sodium Hydroxide(Na03) quished By (Sign) Tim Holt/City of Harrison 9-24/2012/1:00pm Rec'd Date / Time: 9-24/2012/1:00pm	12:35pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X X iii (1) Niuric Acid(Ntru3) (2) Hydrochloric Acid(HCL) hisoulfate(Na25203) (4) Sodium Hydroxide(Nth03) quiched Ro. (Sign) Tim Holt/City of Harrison 9-24/2012/1:00pm Tim Holt/City of Harrison 9-24/2012/1:00pm Rec'd Date / Time: 9-24/2012/1:00pm Comments: 6-25	9/24/2012	12:25pm	HWY 62-65 Bridge (Upstream)		olastic	-	NONE	+	+	×				-
12.35pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X X 12.35pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X X 12.35pm WWTP DISCHARGE POINT 12. (1) Nitric Acid(NH03) (2)Hydrochloric Acid(HCL) 13. (1) Nitric Acid(NH03) (2)Hydrochloric Acid(HCL) 14. (1) Nitric Acid(NH03) (2)Hydrochloric Acid(HCL) 15. (1) Nitric Acid(NH03) (2)Hydrochloric Acid(HCL) 16. (1) Nitric Acid(NH03) (2)Hydrochloric Acid(HCL) 16. (1) Nitric Acid(NH03) (2)Hydrochloric Acid(HCL) 17. (1) Nitric Acid(NH03) (2)Hydrochloric Acid(HCL) 18. (1) Nitric Acid(HC	12:35pm WWTP DISCHARGE POINT water plastic 1 NONE G X X X									1					-
### (1) Nitric Acid(NH03) (2)Hydrochloric Acid(HCL) hissulfate(Na2S203) (4) Sodium Hydroxide(Na03) quishted By (Sign) Tim Holt/City of Harrison 9-24/2012/1:00pm Recid Date Time: 9-5	in (1) Nitric Acid(NH03) (2)Hydrochloric Acid(HCL) Sinit South Hydroxide(Na03) quirkheid By (Sign) Tim Holt/City of Harrison 9-24/2012/1:00pm Tim Holt/City of Harrison 9-24/2012/1:00pm Print Molty (1) Fee'd Date / Time: 4-5-7	9/24/2012	12:35pm	WWTP DISCHARGE POINT		lastic	-	NONE	-	\dashv	×				+
guished By (Sign) Tim Holt/City of Harrison Period Date / Time Rec'd Date / Time: 9-24/2012/1:00pm Communic	inosulfate(Nea25203) (4) Sodium Hydroxide(Na03) quishted By (Sign) Tim Holt/City of Harrison 9-24/2012/1:00pm (Sign) NEXT DAY AIR Comments: Comments:		gan.						+						+
ii. (1) Nitric Acid(NH03) (2)Hydrochloric Acid(HCL) quished By (Sign) Tim Holt/City of Harrison P-24/2012/1:00pm Rec'd Date / Time: 9-24/2012/1:00pm Communic	### Comments: Comments Comments Comments Comments Comments								+	-	1	-			\vdash
quished By (Sign) Tim Holt/City of Harrison P-24/2012/1:00pm Rec'd Date / Time: 9-24/2012/1:00pm Communic	### (1) Mitric Acid(Mrt03) (2) Hydrochloric Acid(MCL) Client Remarks/Comments: ###################################														4
Tim Holt/City of Harrison 9-24/2012/1:00pm (Sign)	quished By (Sign) Print Name / Company Date / Time Regenced By (Sign) 7: Figure 1 Frint Holt/City of Harrison 9-24/2012/1:00pm Comments: Comm	Sodium Thi	(1) Nitric, osulfate(Na	Acid(NH03) (2)Hydrochloric Acid(HCL)	Client Rem	arks/Cor	mments:								
Tim Holt/City of Harrison 9-24/2012/1:00pm (Signi)	Tim Holt/City of Harrison 9-24/2012/1:00pm (Signi)	Religing	uished B.	1	Company	122	•								
Nec'd Date / Time: 9-75 -17	UPS CED NEXT DAY AIR	The state of the s	Maril 1	Tim Holt/City	f Harriso	g	9-24/2	012/1:0	0pm	*	数	Wed By Gign		e / Comp	â
Rec'd Date / Time: 9-75 -1	UPS ICED NEXT DAY AIR		7	4		+									
	OLD INEXT DAY AIR	inned Via		7	Rec'd Date	Time:	7-75	1				Comments	10101		



"A Laboratory Management Partner

Memphis, Tennessee 38133

(901) 213-2400

10/16/2012

Harrison Wastewater Treatment Plant Ms. Kathryn Catlin PO Box 1715 Harrison, AR, 72601

Ref:

Analytical Testing

ETC Report Number: 12-283-0211

Client Project Description: Crooked Creek Sampling

Dear Ms. Kathryn Catlin:

Environmental Testing and Consulting, Inc. received sample(s) on 10/9/2012 for the analyses presented in the following report.

The above referenced project has been analyzed per your instructions. The analyses were performed in accordance with the applicable analytical method.

The analytical data has been validated using standard quality control measures performed as required by the analytical method. Quality Assurance, method validations, instrumentation maintenance and calibration for all parameters (NELAP and non-NELAP) were performed in accordance with guidelines established by the USEPA and NELAC unless otherwise indicated. Any parameter for which the laboratory is not officially NELAP accredited is indicated by a '~' symbol. These are not included in the scope because NELAP accreditation is either not available or has not been applied for. Additional certifications may be held/are available for parameters, where NELAP accreditation is not required or applicable. A full list of certifications is available upon request.

The results are shown on the attached Report of Analysis(s). Results for solid matrices are reported on an asreceived basis unless otherwise indicated. This report shall not be reproduced except in full and relates only to the samples included in this report.

Please do not hesitate to contact me or client services if you have any questions or need additional information.

Sincerely,

Randy Thomas

Rendell H. Thomas

Project Manager

Laboratory's liability in any claim relating to analyses performed shall be limited to, at laboratory's option, repeating the analysis in question at laboratory's expense, or the refund of the charges paid for performance of said analysis.

Kentucky UST #41

#9311



2790 Whitten Road

Memphis, Tennessee 38133

(901) 213-240

Fax (901) 213-2440

A Laboratory Management Partner

03322

Harrison Wastewater Treatment Plant

Ms. Kathryn Catlin

PO Box 1715

Harrison , AR 72601

Project

t Crooked Creek Sampling

Information:

Report Date: 10/16/2012

Report Number : 12-283-0211

REPORT OF ANALYSIS

Received: 10/9/2012

Lab No:

89148

Sample ID : Silver Valley Bridge (Downstream)

Matrix: Aqueous

Sampled: 10/8/2012 10:25

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Chloride	14.0	mg/L	0.400	1	10/10/12 18:31	RQE	EPA-300.0
Total Dissolved Solids	251	mg/L	10	1	10/12/12 14:20	NRT	2540C
Sulfate	14.0	mg/L	1.00	1	10/10/12 18:31	RQE	EPA-300.0

Lab No:

89149

Sample ID: Hwy 62-65 Bridge (Upstream)

Matrix: Aqueous

Sampled: 10/8/2012 10:15

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Chloride	7.68	mg/L	0.400	1	10/10/12 18:49	RQE	EPA-300.0
Total Dissolved Solids	227	mg/L	10	1	10/12/12 14:20	NRT	2540C
Sulfate	5.14	mg/L	1.00	1	10/10/12 18:49	RQE	EPA-300.0

Lab No:

89150

Sample ID: WWTP Discharge Point

Matrix: Aqueous

Sampled: 10/8/2012 10:35

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Chloride	59.3	mg/L	2.00	5	10/12/12 10:56	RQE	EPA-300.0
Total Dissolved Solids	438	mg/L	10	1	10/12/12 14:20	NRT	2540C
Sulfate	58.4	mg/L	5.00	5	10/12/12 10:56	RQE	EPA-300.0

Qualifiers/ Definitions

* MQL Outside QC limit

Method Quantitation Limit

DF





2790 Whitten Road

Memphis, Tennessee 38133

"A Laboratory Management Partner"

Fax (901) 213-2440

Cooler Receipt Form

Customer Number: 03322

Customer Name: Harrison Wastewater Treatment Plant

Report Number:

12-283-0211

Shipping Mathed

Shippin	ig wethod		
○ Fed Ex ● UPS ○ US Postal ○ Client	○ Lab	Ourier	Other:
Shipping container/cooler uncompromised?	Yes	○ No	
Custody seals intact on shipping container/cooler?	O Yes	○ No	Not Required
Custody seals intact on sample bottles?	O Yes	○ No	Not Required
Chain of Custody (COC) present?	Yes	○ No	
COC agrees with sample label(s)?	Yes	○ No	
COC properly completed	Yes	○ No	
Samples in proper containers?	Yes	○ No	
Sample containers intact?	Yes	○ No	
Sufficient sample volume for indicated test(s)?	Yes	○ No	-
All samples received within holding time?	Yes	○ No	
Cooler temperature in compliance?	Yes	○ No	
Cooler/Samples arrived at the laboratory on ice. Samples were considered acceptable as cooling process had begun.	Yes	○ No	
Water - Sample containers properly preserved	Yes	○ No	○ N/A
Water - VOA vials free of headspace	O Yes	○ No	● N/A
Trip Blanks received with VOAs	O Yes	○ No	N/A
Soil VOA method 5035 – compliance criteria met	O Yes	○ No	● N/A
High concentration container (48 hr)	Low	concentration EnCo	ore samplers (48 hr)
High concentration pre-weighed (methanol -14 of	d) Low	conc pre-weighed v	vials (Sod Bis -14 d)
Special precautions or instructions included?	O Yes	No	
Comments:			

Signature: Rebekah Ross

Date & Time: 10/09/2012 09:47:33

City Of Harrison

1508 Silver Valley Road Harriozn. AR 72601 hwwtp2@windstream.net 870-741-426 870-741-426 870-741-426 Randy Reese Randy Reese Randy Reese Silver Valley Bridge (Downstream) Water 15a.m HWY 62-65 Bridge (Upstream) water (1) Nitric Acid(NH03) (2)Hydrochloric Acid(HCL) suffate(Na25202) (4) Sodium Hydroxide(Na03) isshead By (Signt) Randy Reese Randy Reese(City of H		S. 1. S. S.	Steen of Hammies	-	ā	Project Number	lumber		4	Analysis		Ramson Washwaren Cooled Creek Samolina	тойна		
Harriora, AR 72601	Cirent	7) 4	Og Silver Valley R	ngo gad							,		-	-	_
Part	Address	H	arriosn. AR 72601			8.4									
STOCATAL-1426 STOCATAL-1426 STOCATAL-1426 STOCATAL-1426 STOCATAL-1426 STOCATAL-1426 STOCATAL-1426 STOCATAL-1422 STOCATAL-1426 STOCATAL-142	email address	E	wwtp2@windstree	amanet		=				то					
Sample Received Purchase Order # 10.00	Phone No.	60	70-741-4426		き				i in	ΓAL					
CROOKED CREEK SAMPLING	FAX No.	60	70-741-5022		Purchase	Order #			(G)	DIS					
Monthly Ousrierly Semi-Annual Matrix Types No. Press. Pr	Project:	C	ROOKED CREEK	SAMPLING					rab	SOL					
Monthly Quarterly Semi-Annual Mistrix Type No. Press	Project Manage		andy Reese						-	.VEI	C1				
Monthly Quarterly Semi-Annual Matrix Type No. Pres. Sample Jeditification Matrix Type No. Pres. Jed.	Type of Event:					***************************************			-	D S	HLC				
Time Sample Identification Metrit Type No. Pres.	Single Daily		Monthly Quarter	ly Semi-Annual				-	-	OLL	ORI				
water plastic 1 NONE G X X X water plastic 1 NONE G X X X X water plastic 1 NONE G X X X X Cilent Remarks/Comments: City of Harrison 10-8-2012/10:45 a.m Comments: Co	20000	Time	Sample	Identification		Туре	Mo	1000		טט	DE	1	1		
water plastic 1 NONE G X X X water plastic 1 NONE G X X X Cilent Remarks/Comments: City of Harrison 10-8-2012/10:45 a.m City of Harrison 10-8-2012/10:45 a.m Comments:	0	0:25а.ш	Silver Valley B	ridge (Downstream)		plastic	-	NONE	-	_	×	-	+		
water plastic 1 NONE G X X X water plastic 1 NONE G X X X Client Remarks/Comments: City of Harrison 10-8-2012/10:45 a.m City of Harrison 10-8-2012/10:45 a.m Comments:		1				30.25							. Promis		
water plastic 1 NONE G X X X Client Remarks/Comments: City of Harrison 10-8-2012/10:45 a.m City of Harrison 10-8-2012/10:45 a.m		0:15a.m	HWY 62-65	Bridge (Upstream)		plastic	-	NONE		\vdash	×				
City of Harrison 10-8-2012/10:45 a.m						100			+	_					
City of Harrison 10-8-2012/10:45 a.m		;	on dame	CHABGE POINT	-	plastic	-	NONE	-		×				
City of Harrison 10-8-2012/10:45 a.m	T	U;35a.m	WWIT DIS	Chronic Can											
City of Harrison 10-8-2012/10:45 a.m							0								
City of Harrison 10-8-2012/10:45 a.m (Comments:															
City of Harrison 10-8-2012/10:45 a.m										-			1	1	
City of Harrison 10-8-2012/10:45 a.m (Comments:										_					
/City of Harrison 10-8-2012/10:45 a.m (City of Harrison 10-8-2012/10:45 a.m (Comments:	Preservatives:	(1) Nitric	Acid(NH03) (2)Hyo	Irochloric Acid(HCL) Hydroxide(Na03)	Cilent R	emarks/C	omments								
Randy Reese/City of Harrison 10-8-2012/10:45 a.m	(s) section interest	Missing P	Sv (Sign)	Print Name /	Compan		1	ate Tr	ne		Rec	rived By (S	ign)	2	Yame / Co.
Rock'd Date (Time:	Kindle	John So		Randy Reese/Cit	y of Han	Tison	10-8-2	012/10	:45 a.r	u	Y			-	
Roc'd Date (Time:	A CONTRACT	N N N N N N N N N N N N N N N N N N N								7	X	9,	٧		いるの
Roc'd Date / Time:										-					
	Rec'd at Lab By:	1.			Rec'd D	ate / Time						Commer	IS:		



"A Laboratory Management Partner"

2790 Whitten Road

Memphis, Tennessee 38133

(901) 213-2400

10/31/2012

Harrison Wastewater Treatment Plant Ms. Kathryn Catlin PO Box 1715 Harrison, AR, 72601

Ref:

Analytical Testing

ETC Report Number: 12-297-0221

Client Project Description: Crooked Creek Sampling

Dear Ms. Kathryn Catlin:

Environmental Testing and Consulting, Inc. received sample(s) on 10/23/2012 for the analyses presented in the following report.

The above referenced project has been analyzed per your instructions. The analyses were performed in accordance with the applicable analytical method.

The analytical data has been validated using standard quality control measures performed as required by the analytical method. Quality Assurance, method validations, instrumentation maintenance and calibration for all parameters (NELAP and non-NELAP) were performed in accordance with guidelines established by the USEPA and NELAC unless otherwise indicated. Any parameter for which the laboratory is not officially NELAP accredited is indicated by a '~' symbol. These are not included in the scope because NELAP accreditation is either not available or has not been applied for. Additional certifications may be held/are available for parameters, where NELAP accreditation is not required or applicable. A full list of certifications is available upon request.

The results are shown on the attached Report of Analysis(s). Results for solid matrices are reported on an asreceived basis unless otherwise indicated. This report shall not be reproduced except in full and relates only to the samples included in this report.

Please do not hesitate to contact me or client services if you have any questions or need additional information.

Sincerely,

Randy Thomas

Project Manager

Rendell H. Thomas

Laboratory's liability in any claim relating to analyses performed shall be limited to, at laboratory's option, repeating the analysis in question at laboratory's expense, or the refund of the charges paid for performance of said analysis.



2790 Whitten Road

Memphis, Tennessee 38133

(901) 213-2400

Fax (901) 213-2440

A Laboratory Management Partner

03322

Harrison Wastewater Treatment Plant

Ms. Kathryn Catlin

PO Box 1715 Harrison , AR 72601 Project

Crooked Creek Sampling

Information:

Report Date: 10/31/2012

Report Number : 12-297-0221

REPORT OF ANALYSIS

Received: 10/23/2012

Lab No:

91592

Sample ID: Silver Valley Bridge (Downstream)

Matrix: Aqueous

Sampled: 10/22/2012 9:30

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Chloride	13.0	mg/L	0.400	1	10/24/12 18:34	RQE	EPA-300.0
Total Dissolved Solids	219	mg/L	10	1	10/29/12 10:15	NRT	2540C
Sulfate	9.12	mg/L	1.00	1	10/30/12 16:58	RQE	EPA-300.0

Lab No:

91593

Sample ID: Hwy 62/65 Bridge (Upstream)

Matrix: Aqueous

Sampled: 10/22/2012 9:20

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Chloride	7.31	mg/L	0.400	1	10/24/12 18:51	RQE	EPA-300.0
Total Dissolved Solids	205	mg/L	10	1	10/29/12 10:15	NRT	2540C
Sulfate	4.97	mg/L	1.00	1	10/30/12 16:40	RQE	EPA-300.0

Lab No:

91594

Sample ID: WWTP Discharge Point

Matrix: Aqueous

Sampled: 10/22/2012 9:10

				Date / Time Analyzed	Ву	Analytical Method
55.5	mg/L	4.00	10	10/23/12 15:53	RQE	EPA-300.0
22.5	mg/L	1.00	10	10/23/12 15:53	RQE	EPA-300.0
0.142	mg/L	0.100	1	10/23/12 15:35	RQE	EPA-300.0
22.6	mg/L	0.100	1	10/23/12 15:35		EPA-300.0
324	mg/L	10	1	10/29/12 10:15	NRT	2540C
41.4	mg/L	1.00	1	10/23/12 15:35	RQE	EPA-300.0
	22.5 0.142 22.6 324	22.5 mg/L 0.142 mg/L 22.6 mg/L 324 mg/L	22.5 mg/L 1.00 0.142 mg/L 0.100 22.6 mg/L 0.100 324 mg/L 10	22.5 mg/L 1.00 10 0.142 mg/L 0.100 1 22.6 mg/L 0.100 1 324 mg/L 10 1	22.5 mg/L 1.00 10 10/23/12 15:53 0.142 mg/L 0.100 1 10/23/12 15:35 22.6 mg/L 0.100 1 10/23/12 15:35 324 mg/L 10 1 10/29/12 10:15	22.5 mg/L 1.00 10 10/23/12 15:53 RQE 0.142 mg/L 0.100 1 10/23/12 15:35 RQE 22.6 mg/L 0.100 1 10/23/12 15:35 324 mg/L 10 1 10/29/12 10:15 NRT

Qualifiers/ Definitions

* MQL Outside QC limit

I Met

Method Quantitation Limit

DF



2790 Whitten Road

Memphis, Tennessee 38133

(901) 213-2400

Fax (901) 213-2440

"A Laboratory Management Partner"

Cooler Receipt Form

Custody seals intact on shipping container/cooler? Yes No Not Require Custody seals intact on sample bottles? Yes No Not Require Chain of Custody (COC) present? Yes No COC agrees with sample label(s)? Yes No COC properly completed Yes No Samples in proper containers? Yes No Sample containers intact? Yes No Sufficient sample volume for indicated test(s)? Yes No	Report Number: 12-297-0221	na Method		
Shipping container/cooler uncompromised? Custody seals intact on shipping container/cooler? Yes No Not Require Custody seals intact on sample bottles? Yes No Not Require Chain of Custody (COC) present? Yes No COC agrees with sample label(s)? Yes No COC properly completed Yes No Samples in proper containers? Yes No Sufficient sample volume for indicated test(s)? All samples received within holding time? Yes No Cooler/Samples arrived at the laboratory on ice. Samples were considered acceptable as cooling process had begun. Water - VOA vials free of headspace Yes No No No No No No No No No N				
Custody seals intact on shipping container/cooler? Yes No Not Require Custody seals intact on sample bottles? Yes No Not Require Chain of Custody (COC) present? Yes No COC agrees with sample label(s)? Yes No COC properly completed Yes No Samples in proper containers? Yes No Sample containers intact? Yes No Sufficient sample volume for indicated test(s)? Yes No All samples received within holding time? Yes No Cooler temperature in compliance? Yes No Cooler/Samples arrived at the laboratory on ice. Samples were considered acceptable as cooling process had begun. Water - Sample containers properly preserved Yes No No N/A Water - VOA vials free of headspace Yes No No Soil VOA method 5035 – compliance criteria met Yes No N/A High concentration container (48 hr) Low concentration EnCore samplers (48 hr) High concentration pre-weighed (methanol -14 d) Special precautions or instructions included? Yes No	Fed Ex UPS US Posta Client	Lab	Ourier Courier	Other:
Custody seals intact on sample bottles? Chain of Custody (COC) present? Yes No COC agrees with sample label(s)? Yes No COC properly completed Yes No Samples in proper containers? Yes No Sample containers intact? Yes No Sufficient sample volume for indicated test(s)? All samples received within holding time? Yes No Cooler temperature in compliance? Yes No Cooler/Samples arrived at the laboratory on ice. Samples were considered acceptable as cooling process had begun. Water - Sample containers properly preserved Yes No No No N/A Water - VOA vials free of headspace Yes No No N/A Trip Blanks received with VOAs Soil VOA method 5035 – compliance criteria met High concentration container (48 hr) Low concentration EnCore samplers (48 hr) High concentration or instructions included? Yes No No Soil Voa method 5035 – compliance criteria met Yes No No N/A Low concentration EnCore samplers (48 hr) Low conc pre-weighed vials (Sod Bis -14 d) Special precautions or instructions included? Yes No	Shipping container/cooler uncompromised?	Yes	○ No	
Chain of Custody (COC) present? OCC agrees with sample label(s)? OCC properly completed Yes No Samples in proper containers? Yes No Sample containers intact? Yes No Sufficient sample volume for indicated test(s)? All samples received within holding time? OCOI temperature in compliance? Yes No Cooler temperature in compliance? Yes No Cooler/Samples arrived at the laboratory on ice. Samples were considered acceptable as cooling process had begun. Water - Sample containers properly preserved Yes No No N/A Water - VOA vials free of headspace Yes No N/A Trip Blanks received with VOAs Soil VOA method 5035 – compliance criteria met Yes No No N/A Low concentration EnCore samplers (48 hr) High concentration pre-weighed (methanol -14 d) Special precautions or instructions included? Yes No	Custody seals intact on shipping container/cooler?	O Yes	○ No	Not Required
COC agrees with sample label(s)? Yes No Samples in proper containers? Yes No Sample containers intact? Yes No Sufficient sample volume for indicated test(s)? All samples received within holding time? Cooler temperature in compliance? Yes No Cooler/Samples arrived at the laboratory on ice. Samples were considered acceptable as cooling process had begun. Water - Sample containers properly preserved Yes No	Custody seals intact on sample bottles?	O Yes	○ No	Not Required
COC properly completed Yes No Samples in proper containers? Yes No Sample containers intact? Yes No Sufficient sample volume for indicated test(s)? All samples received within holding time? Yes No Cooler temperature in compliance? Yes No Cooler/Samples arrived at the laboratory on ice. Samples were considered acceptable as cooling process had begun. Water - Sample containers properly preserved Yes No No N/A Water - VOA vials free of headspace Yes No No N/A Trip Blanks received with VOAs Yes No N/A Soil VOA method 5035 – compliance criteria met Yes No N/A High concentration container (48 hr) High concentration pre-weighed (methanol -14 d) Special precautions or instructions included? Yes No No N/A Low conc pre-weighed vials (Sod Bis -14 d) Special precautions or instructions included?	Chain of Custody (COC) present?	Yes	○ No	
Samples in proper containers? Yes No Sample containers intact? Yes No Sufficient sample volume for indicated test(s)? All samples received within holding time? Yes No Cooler temperature in compliance? Yes No Cooler/Samples arrived at the laboratory on ice. Samples were considered acceptable as cooling process had begun. Water - Sample containers properly preserved Yes No No N/A Water - VOA vials free of headspace Yes No N/A Trip Blanks received with VOAs Soil VOA method 5035 – compliance criteria met Yes No N/A High concentration container (48 hr) High concentration pre-weighed (methanol -14 d) Special precautions or instructions included? Yes No No NO N/A Low conceptration EnCore samplers (48 hr) Low conc pre-weighed vials (Sod Bis -14 d) Special precautions or instructions included? Yes No	COC agrees with sample label(s)?	Yes	○ No	
Sample containers intact? Yes No Sufficient sample volume for indicated test(s)? Yes No All samples received within holding time? Yes No Cooler temperature in compliance? Yes No Cooler/Samples arrived at the laboratory on ice. Samples were considered acceptable as cooling process had begun. Water - Sample containers properly preserved Yes No N/A Water - VOA vials free of headspace Yes No N/A Trip Blanks received with VOAs Yes No N/A Soil VOA method 5035 – compliance criteria met Yes No N/A High concentration container (48 hr) Low concentration EnCore samplers (48 hr) High concentration pre-weighed (methanol -14 d) Low conc pre-weighed vials (Sod Bis -14 d) Special precautions or instructions included? Yes No	COC properly completed	Yes	○ No	
Sufficient sample volume for indicated test(s)? All samples received within holding time? Yes No Cooler temperature in compliance? Yes No Cooler/Samples arrived at the laboratory on ice. Samples were considered acceptable as cooling process had begun. Water - Sample containers properly preserved Yes No No N/A Water - VOA vials free of headspace Yes No N/A Trip Blanks received with VOAs Yes No N/A Soil VOA method 5035 – compliance criteria met Yes No N/A High concentration container (48 hr) High concentration pre-weighed (methanol -14 d) Special precautions or instructions included? Yes No	Samples in proper containers?	Yes	○ No	
All samples received within holding time? Yes No Cooler temperature in compliance? Yes No Cooler/Samples arrived at the laboratory on ice. Samples were considered acceptable as cooling process had begun. Water - Sample containers properly preserved Yes No N/A Water - VOA vials free of headspace Yes No N/A Trip Blanks received with VOAs Yes No N/A Soil VOA method 5035 – compliance criteria met Yes No N/A High concentration container (48 hr) High concentration pre-weighed (methanol -14 d) Special precautions or instructions included? Yes No	Sample containers intact?	Yes	○ No	
Cooler temperature in compliance? Cooler/Samples arrived at the laboratory on ice. Samples were considered acceptable as cooling process had begun. Water - Sample containers properly preserved Yes No N/A Water - VOA vials free of headspace Yes No N/A Trip Blanks received with VOAs Soil VOA method 5035 – compliance criteria met Yes No N/A Low concentration EnCore samplers (48 hr) High concentration pre-weighed (methanol -14 d) Special precautions or instructions included? Yes No	Sufficient sample volume for indicated test(s)?	Yes	○ No	
Cooler/Samples arrived at the laboratory on ice. Samples were considered acceptable as cooling process had begun. Water - Sample containers properly preserved Yes No N/A Water - VOA vials free of headspace Yes No N/A Trip Blanks received with VOAs Yes No N/A Soil VOA method 5035 – compliance criteria met Yes No N/A High concentration container (48 hr) Low concentration EnCore samplers (48 hr) High concentration pre-weighed (methanol -14 d) Low conc pre-weighed vials (Sod Bis -14 d) Special precautions or instructions included? Yes No	All samples received within holding time?	Yes	○ No	
Samples were considered acceptable as cooling process had begun. Water - Sample containers properly preserved Yes No N/A Water - VOA vials free of headspace Yes No N/A Trip Blanks received with VOAs Yes No N/A Soil VOA method 5035 – compliance criteria met Yes No N/A High concentration container (48 hr) Low concentration EnCore samplers (48 hr) High concentration pre-weighed (methanol -14 d) Low conc pre-weighed vials (Sod Bis -14 d) Special precautions or instructions included? Yes No	Cooler temperature in compliance?	Yes	○ No	
Water - VOA vials free of headspace Yes No N/A Trip Blanks received with VOAs Soil VOA method 5035 – compliance criteria met Yes No N/A High concentration container (48 hr) High concentration pre-weighed (methanol -14 d) Special precautions or instructions included? Yes No N/A Low concentration EnCore samplers (48 hr) Low conc pre-weighed vials (Sod Bis -14 d) Special precautions or instructions included? Yes No	Samples were considered acceptable as cooling	Yes	○ No	
Trip Blanks received with VOAs Yes No N/A Soil VOA method 5035 – compliance criteria met Yes No N/A High concentration container (48 hr) High concentration pre-weighed (methanol -14 d) Special precautions or instructions included? Yes No N/A Low concentration EnCore samplers (48 hr) Low conc pre-weighed vials (Sod Bis -14 d) Special precautions or instructions included? Yes No	Water - Sample containers properly preserved	Yes	○ No	○ N/A
Soil VOA method 5035 – compliance criteria met Yes No N/A High concentration container (48 hr) Low concentration EnCore samplers (48 hr) High concentration pre-weighed (methanol -14 d) Special precautions or instructions included? Yes No	Water - VOA vials free of headspace	O Yes	○ No	N/A
High concentration container (48 hr) High concentration pre-weighed (methanol -14 d) Special precautions or instructions included? Low concentration EnCore samplers (48 hr) Low conc pre-weighed vials (Sod Bis -14 d) Yes No	Trip Blanks received with VOAs	O Yes	○ No	N/A
High concentration pre-weighed (methanol -14 d) Low conc pre-weighed vials (Sod Bis -14 d) Special precautions or instructions included? Yes No	Soil VOA method 5035 – compliance criteria met	O Yes	○ No	N/A
Special precautions or instructions included? Yes No	High concentration container (48 hr)	Low	concentration EnC	ore samplers (48 hr)
	High concentration pre-weighed (methanol -14	d) Low	conc pre-weighed	vials (Sod Bis -14 d)
Comments:	Special precautions or instructions included?	O Yes	No	
	Comments:		, 1004110	

Any regulatory non-compliance issues will be recorded on non-compliance report.

Signature: Brooke Shoup

Date & Time: 10/23/2012 10:44:56

CO
rris
Ta
Ö
City

Citz	/ Of	City Of Harrison	I	Chroliert Creek Samilina	valer Treat	Effeatment Plant		Comment them	12-297-0221 93522 2012-10-23 10-44 39		Shain	ot (Chain of Custody	>
Client		City of Harrison		2000	numer v						sted			(1 mm) (1 mm) (2 mm) (3 mm) (4 mm) (4 mm)
		1508 Silver Valley Road				100				*******	-			
		Harriosn, AR 72601												
email address	93	hwwtp2@windstream.net		1111	17 14 14 14 14 14 14 14 14 14 14 14 14 14	11.5 2 21.11		TO	,					
Phone No.		870-741-4426	曹					TAI						
FAX No.		870-741-5022	Purcha	Purchase Order#	**		((. DI						- Contract
Project:		CROOKED CREEK SAMPLING		*****			i)rab	SSO				engel to get the sea		******
Project Manager	ager	Tim Holt					or (LVI	(····		***************************************
Type of Event	¥							-	THL					
Single Daily	Section Control	Monthly Quarterly Semi-Annual						LFA	OR					
Bate	Firme	Sample Identification	Matrix	Type	No.	Pres		-	IDE					
10/22/2012	9:30 AM	_	water	plastic	-	NONE		×	×					
								H						
								-						
10/22/2012	9:20 AM	HWY 62-65 Bridge (Upstream)	water	plastic		NONE	ပ	×	×					
												35		
							, A							
10/22/2012	9:10 AM	WWTP DISCHARGE POINT	water	plastic	-	NONE	Ð	XX	×			t		
	1					-			AL PARTICION AND ADDRESS OF THE PARTICIPATION AND ADDRESS OF THE P		3		اراج	-11
								-					B ₁ S ₁	
								20	_		The state of the s			
								2)						
Preservative	biosulfated	Preservatives: (1) Nitric Acid(NH03) (2)Hydrochloric Acid(HCL)	Client F	Client Remarks/Comments	omment	12								
Relli	uquished	Relinquished By (Sign) Print Name / Campany	Compan	â	7	Date / Time	24	A222100	*	eceived	Received By (Sign)		Print Name / Company	yany
Har	Willer	Ban			11-55-01		9:50 AM	5						
1								+						
de l'action de		一 一 二 二 二 二 二 二 二 二 二 二 二 二 二	Dan'al	David Dave (Time:		11-11		-8	(Commonde.			
Chimad Va	4	CEC ONEXT DAY AIR	Met is I.	alle / Tame	2	7			B					
Sumbea va	CLO	ICED CHEAT DATE AIM										-		



"A Laboratory Management Partner

2790 Whitten Road

Memphis, Tennessee 38133

(901) 213-2400

11/13/2012

Harrison Wastewater Treatment Plant Ms. Kathryn Catlin PO Box 1715 Harrison, AR, 72601

Ref:

Analytical Testing

ETC Report Number: 12-311-0214

Client Project Description: Crooked Creek Sampling

Dear Ms. Kathryn Catlin:

Environmental Testing and Consulting, Inc. received sample(s) on 11/6/2012 for the analyses presented in the following report.

The above referenced project has been analyzed per your instructions. The analyses were performed in accordance with the applicable analytical method.

The analytical data has been validated using standard quality control measures performed as required by the analytical method. Quality Assurance, method validations, instrumentation maintenance and calibration for all parameters (NELAP and non-NELAP) were performed in accordance with guidelines established by the USEPA and NELAC unless otherwise indicated. Any parameter for which the laboratory is not officially NELAP accredited is indicated by a '~' symbol. These are not included in the scope because NELAP accreditation is either not available or has not been applied for. Additional certifications may be held/are available for parameters, where NELAP accreditation is not required or applicable. A full list of certifications is available upon request.

The results are shown on the attached Report of Analysis(s). Results for solid matrices are reported on an asreceived basis unless otherwise indicated. This report shall not be reproduced except in full and relates only to the samples included in this report.

Please do not hesitate to contact me or client services if you have any questions or need additional information.

Sincerely,

Randy Thomas Project Manager

Rendell H. Thomas

Laboratory's liability in any claim relating to analyses performed shall be limited to, at laboratory's option, repeating the analysis in question at laboratory's expense, or the refund of the charges paid for performance of said analysis.



2790 Whitten Road

Memphis, Tennessee 38133

(901) 213-2400

Fax (901) 213-2440

A Laboratory Management Partner

03322

Harrison Wastewater Treatment Plant

Ms. Kathryn Catlin

PO Box 1715 Harrison, AR 72601

Project

Crooked Creek Sampling

Information:

Report Date: 11/13/2012

Report Number: 12-311-0214

REPORT OF ANALYSIS

Received: 11/6/2012

Lab No:

93872

Sample ID: Silver Valley Bridge (Downstream)

Matrix: Aqueous

Sampled: 11/5/2012 8:15

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Chloride	11.3	mg/L	0.400	1	11/06/12 13:08	RQE	EPA-300.0
Total Dissolved Solids	213	mg/L	10	1	11/08/12 08:00	NRT	2540C
Sulfate	9.47	mg/L	1.00	1	11/06/12 13:08	RQE	EPA-300.0

Lab No:

93873

Sample ID: Hwy 62/65 Bridge (Upstream)

Matrix: Aqueous

Sampled: 11/5/2012 8:25

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Chloride	7.04	mg/L	0.400	1	11/06/12 13:25	RQE	EPA-300.0
Total Dissolved Solids	208	mg/L	10	1	11/08/12 08:00	NRT	2540C
Sulfate	5.13	mg/L	1.00	1	11/06/12 13:25	RQE	EPA-300.0

Lab No:

93874

Sample ID: WWTP Discharge Point

Matrix: Aqueous

Sampled: 11/5/2012 8:35

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Chloride	61.0	mg/L	4.00	10	11/08/12 10:49	RQE	EPA-300.0
Nitrate (NO3-N)	20.7	mg/L	1.00	10	11/08/12 10:49	RQE	EPA-300.0
Nitrite (NO2-N)	<0.100	mg/L	0.100	1	11/06/12 11:23	RQE	EPA-300.0
Nitrate+Nitrite-N	20.7	mg/L	0.100	1	11/06/12 11:23		EPA-300.0
Total Dissolved Solids	352	mg/L	10	1	11/08/12 08:00	NRT	2540C
Sulfate	56.6	mg/L	10.0	10	11/08/12 10:49	RQE	EPA-300.0

Qualifiers/ **Definitions**

Outside QC limit

MQL

Method Quantitation Limit

DF



2790 Whitten Road

Memphis, Tennessee 38133

(901) 213-2400

Fax (901) 213-244

A Laboratory Management Partner

Cooler Receipt Form

Shipping container/cooler uncompromised? Custody seals intact on shipping container/cooler? Yes No Not Required Custody seals intact on sample bottles? Chain of Custody (COC) present? Chain of Custody (COC) present? Yes No COC agrees with sample label(s)? Yes No COC properly completed Yes No Samples in proper containers? Yes No Sufficient sample volume for indicated test(s)? All samples received within holding time? Yes No Cooler temperature in compliance? Yes No Cooler/Samples arrived at the laboratory on ice. Samples were considered acceptable as cooling process had begun.	-	ng Method		O
Custody seals intact on shipping container/cooler? Yes No Not Required Custody seals intact on sample bottles? Yes No Not Required Chain of Custody (COC) present? Yes No COC agrees with sample label(s)? Yes No COC properly completed Yes No Samples in proper containers? Yes No Samples in proper containers? Yes No Sample containers intact? Yes No Sufficient sample volume for indicated test(s)? Yes No Cooler temperature in compliance? Yes No Cooler temperature in compliance? Yes No Samples were considered acceptable as cooling process had begun. Water - Sample containers properly preserved Yes No No N/A Water - VOA vials free of headspace Yes No No N/A Soil VOA method 5035 – compliance criteria met Yes No N/A High concentration container (48 hr) Low concentration EnCore samplers (48 hr) High concentration pre-weighed (methanol -14 d) Low conc pre-weighed vials (Sod Bis -14 d) Special precautions or instructions included?	Fed Ex UPS US Postal Clien	t () Lab	Courier (Other:
Custody seals intact on sample bottles? Chain of Custody (COC) present? COC agrees with sample label(s)? COC properly completed Yes No COC properly completed Yes No Samples in proper containers? Yes No Sample containers intact? Yes No Sufficient sample volume for indicated test(s)? All samples received within holding time? Yes No Cooler temperature in compliance? Yes No Cooler/Samples arrived at the laboratory on ice. Samples were considered acceptable as cooling process had begun. Water - Sample containers properly preserved Yes No No N/A Water - VOA vials free of headspace Yes No N/A Trip Blanks received with VOAs Soil VOA method 5035 – compliance criteria met Yes No No N/A High concentration container (48 hr) Low concentration EnCore samplers (48 hr) High concentration pre-weighed (methanol -14 d) Special precautions or instructions included? Yes No No No No No No No No No N	Shipping container/cooler uncompromised?	Yes	○ No	
Chain of Custody (COC) present? Yes No COC agrees with sample label(s)? Yes No COC properly completed Yes No Samples in proper containers? Yes No Sample containers intact? Yes No Sufficient sample volume for indicated test(s)? All samples received within holding time? Yes No Cooler/Samples arrived at the laboratory on ice. Samples were considered acceptable as cooling process had begun. Water - Sample containers properly preserved Yes No Water - VOA vials free of headspace Yes No No No NA Trip Blanks received with VOAs Yes No No N/A High concentration container (48 hr) High concentration pre-weighed (methanol -14 d) Special precautions or instructions included? Yes No No No No No No No No N/A Low conc pre-weighed vials (Sod Bis -14 d) Special precautions or instructions included?	Custody seals intact on shipping container/cooler?	Yes	○ No	Not Required
COC agrees with sample label(s)? COC properly completed Yes No Samples in proper containers? Yes No Sample containers intact? Yes No Sufficient sample volume for indicated test(s)? All samples received within holding time? Yes No Cooler temperature in compliance? Yes No Cooler/Samples arrived at the laboratory on ice. Samples were considered acceptable as cooling process had begun. Water - Sample containers properly preserved Yes No No No N/A Water - VOA vials free of headspace Yes No No N/A Trip Blanks received with VOAs Yes No No N/A Soil VOA method 5035 – compliance criteria met Yes No No N/A High concentration container (48 hr) High concentration pre-weighed (methanol -14 d) Special precautions or instructions included? Yes No	Custody seals intact on sample bottles?	O Yes	○ No	Not Required
COC properly completed Yes No Samples in proper containers? Yes No Sufficient sample volume for indicated test(s)? All samples received within holding time? Cooler temperature in compliance? Yes No Cooler/Samples arrived at the laboratory on ice. Samples were considered acceptable as cooling process had begun. Water - Sample containers properly preserved Yes No No N/A Water - VOA vials free of headspace Yes No N/A Trip Blanks received with VOAs Soil VOA method 5035 – compliance criteria met High concentration container (48 hr) High concentration pre-weighed (methanol -14 d) Special precautions or instructions included? Yes No No No No No No No No No N	Chain of Custody (COC) present?	Yes	○ No	
Samples in proper containers? Yes No Sample containers intact? Yes No Sufficient sample volume for indicated test(s)? All samples received within holding time? Yes No Cooler temperature in compliance? Yes No Cooler/Samples arrived at the laboratory on ice. Samples were considered acceptable as cooling process had begun. Water - Sample containers properly preserved Yes No No N/A Water - VOA vials free of headspace Yes No N/A Trip Blanks received with VOAs Yes No N/A Soil VOA method 5035 – compliance criteria met Yes No N/A High concentration container (48 hr) Low concentration EnCore samplers (48 hr) High concentration pre-weighed (methanol -14 d) Special precautions or instructions included? Yes No	COC agrees with sample label(s)?	Yes	○ No	
Sample containers intact? Sufficient sample volume for indicated test(s)? All samples received within holding time? Yes No Cooler temperature in compliance? Yes No Cooler/Samples arrived at the laboratory on ice. Samples were considered acceptable as cooling process had begun. Water - Sample containers properly preserved Yes No No N/A Water - VOA vials free of headspace Yes No N/A Trip Blanks received with VOAs Soil VOA method 5035 – compliance criteria met Yes No N/A High concentration container (48 hr) High concentration pre-weighed (methanol -14 d) Special precautions or instructions included? Yes No No No No No N/A Low concentration EnCore samplers (48 hr) Low conc pre-weighed vials (Sod Bis -14 d)	COC properly completed	Yes	○ No	
Sufficient sample volume for indicated test(s)? All samples received within holding time? Yes No Cooler temperature in compliance? Yes No Cooler/Samples arrived at the laboratory on ice. Samples were considered acceptable as cooling process had begun. Water - Sample containers properly preserved Yes No No N/A Water - VOA vials free of headspace Yes No N/A Trip Blanks received with VOAs Yes No N/A Soil VOA method 5035 – compliance criteria met Yes No N/A High concentration container (48 hr) Low concentration EnCore samplers (48 hr) High concentration pre-weighed (methanol -14 d) Special precautions or instructions included? Yes No	Samples in proper containers?	Yes	○ No	
All samples received within holding time? Yes No Cooler temperature in compliance? Yes No Cooler/Samples arrived at the laboratory on ice. Samples were considered acceptable as cooling process had begun. Water - Sample containers properly preserved Yes No N/A Water - VOA vials free of headspace Yes No N/A Trip Blanks received with VOAs Yes No N/A Soil VOA method 5035 – compliance criteria met Yes No N/A High concentration container (48 hr) High concentration pre-weighed (methanol -14 d) Special precautions or instructions included? Yes No No No N/A Low conc pre-weighed vials (Sod Bis -14 d)	Sample containers intact?	Yes	○ No	
Cooler temperature in compliance? Cooler/Samples arrived at the laboratory on ice. Samples were considered acceptable as cooling process had begun. Water - Sample containers properly preserved Water - VOA vials free of headspace Yes No N/A Trip Blanks received with VOAs Soil VOA method 5035 – compliance criteria met High concentration container (48 hr) High concentration pre-weighed (methanol -14 d) Special precautions or instructions included? Yes No No No N/A Low concentration EnCore samplers (48 hr) Low conc pre-weighed vials (Sod Bis -14 d)	Sufficient sample volume for indicated test(s)?	Yes	○ No	
Cooler/Samples arrived at the laboratory on ice. Samples were considered acceptable as cooling process had begun. Water - Sample containers properly preserved Yes No N/A Water - VOA vials free of headspace Yes No N/A Trip Blanks received with VOAs Yes No N/A Soil VOA method 5035 – compliance criteria met Yes No N/A High concentration container (48 hr) Low concentration EnCore samplers (48 hr) High concentration pre-weighed (methanol -14 d) Low conc pre-weighed vials (Sod Bis -14 d) Special precautions or instructions included? Yes No	All samples received within holding time?	Yes	○ No	
Samples were considered acceptable as cooling process had begun. Water - Sample containers properly preserved Yes No N/A Water - VOA vials free of headspace Yes No N/A Trip Blanks received with VOAs Yes No N/A Soil VOA method 5035 – compliance criteria met Yes No N/A High concentration container (48 hr) Low concentration EnCore samplers (48 hr) High concentration pre-weighed (methanol -14 d) Low conc pre-weighed vials (Sod Bis -14 d) Special precautions or instructions included? Yes No	Cooler temperature in compliance?	Yes	○ No	
Water - VOA vials free of headspace Yes No N/A Trip Blanks received with VOAs Soil VOA method 5035 – compliance criteria met Yes No N/A High concentration container (48 hr) High concentration pre-weighed (methanol -14 d) Special precautions or instructions included? Yes No N/A Low concentration EnCore samplers (48 hr) Low conc pre-weighed vials (Sod Bis -14 d) Special precautions or instructions included? Yes No	Cooler/Samples arrived at the laboratory on ice. Samples were considered acceptable as cooling process had begun.	Yes	○ No	
Trip Blanks received with VOAs Soil VOA method 5035 – compliance criteria met Yes No N/A High concentration container (48 hr) High concentration pre-weighed (methanol -14 d) Special precautions or instructions included? Yes No N/A Low concentration EnCore samplers (48 hr) Low conc pre-weighed vials (Sod Bis -14 d) Special precautions or instructions included? Yes No	Water - Sample containers properly preserved	Yes	○ No	○ N/A
Soil VOA method 5035 – compliance criteria met Yes No N/A High concentration container (48 hr) Low concentration EnCore samplers (48 hr) High concentration pre-weighed (methanol -14 d) Low conc pre-weighed vials (Sod Bis -14 d) Special precautions or instructions included? Yes No	Water - VOA vials free of headspace	O Yes	○ No	● N/A
High concentration container (48 hr) High concentration pre-weighed (methanol -14 d) Special precautions or instructions included? Low concentration EnCore samplers (48 hr) Low conc pre-weighed vials (Sod Bis -14 d) Yes No	Trip Blanks received with VOAs	O Yes	○ No	N/A
High concentration pre-weighed (methanol -14 d) Low conc pre-weighed vials (Sod Bis -14 d) Special precautions or instructions included? Yes No	Soil VOA method 5035 – compliance criteria met	O Yes	○ No	● N/A
Special precautions or instructions included? Yes No	High concentration container (48 hr)	Low	concentration EnCo	ore samplers (48 hr)
	High concentration pre-weighed (methanol -14	d) Low o	conc pre-weighed v	vials (Sod Bis -14 d)
Comments: Add NO3, NO2 to WWTP Discharge Point sample per client.	Special precautions or instructions included?	O Yes	No	
	Comments: Add NO3 NO2 to WWTP Dischard	e Point sample	per client.	

Any regulatory non-compliance issues will be recorded on non-compliance report.

Signature: Rebekah Ross

Date & Time: 11/06/2012 10:20:14

Chain of Custody

City Of Harrison

Client	City of Harrison	rrison		roject	Project Number	5		Amal	VSIS	Analysis Requested	este						
Address	1508 Silver Valley Road	lley Road						***************************************		<u></u>	(O	_	-		_		
	Harriosn, AR 72601	2601)	\						7 244
email address	hwwtp2@windstream.net	istream.net			1/16/1/ 1/16/1			TC		N							03322
Phone No.	870-741-4426		曹品					OTA		03		Harrison Wastewater Treatment Plant Crooked Creek Sampling	lastewater	Treatment Treatment	nt Plant		10-19-05
FAX No.	870-741-5022		Purchas	Purchase Order #	#		(0	L D	_	3							
Project:	CROOKED CR	CROOKED CREEK SAMPLING					3)ra	ISSC		M			X	_	-	_	-
Project Manager	Randy Reese						b or	DLV									
Type of Event:								10.70			******						
Single Dally ::- *	a	Monthly Quarterly Semi-Annual	_	P1 500													
Date	92	Sample Identification	Matrix	Type	SS.	Pres	osite	JDS ATE	UDE						Ì.		
	8:15, a.m Silver Val	Silver Valley Bridge (Downstream)	water	plastic	-	NONE	-	×									
11-5-12 8:2	8:25g.m HWY 62	HWY 62-65 Bridge (Upstream)	water	plastic	1	NONE	၅	× 3	х х	J.							
								\dashv		\dashv			\forall				
- 1								+	+	-		-	+	_			I
いる エーケール	8.35am WWTP	WWTP DISCHARGE POINT	water	plastic	-	NONE	Ö	×	×	X		1	-	1	1		T
							1	+	+	+		1	+	_	-		I
	1						1	+	+	+			+	_	1	i.	
							1	+	+	-			+				
								-	+	-							
								-	_	,							
(3) Sodium Thiosu.	Nitric Acid(NH03) (2) ffate(Na2S203) (4) So	Preservatives: (1) Nitric Acid(NH03) (2)Hydrochloric Acid(HCL) (3) Sodium Thiosulfate(Na2S203) (4) Sodium Hydroxide(Na03)	Cilent R	emarks/C	Cllent Remarks/Comments:	14											
Redingues	Relinguíshed By (Sign)	Print Name / Company	ontpan			Date / Time	9			Received By (Sign)	ed By	(väis)		Print	Print Name / Company	ompa	
Kod	Karo	Randy Reese/City	of Harrison	rison	11-5	-12/9.	9:00 a.n	_		(((
					9	240	5	Ė	7	8	3			T	200	N	Γ
							+	-	5	R			-				Τ
Rec'd at Lab By:			Rec'd Do	Rec'd Date / Time:							Comments.	ents:					Γ
Shipped Via	UPS	NEXT DAY AIR															
																	1
											_						

<u>.</u>



"A Laboratory Management Partner

2790 Whitten Road

Memphis, Tennessee 38133

(901) 213-2400

12/5/2012

Harrison Wastewater Treatment Plant Ms. Kathryn Catlin PO Box 1715 Harrison, AR, 72601

Ref:

Analytical Testing

ETC Report Number: 12-326-0233

Client Project Description: Crooked Creek Sampling

Dear Ms. Kathryn Catlin:

Environmental Testing and Consulting, Inc. received sample(s) on 11/21/2012 for the analyses presented in the following report.

The above referenced project has been analyzed per your instructions. The analyses were performed in accordance with the applicable analytical method.

The analytical data has been validated using standard quality control measures performed as required by the analytical method. Quality Assurance, method validations, instrumentation maintenance and calibration for all parameters (NELAP and non-NELAP) were performed in accordance with guidelines established by the USEPA and NELAC unless otherwise indicated. Any parameter for which the laboratory is not officially NELAP accredited is indicated by a '~' symbol. These are not included in the scope because NELAP accreditation is either not available or has not been applied for. Additional certifications may be held/are available for parameters, where NELAP accreditation is not required or applicable. A full list of certifications is available upon request.

The results are shown on the attached Report of Analysis(s). Results for solid matrices are reported on an asreceived basis unless otherwise indicated. This report shall not be reproduced except in full and relates only to the samples included in this report.

Please do not hesitate to contact me or client services if you have any questions or need additional information.

Sincerely,

Randy Thomas

Rendell H. Thomas

Project Manager

Laboratory's liability in any claim relating to analyses performed shall be limited to, at laboratory's option, repeating the analysis in question at laboratory's expense, or the refund of the charges paid for performance of said analysis.

#TN00012

Kentucky UST #41

#9311



2790 Whitten Road

Memphis, Tennessee 38133

"A Laboratory Management Partner"

03322

Harrison Wastewater Treatment Plant

Ms. Kathryn Catlin

PO Box 1715

Harrison, AR 72601

Project

Crooked Creek Sampling

Information:

Report Date: 12/5/2012

Report Number: 12-326-0233

REPORT OF ANALYSIS

Received: 11/21/2012

Lab No:

96804

Sample ID: Silver Valley Bridge (Downstream)

Matrix: Aqueous

Sampled: 11/20/2012 8:35

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Alkalinity (as CaCO3)	156	mg/L	1	1	11/28/12 11:05	EWB	2320B
Chloride	12.1	mg/L	0.400	1	11/29/12 20:54	RQE	EPA-300.0
Total Dissolved Solids	216	mg/L	10	1	11/26/12 14:30	NRT	2540C
Total Calcium	70.0	mg/L	0.100	1	12/01/12 05:45	BKN	EPA-200.7
Total Magnesium	2.11	mg/L	0.100	1	12/01/12 05:45	BKN	EPA-200.7
Total Potassium	2.27	mg/L	0.100	1	12/04/12 13:42	JTR	EPA-200.7
Total Sodium	7.96	mg/L	0.500	1	12/04/12 13:42	JTR	EPA-200.7
Sulfate	8.99	mg/L	1.00	1	11/29/12 20:54	RQE	EPA-300.0

Lab No:

96805

Sample ID: Hwy 62/65 Bridge (Upstream)

Matrix: Aqueous

Sampled: 11/20/2012 8:45

4	WATER - 1871 E	-BRYGOWY?	W 120	west in which has		
Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
166	mg/L	1	1	11/28/12 11:05	EWB	2320B
7.42	mg/L	0.400	1	11/29/12 21:12	RQE	EPA-300.0
182	mg/L	10	1	11/26/12 14:30	NRT	2540C
71.4	mg/L	0.100	1	12/01/12 05:52	BKN	EPA-200.7
1.94	mg/L	0.100	1	12/01/12 05:52	BKN	EPA-200.7
1.46	mg/L	0.100	1	12/04/12 13:44	JTR	EPA-200.7
3.79	mg/L	0.500	1	12/04/12 13:44	JTR	EPA-200.7
4.72	mg/L	1.00	1	11/29/12 21:12	RQE	EPA-300.0
	166 7.42 182 71.4 1.94 1.46 3.79	166 mg/L 7.42 mg/L 182 mg/L 71.4 mg/L 1.94 mg/L 1.46 mg/L 3.79 mg/L	166 mg/L 1 7.42 mg/L 0.400 182 mg/L 10 71.4 mg/L 0.100 1.94 mg/L 0.100 1.46 mg/L 0.100 3.79 mg/L 0.500	166 mg/L 1 1 7.42 mg/L 0.400 1 182 mg/L 10 1 71.4 mg/L 0.100 1 1.94 mg/L 0.100 1 1.46 mg/L 0.100 1 3.79 mg/L 0.500 1	Analyzed 166 mg/L 1 1 11/28/12 11:05 7.42 mg/L 0.400 1 11/29/12 21:12 182 mg/L 10 1 11/26/12 14:30 71.4 mg/L 0.100 1 12/01/12 05:52 1.94 mg/L 0.100 1 12/01/12 05:52 1.46 mg/L 0.100 1 12/04/12 13:44 3.79 mg/L 0.500 1 12/04/12 13:44	Analyzed 166 mg/L 1 1 11/28/12 11:05 EWB 7.42 mg/L 0.400 1 11/29/12 21:12 RQE 182 mg/L 10 1 11/26/12 14:30 NRT 71.4 mg/L 0.100 1 12/01/12 05:52 BKN 1.94 mg/L 0.100 1 12/01/12 05:52 BKN 1.46 mg/L 0.100 1 12/04/12 13:44 JTR 3.79 mg/L 0.500 1 12/04/12 13:44 JTR

Qualifiers/ Definitions

MQL

Outside QC limit

Method Quantitation Limit

DF



2790 Whitten Road

Memphis, Tennessee 38133

"A Laboratory Management Partner"

03322

Harrison Wastewater Treatment Plant

Ms. Kathryn Catlin

PO Box 1715

Harrison, AR 72601

Project

Crooked Creek Sampling

Information:

Report Date: 12/5/2012

Report Number: 12-326-0233

REPORT OF ANALYSIS

Received: 11/21/2012

Lab No:

96806

Sample ID: WWTP Discharge Point

Matrix: Aqueous

Sampled: 11/20/2012 9:00

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Alkalinity (as CaCO3)	31	mg/L	1	1	11/28/12 11:05	EWB	2320B
Chloride	57.7	mg/L	4.00	10	11/21/12 12:30	RQE	EPA-300.0
Nitrate (NO3-N)	22.3	mg/L	1.00	10	11/21/12 12:30	RQE	EPA-300.0
Nitrite (NO2-N)	<0.100	mg/L	0.100	1	11/21/12 11:20	RQE	EPA-300.0
Nitrate+Nitrite-N	22.3	mg/L	0.100	1	11/21/12 11:20		EPA-300.0
Total Dissolved Solids	331	mg/L	10	1	11/26/12 14:30	NRT	2540C
Total Calcium	43.3	mg/L	0.100	1	12/01/12 05:58	BKN	EPA-200.7
Total Magnesium	3.58	mg/L	0.100	1	12/01/12 05:58	BKN	EPA-200.7
Total Potassium	12.7	mg/L	0.500	5	12/04/12 13:49	JTR	EPA-200.7
Total Sodium	62.1	mg/L	2.50	5	12/04/12 13:49	JTR	EPA-200.7
Sulfate	60.8	mg/L	10.0	10	11/21/12 12:30	RQE	EPA-300.0

Qualifiers/ **Definitions** Outside QC limit

MQL

Method Quantitation Limit

DF



Customer Number: 03322

Environmental Testing & Consulting, Inc.

2790 Whitten Road

Memphis, Tennessee 38133

(901) 213-2400

Fax (901) 213-2440

•

Cooler Receipt Form

Customer Name: Harrison Wastewater Treatm Report Number: 12-326-0233	nent Plant		
	ng Method		
Fed Ex UPS US Postal Client	t C Lab	O Courier	Other:
Shipping container/cooler uncompromised?	Yes	○ No	
Custody seals intact on shipping container/cooler?	Yes	○ No	Not Required
Custody seals intact on sample bottles?	O Yes	○ No	Not Required
Chain of Custody (COC) present?	Yes	○ No	
COC agrees with sample label(s)?	Yes	○ No	
COC properly completed	Yes	○ No	
Samples in proper containers?	Yes	○ No	
Sample containers intact?	Yes	○ No	
Sufficient sample volume for indicated test(s)?	Yes	○ No	
All samples received within holding time?	Yes	○ No	
Cooler temperature in compliance?	Yes	○ No	
Cooler/Samples arrived at the laboratory on ice. Samples were considered acceptable as cooling process had begun.	Yes	○ No	
Water - Sample containers properly preserved	Yes	○ No	
Water - VOA vials free of headspace	O Yes	○ No	● N/A
Trip Blanks received with VOAs	O Yes	○ No	N/A
Soil VOA method 5035 – compliance criteria met	O Yes	○ No	N/A
High concentration container (48 hr)	Low	concentration EnC	ore samplers (48 hr)
High concentration pre-weighed (methanol -14	d) Low	conc pre-weighed	vials (Sod Bis -14 d)
Special precautions or instructions included?	O Yes	No	-
Comments:			

Any regulatory non-compliance issues will be recorded on non-compliance report.

Signature: Brooke Shoup

Date & Time: 11/21/2012 10:03:50

Project Number Harrison Waste Crocked Graek (G) tab of (C) An Harrison Waste Crocked Graek Cooked Graek	ORIDE X OLIDS X ILFATE X IESIUM X ASSIUM X Omposite D INON T	×	water plastic 1 NONE G X X X X X X X X X X X X X X X X X X	Company Company y of Harrison 11-20-2012/9:45am	Rec'd Date / Time: (- U - C - Comments:
City of Harrison 1508 Silver Valley Road Harrison, AR 72601 mwwnp2@windstream.net 870-741-426 870-741-5022 CROOKED CREEK SAMPLING	Quarterly Semi-Annual Sample (dentification r Valley Bridge (Downstream)	11/20/2012 8:45am HWY 62-65 Bridge (Upstream) wa	11/20/2012 9:00am WWTP DISCHARGE POINT W	Preservatives: (1) Nitric Acid(NH03) (2)Hydrochloric Acid(HCL) Client Remar (3) Sodium Thiosulfate(Na2S203) (4) Sodium Hydroxide(Na03) (3) Sodium Thiosulfate(Na2S203) (4) Sodium Hydroxide(Na03) (3) Sodium Thiosulfate(Na2S203) (4) Sodium Hydroxide(Na03)	Borit at Lab By: (F. All M. Of & C.



"A Laboratory Management Partner

Memphis, Tennessee 38133

(901) 213-2400

12/12/2012

Harrison Wastewater Treatment Plant Ms. Kathryn Catlin PO Box 1715 Harrison, AR, 72601

Ref:

Analytical Testing

ETC Report Number: 12-339-0216

Client Project Description: Crooked Creek Sampling

Dear Ms. Kathryn Catlin:

Environmental Testing and Consulting, Inc. received sample(s) on 12/4/2012 for the analyses presented in the following report.

The above referenced project has been analyzed per your instructions. The analyses were performed in accordance with the applicable analytical method.

The analytical data has been validated using standard quality control measures performed as required by the analytical method. Quality Assurance, method validations, instrumentation maintenance and calibration for all parameters (NELAP and non-NELAP) were performed in accordance with guidelines established by the USEPA and NELAC unless otherwise indicated. Any parameter for which the laboratory is not officially NELAP accredited is indicated by a '~' symbol. These are not included in the scope because NELAP accreditation is either not available or has not been applied for. Additional certifications may be held/are available for parameters, where NELAP accreditation is not required or applicable. A full list of certifications is available upon request.

The results are shown on the attached Report of Analysis(s). Results for solid matrices are reported on an asreceived basis unless otherwise indicated. This report shall not be reproduced except in full and relates only to the samples included in this report.

Please do not hesitate to contact me or client services if you have any questions or need additional information.

Sincerely,

Randy Thomas

Rendell H. Thomas

Project Manager

Laboratory's liability in any claim relating to analyses performed shall be limited to, at laboratory's option, repeating the analysis in question at laboratory's expense, or the refund of the charges paid for performance of said analysis.



2790 Whitten Road

Memphis, Tennessee 38133

Fax (901) 213-2440

"A Laboratory Management Partner"

03322

Harrison Wastewater Treatment Plant

Ms. Kathryn Catlin

PO Box 1715 Harrison, AR 72601 Project

Crooked Creek Sampling

Information:

Report Date: 12/12/2012

Report Number: 12-339-0216

REPORT OF ANALYSIS

Received: 12/4/2012

Lab No:

98669

Matrix: Aqueous

Sampled: 12/3/2012 7:30

Sample ID: Silver Valley Bridge (Downstream) Test Results Units MQL

DF Date / Time Analytical Analyzed Method Chloride EPA-300.0 mg/L 13.4 0.400 1 12/10/12 18:26 RQE Total Dissolved Solids 2540C 222 mg/L 10 1 12/05/12 13:00 NRT Sulfate 1 12/10/12 18:26 RQE EPA-300.0 12.1 mg/L 1.00

Lab No:

98670

Sample ID: Hwy 62/65 Bridge (Upstream)

Matrix: Aqueous

Sampled: 12/3/2012 7:00

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Chloride	7.72	mg/L	0.400	1	12/10/12 18:44	RQE	EPA-300.0
Total Dissolved Solids	215	mg/L	10	1	12/05/12 13:00	NRT	2540C
Sulfate	5.21	mg/L	1.00	1	12/10/12 18:44	RQE	EPA-300.0

Lab No:

98671

Sample ID: WWTP Discharge Point

Matrix: Aqueous

Sampled: 12/3/2012 7:15

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Chloride	63.8	mg/L	2.00	5	12/11/12 22:48	RQE	EPA-300.0
Total Dissolved Solids	382	mg/L	10	1	12/05/12 13:00	NRT	2540C
Sulfate	73.0	mg/L	5.00	5	12/11/12 22:48	RQE	EPA-300.0

Qualifiers/ **Definitions**

Outside QC limit

Method Quantitation Limit

DF



2790 Whitten Road

Memphis, Tennessee 38133

(901) 213-2400

Fax (901) 213-2440

"A Laboratory Management Partner"

Cooler Receipt Form

Shippir	ng Method		
○ Fed Ex ● UPS ○ US Postal ○ Client	_ Lab	Ourier Courier	Other:
Shipping container/cooler uncompromised?	Yes	○ No	
Custody seals intact on shipping container/cooler?	O Yes	○ No	Not Required
Custody seals intact on sample bottles?	O Yes	○ No	Not Required
Chain of Custody (COC) present?	Yes	○ No	
COC agrees with sample label(s)?	Yes	○ No	
COC properly completed	Yes	○ No	
Samples in proper containers?	Yes	○ No	
Sample containers intact?	Yes	○ No	
Sufficient sample volume for indicated test(s)?	Yes	○ No	
All samples received within holding time?	Yes	○ No	
Cooler temperature in compliance?	Yes	○ No	
Cooler/Samples arrived at the laboratory on ice. Samples were considered acceptable as cooling process had begun.	Yes	○ No	
Water - Sample containers properly preserved	Yes	○ No	○ N/A
Water - VOA vials free of headspace	O Yes	○ No	N/A
Trip Blanks received with VOAs	O Yes	○ No	N/A
Soil VOA method 5035 – compliance criteria met	O Yes	○ No	N/A
High concentration container (48 hr)	Low	concentration EnC	ore samplers (48 hr)
High concentration pre-weighed (methanol -14	d) Low	conc pre-weighed	vials (Sod Bis -14 d)
Special precautions or instructions included?	O Yes	● No	
Comments:			
Comments:			

Any regulatory non-compliance issues will be recorded on non-compliance report.

Signature: Rebekah Ross

Date & Time: 12/04/2012 09:55:12

City Of Harrison

Y Language of the second of th	Client		City of Harrison	u 0		Project	Project Number	er		Analys	21	Harrison Wastewater Treatment Plant Crooked Creek Samolino	water Treatment Plant Samolino		2012-12-04
Harriosa, A.R. 72601	Address		1508 Silver Valley I	Road											
STO-741-425			Harriosn, AR 72601								***************************************	-			7
Strick S	email addres	Si	hwwtp2@windstre	<u>aam.11e[</u>	. in		100	1 11		TC				*********	*
Strip.741-5023 Purchase Order # Earnorman Purchase Order # Earnorman CROOKED CREEK SAMPLING	Phone No.	*	870-741-4426		FID#					TA	***************************************				
Tim Holt	FAX No.		870-741-5022		Purcha	se Order	#		(C	L DI	***********	AND T			
Tim Holt Monthly Quarterly Semi-Annual Monthly Quarterly Semi-Annual Monthly Quarterly Semi-Annual Monthly Charles Monthly Quarterly Semi-Annual Monthly Charles Monthly Quarterly Semi-Annual Monthly Charles M	Project:		CROOKED CREEK	K SAMPLING.					i)ral	SSC					
Mornthly Quarterly Serni-Annual Morth, Type No. Pres.	Project Mana	1ger	Tim Holt						יוס כ)LV	-				
Monthly Quarterly Semi-Aanual Matrix Types No. Press. 25 27 27 27 27 27 27 27	Type of Ever	ıt.									****				
Time Sample (Jennification Matrix Type No. Pres.	Single Duily			k .					-	-	******				
7:30am Silver Valley Bridge (Downstream) water plastic 1 NONE G X X X 7:00am HWY 62-65 Bridge (Upstream) water plastic 1 NONE G X X X 7:15am WWTP DISCHARGE POINT water plastic 1 NONE G X X X 7:15am WWTP DISCHARGE POINT water plastic 1 NONE G X X X 7:15am WWTP DISCHARGE POINT water plastic 1 NONE G X X X 7:15am WWTP DISCHARGE POINT water plastic 1 NONE G X X X 7:15am WWTP DISCHARGE POINT water plastic 1 NONE G X X X 7:15am WWTP DISCHARGE POINT water plastic 1 NONE G X X X 7:15am WWTP DISCHARGE POINT water plastic 1 NONE G X X X 7:15am WWTP DISCHARGE POINT water plastic 1 NONE G X X X X 7:15am WWTP DISCHARGE POINT Water Plastic 1 NONE G X X X X 7:15am WWTP DISCHARGE POINT WATER Plastic 1 NONE G X X X X 7:15am WWTP DISCHARGE POINT WATER Plastic 1 NONE G X X X X X 7:15am WWTP DISCHARGE POINT WATER Plastic 1 NONE G X X X X X X X 7:15am WWTP DISCHARGE POINT WATER Plastic 1 NONE G X X X X X X X X X X X X X X X X X X	Date	1000	Sample	Identification	Matrix		No.	Pres		B4 1					
7:00am HWY 62-65 Bridge (Upstream) water plastic 1 NONE G X X X 7:15am WWTP DISCHARGE POINT water plastic 1 NONE G X X X 7:15am WWTP DISCHARGE POINT water plastic 1 NONE G X X X 7:15am WWTP DISCHARGE POINT water plastic 1 NONE G X X X 7:15am WWTP DISCHARGE POINT water plastic 1 NONE G X X X 7:15am WWTP DISCHARGE POINT water plastic 1 Loone G X X X 7:15am WWTP DISCHARGE POINT water plastic 1 Loone G X X X 7:15am WWTP DISCHARGE POINT water plastic 1 Loone G X X X 7:15am WWTP DISCHARGE POINT water plastic 1 Loone G X X X 7:15am WWTP DISCHARGE POINT water plastic 1 Loone G X X X 7:15am WWTP DISCHARGE POINT water plastic 1 Loone G X X X X 7:15am WWTP DISCHARGE POINT water plastic 1 Loone G X X X X 7:15am WWTP DISCHARGE POINT water plastic 1 Loone G X X X X 7:15am WWTP DISCHARGE POINT water plastic 1 Loone G X X X X 7:15am WWTP DISCHARGE POINT water Plastic G X X X X X X X X X X X X X X X X X X	12/3/2012	7:30am		Bridge (Downstream)	water	plastic	-	NONE	-	\vdash	-				
7:00am HWY 62-65 Bridge (Upstream) water plastic 1 NONE G X X X 7:15am WWTP DISCHARGE POINT water plastic 1 NONE G X X X 7:15am WWTP DISCHARGE POINT water plastic 1 NONE G X X X 7:15am WWTP DISCHARGE POINT water plastic 1 NONE G X X X 7:15am WWTP DISCHARGE POINT water plastic 1 NONE G X X X 7:15am WWTP DISCHARGE POINT water plastic 1 NONE G X X X 7:15am WWTP DISCHARGE POINT water plastic 1 NONE G X X X 7:15am WWTP DISCHARGE POINT water plastic 1 NONE G X X X 7:15am WWTP DISCHARGE POINT water plastic 1 NONE G X X X 7:15am WWTP DISCHARGE POINT Water Plastic 1 NONE G X X X 7:15am WWTP DISCHARGE POINT Water Plastic 1 NONE G X X X 7:15am WWTP DISCHARGE POINT Water Plastic 1 NONE G X X X 7:15am WWTP DISCHARGE POINT Water Plastic 1 NONE G X X X 7:15am WWTP DISCHARGE POINT Water Plastic 1 NONE G X X X 7:15am WWTP DISCHARGE POINT Water Plastic 1 NONE G X X X 7:15am WWTP DISCHARGE POINT Water Plastic 1 NONE G X X X 7:15am WWTP DISCHARGE POINT Water Plastic 1 NONE G X X X 7:15am WWTP DISCHARGE POINT Water Plastic 1 NONE G X X X X 7:15am WWTP DISCHARGE POINT Water Plastic 1 NONE G X X X X 7:15am WWTP DISCHARGE POINT WATER Plastic 1 NONE G X X X X 7:15am WWTP DISCHARGE POINT WATER Plastic 1 NONE G X X X X 7:15am WWTP DISCHARGE POINT WATER Plastic 1 NONE G X X X X 7:15am WWTP DISCHARGE POINT WATER Plastic 1 NONE G X X X X 7:15am WWTP DISCHARGE POINT WATER Plastic 1 NONE G X X X X 7:15am WWTP DISCHARGE POINT WATER Plastic 1 NONE G X X X X 7:15am WWTP DISCHARGE POINT WATER Plastic 1 NONE G X X X X 7:15am WWTP DISCHARGE POINT WATER Plastic 1 NONE G X X X X 7:15am WWTP DISCHARGE POINT WATER Plastic 1 NONE G X X X X 7:15am WWTP DISCHARGE POINT WATER Plastic 1 NONE G X X X X 7:15am WWTP DISCHARGE POINT WATER Plastic 1 NONE G X X X X 7:15am WWTP DISCHARGE POINT WATER Plastic 1 NONE G X X X X 7:15am WWTP DISCHARGE POINT WATER Plastic 1 NONE G X X X X 7:15am WWTP DISCHARGE POINT WATER Plastic 1 NONE G X X X X X X X 7:15am WWTP DISCHARGE POINT WATER Plastic 1 NONE G X X X X X X X X X X X X X X X X X X				20						\dashv	4				
7:15am WWTP DISCHARGE POINT water plastic 1 NONE G X X X 7:15am WWTP DISCHARGE POINT water plastic 1 NONE G X X X X 7:15am WWTP DISCHARGE POINT water plastic 1 NONE G X X X X 10 Ninte Acid(NH03) (2)Hydrocolloric Acid(HCL) 11 Ninte Acid(NH03) (2)Hydrocolloric Acid(HCL) 12 Ninte Acid(NH03) (2)Hydrocolloric Acid(HCL) 13 Ninte Acid(NH03) (2)Hydrocolloric Acid(HCL) 14 Ninte Acid(NH03) (2)Hydrocolloric Acid(HCL) 15 Ninte Acid(NH03) (2)Hydrocolloric Acid(HCL) 16 Ninte Remarks/Comments: 17 Ninte Acid(NH03) (2)Hydrocolloric Acid(HCL) 18 Ninte Acid(NH03) (2)Hydrocolloric Acid(HCL) 19 Ninte Acid(NH03) (2)Hydrocolloric Acid(HCL) 10 Ninte Acid(NH03) (2)Hydrocolloric Acid(HCL) 11 Ninte Acid(NH03) (2)Hydrocolloric Acid(HCL) 12 Ninte Acid(NH03) (2)Hydrocolloric Acid(HCL) 13 Ninte Acid(NH03) (2)Hydrocolloric Acid(HCL) 14 Ninte Acid(NH03) (2)Hydrocolloric Acid(HCL) 15 Ninte Acid(NH03) (2)Hydrocolloric Acid(HCL) 16 Ninte Acid(NH03) (2)Hydrocolloric Acid(HCL) 17 Ninte Acid(NH03) (2)Hydrocolloric Acid(HCL) 18 Ninte Acid(NH03) (2)Hydrocolloric Acid(HCL) 19 Ninte Acid(NH03) (2)Hydrocolloric Acid(HCL) 10 Ninte Acid(NH03) (2)Hydrocolloric Acid(HCL) 10 Ninte Acid(NH03) (2)Hydrocolloric Acid(HCL) 11 Ninte Acid(NH03) (2)Hydrocolloric Acid(HCL) 12 Ninte Acid(NH03) (2)Hydrocolloric Acid(HCL) 13 Ninte Acid(NH03) (2)Hydrocolloric Acid(HCL) 14 Ninte Acid(NH03) (2)Hydrocolloric Acid(HCL) 15 Ninte Acid(NH03) (2)Hydrocolloric Acid(HCL) 16 Ninte Acid(NH03) (2)Hydrocolloric Acid(HCL) 17 Ninte Acid(NH03) (2)Hydrocolloric Acid(HCL) 18 Ninte Acid(NH	Control Control	-1°								-	_				
7:15am WWTP DISCHARGE POINT water plastic 1 NONE G X X X (1) Nitric Acid(NH03) (2)Hydrochloric Acid(HCL) Tuiskled By (Sign) Tuiskled By (Sign) Trim Holt/City of Harrison V Rec'd Date Time Out Comments: Comment	12/3/2012	7:00am	HWY 62-65	Bridge (Upstream)	water	plastic	-	NONE	ပ	_	10.0				
7:15am WWTP DISCHARGE POINT water plastic 1 NONE G X X X X X X X X X X X X X X X X X X										+	-	1			
7:15am WWTP DISCHARGE POINT water plastic 1 NONE G X X X X X X X X X X X X X X X X X X		E .			-	20			_	-	+		+	+	
13) Nitric Acid(NH03) (2)Hydrochloric Acid(HCL) Client Remarks/Comments: 13) Nitric Acid(NH03) (2)Hydrochloric Acid(HCL) Client Remarks/Comments: 12)	12/3/2012	7:15am		SCHARGE POINT	water	plastic	_	NONE	-	+	+			B	
13 Nitric Acid(NH03) (2)Hydrochloric Acid(HCL) Cilient Remarks/Comments: 13 Nitric Acid(NH03) (2)Hydrochloric Acid(HCL) Cilient Remarks/Comments: 14 Nitric Acid(NH03) (2)Hydrochloric Acid(HCL) Cilient Remarks/Comments: 15 15 15 15 15 15 15 15										+	+			1	
to sulfate (National Control of Marrison Tim Holt/City of Harrison Comments: Comments Comments Comments Comments									,	+	-				
Comments: Comments		1						,		-	-	33			
Intercomments Cinent Remarks/Comments Cinent Remarks/Comments								3 20		-					
Trickled By (Sign) Frint Name / Company Date / Time Received By (Sign) 12-3-2012/8:45am 12-3-2012/8:45am Print Holt/City of Harrison 12-3-2012/8:45am Rec'd Date / Time Date / Time Received By (Sign)	Preservatives (3) Sodium Ti	s: (1) Nitri hiosulfate()	ic Acid(NH03) (2)Hyd 'Na2S203) (4) Sodiun	frochloric Acid(HCL) n Hvdroxide(Na03)	Client	Remarks/C	Comments	.:]add			
De U	Relin	quished	By (Sign)	Print Name/	Compa			dit / Tin	me		R	ceived By (Sig)	1988	Print Nat	ne/Compar
	1.54	1	7	Tim Holt/City	of Harr	ison	12-3	-2012/8	:45an	u	1	(
y: Rec'd Date Time: UPS ICED NEXT DAY AIR)					1014	HOP C	B	U.	Y	<0>		反方	33
UPS ICED NEXT DAY AIR								_	14 1	12					1
UPS ICED	Rec'd at Lab	Øy:	· V		Rec'd L	ate Time						Comments:			
	Shipped Via			NEXT DAY AIR											



"A Laboratory Management Partner"

2790 Whitten Road

Memphis, Tennessee 38133

(901) 213-2400

1/2/2013

Harrison Wastewater Treatment Plant Ms. Kathryn Catlin PO Box 1715 Harrison, AR, 72601

Ref:

Analytical Testing

ETC Report Number: 12-354-0214

Client Project Description: Crooked Creek Sampling

Dear Ms. Kathryn Catlin:

Environmental Testing and Consulting, Inc. received sample(s) on 12/19/2012 for the analyses presented in the following report.

The above referenced project has been analyzed per your instructions. The analyses were performed in accordance with the applicable analytical method.

The analytical data has been validated using standard quality control measures performed as required by the analytical method. Quality Assurance, method validations, instrumentation maintenance and calibration for all parameters (NELAP and non-NELAP) were performed in accordance with guidelines established by the USEPA and NELAC unless otherwise indicated. Any parameter for which the laboratory is not officially NELAP accredited is indicated by a '~' symbol. These are not included in the scope because NELAP accreditation is either not available or has not been applied for. Additional certifications may be held/are available for parameters, where NELAP accreditation is not required or applicable. A full list of certifications is available upon request.

The results are shown on the attached Report of Analysis(s). Results for solid matrices are reported on an asreceived basis unless otherwise indicated. This report shall not be reproduced except in full and relates only to the samples included in this report.

Please do not hesitate to contact me or client services if you have any questions or need additional information.

Sincerely,

Randy Thomas Project Manager

Rendell H. Thomas

Laboratory's liability in any claim relating to analyses performed shall be limited to, at laboratory's option, repeating the analysis in question at laboratory's expense, or the refund of the charges paid for performance of said analysis.



2790 Whitten Road

Memphis, Tennessee 38133

"A Laboratory Management Partner"

03322

Harrison Wastewater Treatment Plant

Ms. Kathryn Catlin

PO Box 1715 Harrison, AR 72601 Project

Crooked Creek Sampling

Information:

Report Date: 1/2/2013

Report Number: 12-354-0214

REPORT OF ANALYSIS

Received: 12/19/2012

Lab No:

91183

Sample ID: Silver Valley Bridge (Downstream)

Matrix: Aqueous

Sampled: 12/18/2012 7:15

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Chloride	13.2	mg/L	0.400	1	12/28/12 23:41	RQE	EPA-300.0
Total Dissolved Solids	223	mg/L	10	1	12/21/12 09:45	NRT	2540C
Sulfate	9.81	mg/L	1.00	1	12/28/12 23:41	ROE	EPA-300.0

Lab No:

91184

Sample ID: Hwy 62/65 Bridge (Upstream)

Matrix: Aqueous

Sampled: 12/18/2012 7:30

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Chloride	8.12	mg/L	0.400	1	12/28/12 23:58	RQE	EPA-300.0
Total Dissolved Solids	219	mg/L	10	1	12/21/12 09:45	NRT	2540C
Sulfate	5.37	mg/L	1.00	1	12/28/12 23:58	RQE	EPA-300.0

Lab No:

91185

Sample ID: WWTP Discharge Point

Matrix: Aqueous

Sampled: 12/18/2012 7:00

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Chloride	61.4	mg/L	4.00	10	12/31/12 16:37	RQE	EPA-300.0
Total Dissolved Solids	350	mg/L	10	1	12/21/12 09:45	NRT	2540C
Sulfate	53.2	mg/L	10.0	10	12/31/12 16:37	RQE	EPA-300.0

Qualifiers/ **Definitions**

MQL

Outside QC limit

Method Quantitation Limit

DF



2790 Whitten Road

(901) 213-2400

Fax (901) 213-2440

A Laboratory Management Partner

Cooler Receipt Form

Customer Nun Customer Nan		2 son Wastewa	ter Treatme	nt Plant		
Report Numbe	er: 12-3 5	54-0214				
			Shipping	Method		
Fed Ex	UPS	US Posta	al Client	○ Lab	Ourier (Other:
Shipping conta	iner/cooler	uncompromise	ed?	Yes	○ No	
Custody seals	intact on sl	hipping contain	er/cooler? (Yes	○ No	Not Required
Custody seals	intact on s	ample bottles?	(Yes	○ No	Not Required
Chain of Custo	dy (COC)	present?		Yes	○ No	
COC agrees w	ith sample	label(s)?		Yes	○ No	
COC properly of	completed			Yes	○ No	
Samples in pro	per contai	ners?		Yes	○ No	
Sample contair	ners intact?	?		Yes	○ No	
Sufficient samp	ole volume	for indicated to	est(s)?	Yes	○ No	
All samples red	ceived with	in holding time	?	Y es	○ No	
Cooler tempera	ature in co	mpliance?		Yes	○ No	
	considered	t the laboratory d acceptable as		Yes	○ No	
Nater - Sample	e containe	rs properly pres	served	Yes	○ No	○ N/A
Nater - VOA v	ials free of	headspace	(<u>Yes</u>	○ No	● N/A
Trip Blanks red	ceived with	VOAs	() Yes	○ No	N/A
Soil VOA meth	od 5035 –	compliance cri	teria met	Yes	○ No	N/A
High conce	ntration co	ntainer (48 hr)		Low	concentration EnCo	re samplers (48 hr)
High conce	ntration pre	e-weighed (me	thanol -14 d)	Low	conc pre-weighed v	ials (Sod Bis -14 d)
Special precau	utions or in:	structions inclu	ded?	Yes	No	
Comments:						
	•	"				

Any regulatory non-compliance issues will be recorded on non-compliance report.

Signature: Rebekah Ross

Date & Time: 12/19/2012 10:16:42

OLLIE of Cuctody

City Of Harrison

Client		City of Harrison	uc	-	roject	Project Number			Analysi	74 H	Harriso	Wastewale	Hamson Wastewaler Treatment Plant Crocked Creek Sampling		2012-12-19 10-16-14
Address		1508 Silver Valley Road	coad						3.0		a and a second	Clock odi			
		Harriosn, AR 72601							74.5	Ī		:	-	-	
email address		hwwtp2@windstream.net	am.net			1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	TANKEN OF THE PROPERTY OF THE		то						
Phone No.		870-741-4426		昔品					TAL	- 100					
FAX No.		870-741-5022		Purchas	Purchase Order #	#	•	(G	DI						
Project:	et j	CROOKED CREEK SAMPLING	SAMPLING)rab	SSO						
Project Manager	ier	Tim Holt					Ì			C	70				
Type of Event:						,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		SUI C)or		HLO	-Zin				
Single Daily	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Monthly Quarterly Semi-Annual	ly Semi-Annual					-	The same	ORI		_			
Date	Time	Sample	Sample Identification	Matrix	Туре	Νo	Pres.		478510	DE	103	102		_	
12/18/2012	7:15am	Silver Valley B	Silver Valley Bridge (Downstream)	water	plastic	_	NONE	o o	×	×				1	
							i " Pi		+	_					
								-	+	+				ł	
12/18/2012	7:30am	HWY 62-65	HWY 62-65 Bridge (Upstream)	water	plastic	-	NONE	υ	×	×		+	+		
								T		_					
							di sorri	(>	}	>	>		-	
12/18/2012	7:00am	WWTP DIS	WWTP DISCHARGE POINT	water	plastic		NOME	+	-	+-	<				
										-		-			
												-		1	
										_					
Preservatives:	(1) Nitriu	Preservatives: (1) Nitric Acid(NH03) (2)Hydrochloric Acid(HCl [3] Sodium Thiosulfate(Na2S203) (4) Sodium Hydroxide(Na03)	Preservatives: (1) Nitric Acid(NH03) (2)Hydrochloric Acid(HCL) (3) Sodium Thiosulfate(Na2S203) (4) Sodium Hydroxide(Na03)	Client R	emarks/(Client Remarks/Comments:	12								
Reling	puished	Relinquished By (Sign)	Print Name / Company	Compan			Date / Time	•		(100 mm)	ceire	Received By (Sign)	3	Parents Parent	Print Name / Company
	in the	Bat	Tim Holt/City of Harrison	f Harr	son	12-18	12-18-2012/8:15am	:15a	u	الليط	ł				
					1	19	10	Ž	\$	4	3			200	5
Rec'd at Lab By:	, i.i.			Rec'd D	Rec'd Date / Time:	1 k						Comments:			
		The second secon			-										



"A Laboratory Management Partner

2790 Whitten Road

Memphis, Tennessee 38133

(901) 213-2400

1/11/2013

Harrison Wastewater Treatment Plant Ms. Kathryn Catlin PO Box 1715 Harrison, AR, 72601

Ref:

Analytical Testing

ETC Report Number: 13-004-0222

Client Project Description: Crooked Creek Sampling

Dear Ms. Kathryn Catlin:

Environmental Testing and Consulting, Inc. received sample(s) on 1/4/2013 for the analyses presented in the following report.

The above referenced project has been analyzed per your instructions. The analyses were performed in accordance with the applicable analytical method.

The analytical data has been validated using standard quality control measures performed as required by the analytical method. Quality Assurance, method validations, instrumentation maintenance and calibration for all parameters (NELAP and non-NELAP) were performed in accordance with guidelines established by the USEPA and NELAC unless otherwise indicated. Any parameter for which the laboratory is not officially NELAP accredited is indicated by a '~' symbol. These are not included in the scope because NELAP accreditation is either not available or has not been applied for. Additional certifications may be held/are available for parameters, where NELAP accreditation is not required or applicable. A full list of certifications is available upon request.

The results are shown on the attached Report of Analysis(s). Results for solid matrices are reported on an asreceived basis unless otherwise indicated. This report shall not be reproduced except in full and relates only to the samples included in this report.

Please do not hesitate to contact me or client services if you have any questions or need additional information.

Sincerely,

Randy Thomas Project Manager

Rendell H. Thomas

Laboratory's liability in any claim relating to analyses performed shall be limited to, at laboratory's option, repeating the analysis in question at laboratory's expense, or the refund of the charges paid for performance of said analysis.



2790 Whitten Road

Memphis, Tennessee 38133

(901) 213-2400

*A Laboratory Management Partner

03322

Harrison Wastewater Treatment Plant

Ms. Kathryn Catlin

PO Box 1715

Harrison, AR 72601

Project

Crooked Creek Sampling

Information:

Report Date: 1/11/2013

Report Number: 13-004-0222

REPORT OF ANALYSIS

Received: 1/4/2013

Lab No:

93088

Sample ID: Silver Valley Bridge (Downstream)

Matrix: Aqueous

Sampled: 1/3/2013 9:25

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Chloride	13.8	mg/L	0.400	1	01/07/13 14:46	RQE	EPA-300.0
Total Dissolved Solids	246	mg/L	10	1	01/08/13 14:00	NRT	2540C
Sulfate	8.14	mg/L	1.00	1	01/07/13 14:46	RQE	EPA-300.0

Lab No:

93089

Sample ID: Hwy 62/65 Bridge (Upstream)

Matrix: Aqueous

Sampled: 1/3/2013 9:35

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Chloride	8.64	mg/L	0.400	1	01/07/13 15:03	RQE	EPA-300.0
Total Dissolved Solids	210	mg/L	10	1	01/08/13 14:00	NRT	2540C
Sulfate	5.26	mg/L	1.00	1	01/07/13 15:03	RQE	EPA-300.0

Lab No:

93090

Sample ID: WWTP Discharge Point

Matrix: Aqueous

Sampled: 1/3/2013 9:15

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Chloride	56.6	mg/L	4.00	10	01/04/13 14:34	RQE	EPA-300.0
Nitrate (NO3-N)	18.6	mg/L	1.00	10	01/04/13 14:34	RQE	EPA-300.0
Nitrite (NO2-N)	<0.100	mg/L	0.100	1	01/04/13 13:25	RQE	EPA-300.0
Nitrate+Nitrite-N	18.6	mg/L	0.100	1	01/04/13 13:25		EPA-300.0
Total Dissolved Solids	334	mg/L	10	1	01/08/13 14:00	NRT	2540C
Sulfate	42.6	mg/L	1.00	1	01/04/13 13:25	RQE	EPA-300.0

Qualifiers/ **Definitions**

MQL

Outside QC limit

Method Quantitation Limit

DF





2790 Whitten Road

Memphis, Tennessee 38133

(901) 213-2400

Fax (901) 213-244

*A Laboratory Management Partner

Cooler Receipt Form

Customer Name: Harrison Wastewater Treatmer Report Number: 13-004-0222 Shipping			
		O 0 C	
Fed Ex UPS US Postal Client	C Lab	Courier (Other:
Shipping container/cooler uncompromised?	Yes	○ No	
Custody seals intact on shipping container/cooler?	Yes	○ No	Not Required
Custody seals intact on sample bottles?	Yes	○ No	Not Required
Chain of Custody (COC) present?	Yes	○ No	
COC agrees with sample label(s)?	Yes	○ No	
COC properly completed	Yes	○ No	
Samples in proper containers?	Yes	○ No	
Sample containers intact?	Yes	○ No	
Sufficient sample volume for indicated test(s)?	Yes	○ No	
Ill samples received within holding time?	Yes	○ No	
Cooler temperature in compliance?	Yes	○ No	
Cooler/Samples arrived at the laboratory on ice. Samples were considered acceptable as cooling process had begun.	Yes	○ No	
Vater - Sample containers properly preserved	Yes	○ No	○ N/A
Vater - VOA vials free of headspace	Yes	○ No	N/A
rip Blanks received with VOAs	Yes	○ No	N/A
Soil VOA method 5035 – compliance criteria met	Yes	○ No	● N/A
High concentration container (48 hr)	Low con	centration EnCor	e samplers (48 hr)
High concentration pre-weighed (methanol -14 d)	Low con	c pre-weighed via	als (Sod Bis -14 d)
Special precautions or instructions included?	Yes	● No	
Comments:		=	

Any regulatory non-compliance issues will be recorded on non-compliance report.

Signature: Rebekah Ross

Date & Time: 01/04/2013 10:37:14

5		only or manned.		ΪŌ	Harrison Wastewater Treatment Plant Crooked Creek Sampling	ewater Tre	alment Plan			2013-01-04 10:35:14	40	İ			,			
Client		City of Harrison	Son									2	ted					
Address		1508 Silver Valley Road	Road						_	-	-	,						
	1	Harriosn, AR 72601														We		
email address	T	hwwtp2@windstream.net	earn.net		12 12 12 12 12 12 12 12 12 12 12 12 12 1				10	egr.co		-						
Phone No.	80	870-741-4426		费					TAL	T								
FAX No.	8	870-741-5022		Purcha	Purchase Order#	*		(0	ונו .	D.		بدينية						
Project:	٥	CROOKED CREEK SAMPLING	K SAMPLING))rab	350	cco						a a		
Project Manager		Tim Holt						or (L VI					- 4				
Type of Event:				1-1				(C)a										
Single Daily	THE ST	Monthly Quarte	Monthly Quarterly Semi-Annual					mp	.,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	-	*********			21 191				
	Time	Sample	Sample Identification	Matrix	Type	No.	Press	osite	ATE	IDE	VO3	N02				161		
-	9-25am	Silver Valley I	Silver Valley Bridge (Downstream)	water	plastic	-	NONE	O	×	×	×				20			
						73					В							
					72				A A					-				
1/3/2013 9:3	9:35am	HWY 62-65	HWY 62-65 Bridge (Upstream)	water	plastic	-	NONE	Ö	×	×	×							
	1,	A 171									7 -9	-		\dashv				
			A CONTRACTOR OF THE PROPERTY O						-		- 1	_			-			
1/3/2013 9:	9:15am	WWTP DIS	WWTP DISCHARGE POINT	water	plastic		NONE	Ġ	×	×	×	×			-			
) (2)					-		-	-			
															劫			
				u		r					- 1	_						
												7-1				1		
reservatives: (1) Nitric	Acid(NH03) (2)Hyc	Preservatives: (1) Nitric Acid(NH03) (2)Hydrochloric Acid(HCL) (2) Sortium Thiocutate(N=252)(3) (4) Sortium Hydroches(N=03)	Client F	Client Remarks/Comments:	omment	ió		V 18									
Relinquished By (Sign)	Shed B	(algign)	1	Сотрану	B	1-(1)	Date / Time	me	****		Recei	ped B	Received By (Sign)		A	int Num	Print Nume / Company	(W)
1	1	4	Tim Holt/City	ty of Harrison	son	1-3-	-3-2013/10:00am	:00a	E					5 = 1		(
,						<u> </u>	3-1	R		1	ā	9	S) =			\frac{1}{2}	Ĭ	H
Rec'd at Lab By:				Rec'd D	Rec'd Date / Time:							Con	Comments:					
	Sea so		MINAS DA VAID							.,∆								



"A Laboratory Management Partner

2790 Whitten Road

Memphis, Tennessee 38133

(901) 213-2400

1/24/2013

Harrison Wastewater Treatment Plant Ms. Kathryn Catlin PO Box 1715 Harrison, AR, 72601

Ref:

Analytical Testing

ETC Report Number: 13-015-0223

Client Project Description: Crooked Creek Sampling

Dear Ms. Kathryn Catlin:

Environmental Testing and Consulting, Inc. received sample(s) on 1/15/2013 for the analyses presented in the following report.

The above referenced project has been analyzed per your instructions. The analyses were performed in accordance with the applicable analytical method.

The analytical data has been validated using standard quality control measures performed as required by the analytical method. Quality Assurance, method validations, instrumentation maintenance and calibration for all parameters (NELAP and non-NELAP) were performed in accordance with guidelines established by the USEPA and NELAC unless otherwise indicated. Any parameter for which the laboratory is not officially NELAP accredited is indicated by a '~' symbol. These are not included in the scope because NELAP accreditation is either not available or has not been applied for. Additional certifications may be held/are available for parameters, where NELAP accreditation is not required or applicable. A full list of certifications is available upon request.

The results are shown on the attached Report of Analysis(s). Results for solid matrices are reported on an asreceived basis unless otherwise indicated. This report shall not be reproduced except in full and relates only to the samples included in this report.

Please do not hesitate to contact me or client services if you have any questions or need additional information.

Sincerely,

Randy Thomas Project Manager

Rendell H. Thomas

Laboratory's liability in any claim relating to analyses performed shall be limited to, at laboratory's option, repeating the analysis in question at laboratory's expense, or the refund of the charges paid for performance of said analysis.

#9311

Kentucky

#90047

California

#09267CA NC Tennessee #TN02027 EPA

#TN00012

Oklahoma

Kentucky UST #41

#E-10396



2790 Whitten Road

Memphis, Tennessee 38133

(901) 213-2400

Fax (901) 213-2440

"A Laboratory Management Partner"

03322

Harrison Wastewater Treatment Plant

Ms. Kathryn Catlin

PO Box 1715

Harrison, AR 72601

Project

Crooked Creek Sampling

Information:

Report Date: 1/24/2013

Report Number: 13-015-0223

REPORT OF ANALYSIS

Received: 1/15/2013

94746 Lab No:

Sample ID: Silver Valley Bridge (Downstream) Plus

Matrix: Aqueous

Sampled: 1/14/2013 12:15

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Alkalinity (as CaCO3)	129	mg/L	1	1	01/16/13 09:13	EWB	2320B
Chloride	12.3	mg/L	0.400	1	01/15/13 17:16	RQE	EPA-300.0
Total Dissolved Solids	196	mg/L	10	1	01/21/13 14:00	NRT	2540C
Total Calcium	58.4	mg/L	0.100	1	01/17/13 21:27	BKN	EPA-200.7
Total Magnesium	1.91	mg/L	0.100	1	01/17/13 21:27	BKN	EPA-200.7
Total Potassium	2.30	mg/L	0.100	1	01/19/13 00:39	JTR	EPA-200.7
Total Sodium	8.52	mg/L	0.500	1	01/19/13 00:39	JTR	EPA-200.7
Sulfate	9.62	mg/L	1.00	1	01/15/13 17:16	RQE	EPA-300.0

Lab No:

94747

Sample ID: Hwy 62/65 Bridge (Upstream) plus

Matrix: Aqueous

Sampled: 1/14/2013 12:25

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Alkalinity (as CaCO3)	146	mg/L	1	1	01/16/13 09:13	EWB	2320B
Chloride	6.93	mg/L	0.400	1	01/15/13 17:33	RQE	EPA-300.0
Total Dissolved Solids	188	mg/L	10	1	01/21/13 14:00	NRT	2540C
Total Calcium	66.4	mg/L	0.100	1	01/17/13 21:34	BKN	EPA-200.7
Total Magnesium	1.86	mg/L	0.100	1	01/17/13 21:34	BKN	EPA-200.7
Total Potassium	1.32	mg/L	0.100	1	01/19/13 00:59	JTR	EPA-200.7
Total Sodium	3.84	mg/L	0.500	1	01/19/13 00:59	JTR	EPA-200.7
Sulfate	4.93	mg/L	1.00	1	01/15/13 17:33	RQE	EPA-300.0

Qualifiers/ **Definitions**

Outside QC limit

MQL

Method Quantitation Limit

DF



2790 Whitten Road

Memphis, Tennessee 38133

(901) 213-240

Fax (901) 213-244

A Laboratory Management Partner

03322

Harrison Wastewater Treatment Plant

Ms. Kathryn Catlin

PO Box 1715 Harrison , AR 72601 Project

Crooked Creek Sampling

Information:

Report Date: 1/24/2013

Report Number: 13-015-0223

REPORT OF ANALYSIS

Received: 1/15/2013

Lab No:

94748

Sample ID: WWTP Discharge Point

Matrix: Aqueous

Sampled: 1/14/2013 12:00

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Alkalinity (as CaCO3)	37	mg/L	1	1	01/16/13 09:13	EWB	2320B
Chloride	47.5	mg/L	4.00	10	01/15/13 11:22	RQE	EPA-300.0
Nitrate (NO3-N)	15.2	mg/L	1.00	10	01/15/13 11:22	RQE	EPA-300.0
Nitrite (NO2-N)	<0.100	mg/L	0.100	1	01/15/13 10:42	RQE	EPA-300.0
Nitrate+Nitrite-N	15.2	mg/L	0.100	1	01/15/13 10:42		EPA-300.0
Total Dissolved Solids	297	mg/L	10	1.	01/21/13 14:00	NRT	2540C
Total Calcium	40.8	mg/L	0.100	1	01/17/13 21:40	BKN	EPA-200.7
Total Magnesium	3.22	mg/L	0.100	1	01/17/13 21:40	BKN	EPA-200.7
Total Potassium	10.1	mg/L	0.100	1	01/19/13 01:06	JTR	EPA-200.7
Total Sodium	44.6	mg/L	0.500	1	01/19/13 01:06	JTR	EPA-200.7
Sulfate	43.9	mg/L	1.00	1	01/15/13 10:42	RQE	EPA-300.0



2790 Whitten Road

Memphis, Tennessee 38133

(901) 213-24

Fax (901) 213-2440

*A Laboratory Management Partner

Cooler Receipt Form

Customer Name: Harrison Wastewater Treatm Report Number: 13-015-0223	ent Plant		
*	g Method		
Fed Ex UPS US Postal Client	◯ Lab	Ourier	Other:
Shipping container/cooler uncompromised?	Yes	○ No	
Custody seals intact on shipping container/cooler?	O Yes	○ No	Not Required
Custody seals intact on sample bottles?	O Yes	○ No	Not Required
Chain of Custody (COC) present?	Yes	○ No	
COC agrees with sample label(s)?	Yes	○ No	
COC properly completed	Yes	○ No	
Samples in proper containers?	Yes	○ No	
Sample containers intact?	Yes	○ No	
Sufficient sample volume for indicated test(s)?	Yes	○ No	
All samples received within holding time?	Yes	○ No	
Cooler temperature in compliance?	Yes	○ No	
Cooler/Samples arrived at the laboratory on ice. Samples were considered acceptable as cooling process had begun.	Yes	○ No	
Water - Sample containers properly preserved	Yes	○ No	○ N/A
Water - VOA vials free of headspace	O Yes	○ No	N/A
Trip Blanks received with VOAs	O Yes	○ No	N/A
Soil VOA method 5035 – compliance criteria met	O Yes	○ No	● N/A
High concentration container (48 hr)	Low	concentration EnCo	ore samplers (48 hr)
High concentration pre-weighed (methanol -14 of	d) Low o	conc pre-weighed v	vials (Sod Bis -14 d)
Special precautions or instructions included?) Yes	● No	
Comments:			

Any regulatory non-compliance issues will be recorded on non-compliance report.

Signature: Rebekah Ross

Date & Time: 01/15/2013 09:57:02

1508 Silver Valley Road	1508 Silver Valley Road	2	5	City of namison												13-015-0223 03322 2013-01-15	· ·
1508 Silver Valley Road Harrison, AR 72601 Hotel Repeted Silver Valley Bridge (Downstream) Hotel Three Purchase Order # Purchase Order # Purchase Order #	1508 Silver Valley Road Harrion, AR 72601 Hotels H	Client	11111	City of Harrison		1111	Project	Numbe			Crookec	CreekS	amoling	mont Ha	E	09-56-52	
Harrison AN 72601 Harr	Harrison, AR 72601	Address		1508 Silver Valley Road							,						20 Tay 100 May
St. 12.25pm WWTP DISCHARGE POINT Water Plastic 1 1 1 1 1 1 1 1 1	Supplementation Print Nation P			Harriosn, AR 72601								************		*********			_
STO-741-4426 FID#	STO-741-4126	email addres		hwwtp2@windstream.net		Account to the control of the contro								то			
STO-741-5022 Purchase Order # Purchase Order # CROOKED CREEK SAMPLING	CKOOKED CREEK SAMPLING	Phone No.		870-741-4426		FID#				v pa	,,,,,,,,,,,			TAI			
CROOKED CREEK SAMPLING	Sample CROOKED CREEK SAMPLING Sami-Annual Sample Identification Water Plastic I NOWE G NOWE	FAX No.		870-741-5022		Purcha	se Order	社		10				. D1			
12.25pm	Fig.	Project:		CROOKED CREEK SAMPLI	NG			1	1	Orab				SSO	1		
Bi-Weekly Comments: Comments: Commen	12.25pm HWY 62-65 Bridge (Upstream) Water Plastic 1 NONE G X X X X X X X X X	Project Man	ager	Tim Holt						or	PC	MA					
12.15pm Silver Valley Bridge (Downstream) Wester plastic 1 1 1 1 1 1 1 1 1	12.15pm Sample Identification Watter Type Wo. Press. Els W. Matter Type Wo. Press. Els W. Matter Type Mol. Mol	Type of Ever	Į.										SU				
Sample Identification Wathrix Type No. Pres. F. F. F. F. F. F. F.	Sample isbenification Water Type No. Pres. 25 25 25 25 25 25 25 2	Single Daily	Bi-Weekly	🔐	ni-Annual								LFA				
water plastic 1 NONE G X X X X X X X X X	water plastic 1 NONE G X X X X X X X X X	Date	Trone	1	Įo.	Matrix	Fyne 6	No.		=	3.217		ATE	-			
1	water plastic 1 1 X <td< td=""><td>1/14/2013</td><td>12:15pm</td><td>Silver Valley Bridge (Dov</td><td>vnstream)</td><td>water</td><td>plastic</td><td>-</td><td>NONE</td><td>ຍ</td><td></td><td></td><td>×</td><td>×</td><td>×</td><td></td><td></td></td<>	1/14/2013	12:15pm	Silver Valley Bridge (Dov	vnstream)	water	plastic	-	NONE	ຍ			×	×	×		
water plastic 1 1 1 X <	water plastic 1 1 1 X X X X X X X X X X X X X X X X							1.	+	×	×	×					
Water plastic 1 NONE G X X X X X X X X X	water plastic 1 NONE G X X X X X X X X X																
	1	1/14/2013	12:25pm		stream)	water	plastic	1	NONE	9			×	×	×		
water plastic 1 NONE G X X X X X X X X X X X X X X X X X X	water plastic 1 NONE G X X X X X X X X X X X X X X X X X X						-	-	-	×	×	×					
NONE G	NONE G											-					
	1	1/14/2013	12:00pm	WWTP DISCHARGE	POINT	water	plastic	1	NONE	G			×	×			
Client Remarks/Comments: L) Client Remarks/Comments: Net/ Company 1-14-2013/12:45pm	Comments: Cilient Remarks/Comments: Comments:							-	1	×	×	×					
Client Remarks/Comments: 1. Client Remarks/Comments: Sity of Harrison 1-14-2013/12:45pm Rec'd Date / Time: Rec'd Date / Time:	Client Remarks/Comments: L) Client Remarks/Comments: Net/ Company																
Client Remarks/Comments: Client Remarks/Comments: Dute / Time Received By (Sign)	Client Remarks/Comments: Client Remarks/Comments: Date Time Received By (Sign)																
Client Remarks/Comments: Net/ Company Sity of Harrison 1-14-2013/12:45pm Rec'd Date / Time: Comments:	Client Remarks/Comments: ### Company Ity of Harrison 1-14-2013/12:45pm																
Client Remarks/Comments: Client Remarks/Comments: Received By (Sign)	Client Remarks/Comments: ne/Company Sty of Harrison 1-14-2013/12:45pm						1000										
Sity of Harrison 1-14-2013/12:45pm Received By (Sign) 1	ity of Harrison 1-14-2013/12:45pm	Preservative	S: (1) Nitric	acid(NH03) (2)Hydrochloric (a2SS203) (4) Sodium Hydroxid	Acid(HCL)	Client h	emarks/(comments									
Tim Holt/City of Harrison 1-14-2013/12:45pm FIRST DAY AIR	Tim Holt/City of Harrison 1-14-2013/12:45pm Relli	quished	By (Sign) Pr.	int Name /	Compar			ate / Tim		100	Recei	sed B	(Sign		Print Na	me/Comp	
1 5 3 1 5 5 5 5 5 5 5 5 5			The state of the s	Tim Tim	Holt/City	of Harr	ison	1-14-	2013/12:	45pm	(((
); Rec'd Date / Time: NEXT DAY AIR): Rec'd Date / Time: UPS ICED NEXT DAY AIR							0 =	13-0	ED.	I	M	b			区及	555
Rec'd Date / Time: ICED NEXT DAY AIR	y: UPS ICED NEXT DAY AIR												-				
11PC ICED NEXT DA	UPS ICED NEXT DA	Rec'd at Lab	By:			Rec'd L	ate / Time						Com	nents:			
	210	Shinned Vio			AY AIR												



"A Laboratory Management Partner

2790 Whitten Road

Memphis, Tennessee 38133

(901) 213-2400

2/1/2013

Harrison Wastewater Treatment Plant Ms. Kathrvn Catlin PO Box 1715 Harrison, AR, 72601

Ref:

Analytical Testing

ETC Report Number: 13-029-0230

Client Project Description: Crooked Creek Sampling

Dear Ms. Kathryn Catlin:

Environmental Testing and Consulting, Inc. received sample(s) on 1/29/2013 for the analyses presented in the following report.

The above referenced project has been analyzed per your instructions. The analyses were performed in accordance with the applicable analytical method.

The analytical data has been validated using standard quality control measures performed as required by the analytical method. Quality Assurance, method validations, instrumentation maintenance and calibration for all parameters (NELAP and non-NELAP) were performed in accordance with guidelines established by the USEPA and NELAC unless otherwise indicated. Any parameter for which the laboratory is not officially NELAP accredited is indicated by a '~' symbol. These are not included in the scope because NELAP accreditation is either not available or has not been applied for. Additional certifications may be held/are available for parameters, where NELAP accreditation is not required or applicable. A full list of certifications is available upon request.

The results are shown on the attached Report of Analysis(s). Results for solid matrices are reported on an asreceived basis unless otherwise indicated. This report shall not be reproduced except in full and relates only to the samples included in this report.

Please do not hesitate to contact me or client services if you have any questions or need additional information.

Sincerely,

Rendell H. Thomas

Randy Thomas **Project Manager**

Laboratory's liability in any claim relating to analyses performed shall be limited to, at laboratory's option, repeating the analysis in question at laboratory's expense, or the refund of the charges paid for performance of said analysis.



2790 Whitten Road

Memphis, Tennessee 38133

"A Laboratory Management Partner"

03322

Harrison Wastewater Treatment Plant

Ms. Kathryn Catlin

PO Box 1715 Harrison, AR 72601 Project

Crooked Creek Sampling

Information:

Report Date: 2/1/2013

Report Number: 13-029-0230

REPORT OF ANALYSIS

Received: 1/29/2013

Lab No:

97510

Sample ID: Silver Valley Bridge (Downstream)

Matrix: Aqueous

Sampled: 1/28/2013 9:25

Test	F	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Chloride		12.4	mg/L	0.400	1	01/29/13 15:52	RQE	EPA-300.0
Total Dissolved Solids		209	mg/L	10	1	01/30/13 14:00	NRT	2540C
Sulfate		11.2	mg/L	1.00	1	01/31/13 22:03	RQE	EPA-300.0

Lab No:

97511

Sample ID: Hwy 62/65 Bridge (Upstream)

Matrix: Aqueous

Sampled: 1/28/2013 9:35

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Chloride	7.94	mg/L	0.400	1	01/29/13 16:45	RQE	EPA-300.0
Total Dissolved Solids	188	mg/L	10	1	01/30/13 14:00	NRT	2540C
Sulfate	6.90	mg/L	1.00	1	01/31/13 22:20	RQE	EPA-300.0

Lab No:

97512

Sample ID: WWTP Discharge Point

Matrix: Aqueous

Sampled: 1/28/2013 9:15

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Chloride	59.0	mg/L	4.00	10	01/29/13 11:49	RQE	EPA-300.0
Nitrate (NO3-N)	15.4	mg/L	1.00	10	01/29/13 11:49	RQE	EPA-300.0
Nitrite (NO2-N)	<0.100	mg/L	0.100	1	01/29/13 11:31	RQE	EPA-300.0
Nitrate+Nitrite-N	15.4	mg/L	0.100	1	01/29/13 11:31		EPA-300.0
Total Dissolved Solids	315	mg/L	10	1	01/30/13 14:00	NRT	2540C
Sulfate	63.0	mg/L	10.0	10	01/29/13 11:49	RQE	EPA-300.0

Qualifiers/ **Definitions**

MQL

Outside QC limit

Method Quantitation Limit

DF



A Laboratory Management Partner

2790 Whitten Road

Memphis, Tennessee 38133

(901) 213-2400

Fax (901) 213-2440

Cooler Receipt Form

Customer	Number:	03322	
Customer	Name:	Harrison	٧

Harrison Wastewater Treatment Plant

Report Number: 13-029-0230

Shipping Method

Custody seals intact on shipping container/cooler? Yes No No Not F Custody seals intact on sample bottles? Yes No No Not F Chain of Custody (COC) present? Yes No COC agrees with sample label(s)? Yes No COC properly completed Yes No	en konseperatuen versatur katanet keha
Custody seals intact on shipping container/cooler? Yes No Not F Custody seals intact on sample bottles? Yes No Not F Chain of Custody (COC) present? Yes No COC agrees with sample label(s)? Yes No COC properly completed Yes No	
Custody seals intact on sample bottles? Chain of Custody (COC) present? COC agrees with sample label(s)? COC properly completed Yes No No No No No No No No No N	
Chain of Custody (COC) present? Yes No COC agrees with sample label(s)? Yes No COC properly completed Yes No	Required
COC agrees with sample label(s)? COC properly completed Yes No	Required
COC properly completed Yes No	
Samuelas in managementainers?	
Samples in proper containers? Yes No	
Sample containers intact? Yes No	
Sufficient sample volume for indicated test(s)? Yes No	1
All samples received within holding time? Yes No	
Cooler temperature in compliance? Yes No	
Cooler/Samples arrived at the laboratory on ice. Samples were considered acceptable as cooling process had begun. No	
Water - Sample containers properly preserved Yes No N/A	
Water - VOA vials free of headspace Yes No N/A	
Trip Blanks received with VOAs Yes No N/A	
Soil VOA method 5035 – compliance criteria met Yes No N/A	
High concentration container (48 hr) Low concentration EnCore samplers	(48 hr)
High concentration pre-weighed (methanol -14 d) Low conc pre-weighed vials (Sod Bis	s -14 d)
Special precautions or instructions included? Yes No	
Comments:	
Any regulatory non-compliance issues will be recorded on non-compliance report.	

Signature: Susan Simpson

Date & Time: 01/29/2013 10:25:40

Harrison Wastewaler Treatment Plant 10.23-10

City Of Harrison

Client		City of Mail 13011	rison									States and property		100	CHAMMERS		1111111
Address		1508 Silver Valley Road	ley Road							Te.		ā,					
		Harriosn, AR 72601	1097		tary					i de la companya de l							
email address	1.	hwwtp2@windstream.net	stream.net				211 - 12 211 - 12 21 - 12		TO					14	75		
Phone No.		870-741-4426		FICH					OTA					02. ₀			
FAX No.		870-741-5022		Purcha	Purchase Order #	#		((L D								
Project:		CROOKED CR	CROOKED CREEK SAMPLING					G)ra	ISSO		*******						7
Project Manager	Jer.	Tim Holt						b or	OLV		*******					-	
Type of Event.																	
Single Daily		Monthly Qua	Monthly Quarterly Semi-Annual					mpc	SOL JLF/	.OR		1	. 1,				
Date	Time	Sept	Sample Identification	Matrix	Туре	Ø.	Press				VO3	N02					9
1/28/2013	9:25am	Silver Valla	Silver Valley Bridge (Downstream)	water	plastic	-	NONE		^ ×	×					n		
									\dashv	- 1 - 1		1	6		To di		_
									+	4							-
1/28/2013	9:35am	HWY 62	HWY 62-65 Bridge (Upstream)	water	plastic		NONE	O	×	×		2					
										_							
128/13				100				1	Ga :								30
1/8/2013	9:15am	WWTP	WWTP DISCHARGE POINT	water	plastic	-	NONE	D	XX	X	X	×					
	no y			Part Section		eg.				_				И	à	2/3	
	L adi	442700							de s								
	—		10										2				
		3		9885 INV			2 1000										
	al Y										J		1.17				8.1
(3) Sodium This	(1) Nitric	: Acid(NH03) (2)+ ta2S203) (4) Sod	Preservatives: (1) Nitric Acid(NH03) (2)Hydrochloric Acid(HCL) (3) Sodium Thiosulfate(Na2S203) (4) Sodium Hydroxide(Na03)	Client R	Client Remarks/Comments:	omment	Jo/ :s			- 1					ji		
Reling	wished !	Relinquished By (Sign)	ne/	Company		3	Date / Time	2			eceir	Received By (Sign)	Sign)		Print Name / Company	ne / Com	yany
low	Mole	Ji.	- K	of Harrison	son	1-28-	1-28-2013/10:00am):00ar	וו	3	An	mosh	2		Susan A Sugar	SUCS	ME
						11/20	24/12 601:20	79 TO				2	Sules I			-	
D 5 1 D.									-								31
Kee a at rao ay.				Rec'd De	Rec'd Date / Time:			1				Comments:	nts:				
Shinned Via	2000	C L	NEXT DAV AID									DO THE STATE OF					



"A Laboratory Management Partne

2790 Whitten Road

Memphis, Tennessee 38133

(901) 213-2400

2/18/2013

Harrison Wastewater Treatment Plant Mr. Tim Holt PO Box 1715 Harrison, AR, 72601

Ref:

Analytical Testing

ETC Report Number: 13-043-0216

Client Project Description: Crooked Creek Sampling

Dear Mr. Tim Holt:

Environmental Testing and Consulting, Inc. received sample(s) on 2/12/2013 for the analyses presented in the following report.

The above referenced project has been analyzed per your instructions. The analyses were performed in accordance with the applicable analytical method.

The analytical data has been validated using standard quality control measures performed as required by the analytical method. Quality Assurance, method validations, instrumentation maintenance and calibration for all parameters (NELAP and non-NELAP) were performed in accordance with guidelines established by the USEPA and NELAC unless otherwise indicated. Any parameter for which the laboratory is not officially NELAP accredited is indicated by a '~' symbol. These are not included in the scope because NELAP accreditation is either not available or has not been applied for. Additional certifications may be held/are available for parameters, where NELAP accreditation is not required or applicable. A full list of certifications is available upon request.

The results are shown on the attached Report of Analysis(s). Results for solid matrices are reported on an asreceived basis unless otherwise indicated. This report shall not be reproduced except in full and relates only to the samples included in this report.

Please do not hesitate to contact me or client services if you have any questions or need additional information.

Sincerely,

Randy Thomas

Project Manager

Rendell H. Thomas

Laboratory's liability in any claim relating to analyses performed shall be limited to, at laboratory's option, repeating the analysis in question at laboratory's expense, or the refund of the charges paid for performance of said analysis.

#9311

Mississippi Kentucky



2790 Whitten Road

Memphis, Tennessee 38133

(901) 213-2400

"A Laboratory Management Partner"

03322

Harrison Wastewater Treatment Plant

Mr. Tim Holt

PO Box 1715

Harrison, AR 72601

Project

Crooked Creek Sampling

Information:

Report Date: 2/18/2013

Report Number: 13-043-0216

REPORT OF ANALYSIS

Received: 2/12/2013

Lab No:

89707

Sample ID: Silver Valley Bridge (Downstream)

Matrix: Aqueous

Sampled: 2/11/2013 12:15

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Chloride	9.76	mg/L	0.400	1	02/14/13 21:08	RQE	EPA-300.0
Total Dissolved Solids	204	mg/L	10	1	02/13/13 14:30	NRT	2540C
Sulfate	9.06	mg/L	1.00	1	02/14/13 21:08	RQE	EPA-300.0

Lab No:

89708

Sample ID: Hwy 62/65 Bridge (Upstream)

Matrix: Aqueous

Sampled: 2/11/2013 12:30

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Chloride	6.79	mg/L	0.400	1	02/14/13 21:25	RQE	EPA-300.0
Total Dissolved Solids	196	mg/L	10	1	02/13/13 14:30	NRT	2540C
Sulfate	7.08	mg/L	1.00	1	02/14/13 21:25	RQE	EPA-300.0

Lab No:

89709

Sample ID: WWTP Discharge Point

Matrix: Aqueous

Sampled: 2/11/2013 12:00

Results	Units	MQL	DF	Date / Time	Ву	Analytical
				Analyzed		Method
41.4	mg/L	4.00	10	02/13/13 10:03	RQE	EPA-300.0
15.2	mg/L	1.00	10	02/13/13 10:03	RQE	EPA-300.0
<0.100	mg/L	0.100	1	02/12/13 17:05	RQE	EPA-300.0
15.2	mg/L	0.100	1	02/12/13 17:05		EPA-300.0
235	mg/L	10	1	02/13/13 14:30	NRT	2540C
35.4	mg/L	1.00	1	02/12/13 17:05	RQE	EPA-300.0
	15.2 <0.100 15.2 235	41.4 mg/L 15.2 mg/L <0.100 mg/L 15.2 mg/L 235 mg/L	41.4 mg/L 4.00 15.2 mg/L 1.00 <0.100	41.4 mg/L 4.00 10 15.2 mg/L 1.00 10 <0.100	41.4 mg/L 4.00 10 02/13/13 10:03 15.2 mg/L 1.00 10 02/13/13 10:03 <0.100 mg/L 0.100 1 02/12/13 17:05 15.2 mg/L 0.100 1 02/12/13 17:05 235 mg/L 10 1 02/13/13 14:30	Analyzed 41.4 mg/L 4.00 10 02/13/13 10:03 RQE 15.2 mg/L 1.00 10 02/13/13 10:03 RQE <0.100 mg/L 0.100 1 02/12/13 17:05 RQE 15.2 mg/L 0.100 1 02/12/13 17:05 RQE 235 mg/L 10 1 02/13/13 14:30 NRT

Qualifiers/ **Definitions**

MQL

Outside QC limit

Method Quantitation Limit

DF



2790 Whitten Road

Memphis, Tennessee 38133 (901) 21 *A Laboratory Management Partner*

(901) 213-2400

Fax (901) 213-2440

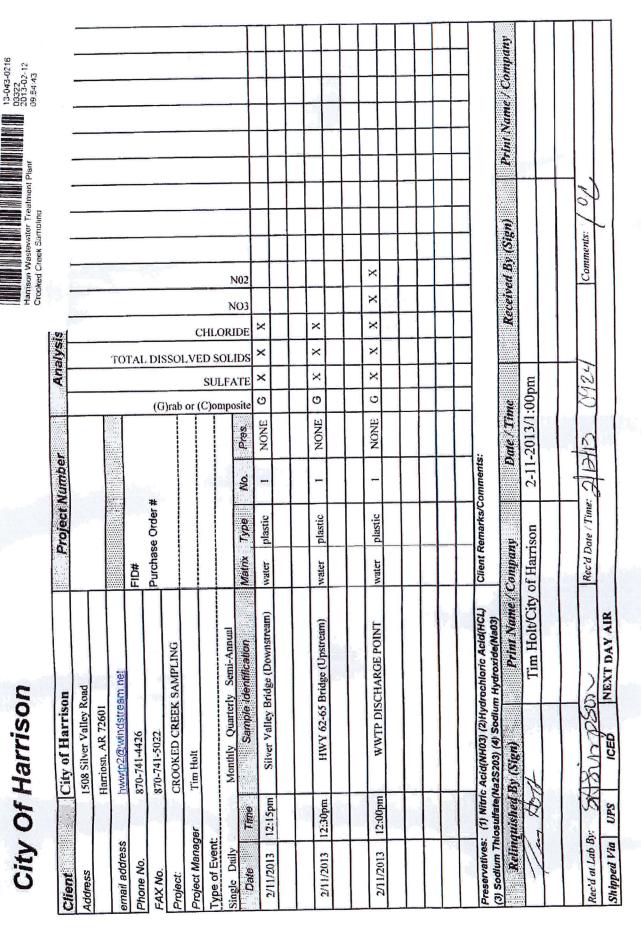
Cooler Ro	eceipt Form			
Customer Number: 03322 Customer Name: Harrison Wastewater Treatmer Report Number: 13-043-0216	ent Plant			
Shippin	g Method			
○ Fed Ex ● UPS ○ US Postal ○ Client	◯ Lab	Ourier Courier	Other:	Epigopolicia (Carlo Sancia
Shipping container/cooler uncompromised?	Yes	○ No		
Custody seals intact on shipping container/cooler?	O Yes	○ No	Not Required	
Custody seals intact on sample bottles?	○ Yes	○ No	Not Required	
Chain of Custody (COC) present?	Yes	○ No		
COC agrees with sample label(s)?	Yes	○ No		
COC properly completed	Yes	○ No		
Samples in proper containers?	Yes	○ No		
Sample containers intact?	Yes	○ No		
Sufficient sample volume for indicated test(s)?	Yes	○ No		
All samples received within holding time?	Yes	○ No		
Cooler temperature in compliance?	Yes	○ No		
Cooler/Samples arrived at the laboratory on ice. Samples were considered acceptable as cooling process had begun.	Yes	○ No		
Water - Sample containers properly preserved	Yes	○ No	○ N/A	
Water - VOA vials free of headspace	O Yes	○ No	N/A	
Trip Blanks received with VOAs	O Yes	○ No	● N/A	
Soil VOA method 5035 – compliance criteria met	○ Yes	○ No	● N/A	
High concentration container (48 hr)	Low cor	ncentration EnC	Core samplers (48 hr)	
High concentration pre-weighed (methanol -14	d) Low cor	nc pre-weighed	vials (Sod Bis -14 d)	
Special precautions or instructions included?	O Yes	No		
Comments:				

Any regulatory non-compliance issues will be recorded on non-compliance report.

Signature: Susan Simpson

Date & Time: 02/12/2013 09:56:03

City Of Harrison





"A Laboratory Management Partner

2790 Whitten Road

Memphis, Tennessee 38133

(901) 213-2400

3/7/2013

Harrison Wastewater Treatment Plant Ms. Kathryn Catlin PO Box 1715 Harrison, AR, 72601

Ref:

Analytical Testing

ETC Report Number: 13-060-0225

Client Project Description: Crooked Creek Sampling

Dear Ms. Kathryn Catlin:

Environmental Testing and Consulting, Inc. received sample(s) on 3/1/2013 for the analyses presented in the following report.

The above referenced project has been analyzed per your instructions. The analyses were performed in accordance with the applicable analytical method.

The analytical data has been validated using standard quality control measures performed as required by the analytical method. Quality Assurance, method validations, instrumentation maintenance and calibration for all parameters (NELAP and non-NELAP) were performed in accordance with guidelines established by the USEPA and NELAC unless otherwise indicated. Any parameter for which the laboratory is not officially NELAP accredited is indicated by a '~' symbol. These are not included in the scope because NELAP accreditation is either not available or has not been applied for. Additional certifications may be held/are available for parameters, where NELAP accreditation is not required or applicable. A full list of certifications is available upon request.

The results are shown on the attached Report of Analysis(s). Results for solid matrices are reported on an asreceived basis unless otherwise indicated. This report shall not be reproduced except in full and relates only to the samples included in this report.

Please do not hesitate to contact me or client services if you have any questions or need additional information.

Sincerely,

Randy Thomas Project Manager

Rendell H. Thomas

Laboratory's liability in any claim relating to analyses performed shall be limited to, at laboratory's option, repeating the analysis in question at laboratory's expense, or the refund of the charges paid for performance of said analysis.

Mississippi Kentucky



2790 Whitten Road

Memphis, Tennessee 38133

(901) 213-2400

Fax (901) 213-2440

"A Laboratory Management Partner"

03322

Harrison Wastewater Treatment Plant

Ms. Kathryn Catlin

Pr

PO Box 1715

Harrison, AR 72601

Project Crooked Creek Sampling

Information:

Report Date: 3/7/2013

Report Number: 13-060-0225

REPORT OF ANALYSIS

Received: 3/1/2013

Lab No:

93237

Matrix: Aqueous

Sample ID: Silver Valley Bridge (Downstream)

Sampled: 2/28/2013 9:40

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Chloride	10.2	mg/L	0.400	1	03/01/13 12:05	RQE	EPA-300.0
Total Dissolved Solids	162	mg/L	10	1	03/05/13 10:00	NRT	2540C
Sulfate	10.9	mg/L	1.00	1	03/01/13 12:05	RQE	EPA-300.0

Lab No:

93238

33238

Sample ID: Hwy 62/65 Bridge (Upstream)

Matrix: Aqueous

Sampled: 2/28/2013 9:55

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Chloride	7.20	mg/L	0.400	1	03/01/13 13:15	RQE	EPA-300.0
Total Dissolved Solids	155	mg/L	10	1	03/05/13 10:00	NRT	2540C
Sulfate	9.61	mg/L	1.00	1	03/01/13 13:15	RQE	EPA-300.0

Lab No:

93239

Sample ID: WWTP Discharge Point

Matrix: Aqueous

Sampled: 2/28/2013 9:25

Test	Results	Units	MQL		ate / Time Analyzed	Ву	Analytical Method
Chloride	42.7	mg/L	4.00	10 03/	/01/13 14:07	RQE	EPA-300.0
Nitrate (NO3-N)	3.38	mg/L	0.100	1 03/	/01/13 13:50	RQE	EPA-300.0
Nitrite (NO2-N)	0.260	mg/L	0.100	1 03/	/01/13 13:50	RQE	EPA-300.0
Nitrate+Nitrite-N	3.64	mg/L	0.100	1 03/	/01/13 13:50		EPA-300.0
Total Dissolved Solids	267	mg/L	10	1 03/	/05/13 10:00	NRT	2540C
Sulfate	37.4	mg/L	1.00	1 03/	/01/13 13:50	RQE	EPA-300.0

Qualifiers/ Definitions

* MQL Outside QC limit

Method Quantitation Limit

DF



2790 Whitten Road

Memphis, Tennessee 38133

(901) 213-2400

Fax (901) 213-2440

A Laboratory Management Partner

Cooler Receipt Form

Report Number: 13-060-0225	n ar Matha al		
Snippii	ng Method		gentionens consistent
Fed Ex UPS US Postal Clien	t Cab	O Courier	Other:
Shipping container/cooler uncompromised?	Yes	○ No	
Custody seals intact on shipping container/cooler?	Yes	○ No	Not Required
Custody seals intact on sample bottles?	O Yes	○ No	Not Required
Chain of Custody (COC) present?	Yes	○ No	
COC agrees with sample label(s)?	Yes	○ No	
COC properly completed	Yes	○ No	
Samples in proper containers?	Yes	○ No	
Sample containers intact?	Yes	○ No	
Sufficient sample volume for indicated test(s)?	Yes	○ No	
All samples received within holding time?	Yes	○ No	
Cooler temperature in compliance?	Yes	○ No	
Cooler/Samples arrived at the laboratory on ice. Samples were considered acceptable as cooling process had begun.	Yes	○ No	
Water - Sample containers properly preserved	Yes	○ No	○ N/A
Water - VOA vials free of headspace	O Yes	○ No	N/A
Trip Blanks received with VOAs	O Yes	○ No	N/A
Soil VOA method 5035 – compliance criteria met	O Yes	○ No	N/A
High concentration container (48 hr)	Low	concentration EnC	ore samplers (48 hr)
High concentration pre-weighed (methanol -14	d) Low	conc pre-weighed	vials (Sod Bis -14 d)
Special precautions or instructions included?	O Yes	No	
Comments:			
			_ = =

Any regulatory non-compliance issues will be recorded on non-compliance report.

Signature: Rebekah Ross

Date & Time: 03/01/2013 09:54:34

2
201
Ë
la
1.1
Ó
3
O

6

Crient		City of main ison			Some soul		5									200	
Address		1508 Silver Valley Road										-	_	,	-	_	
		Harriosn, AR 72601							130								
email address		hwwtp2@windstream.net	100						T								
Phone No.		870-741-4426		FIC#					ATC								
FAX No.		870-741-5022		Purcha	Purchase Order #	#		(LD								
Project:		CROOKED CREEK SAMPLING	ING					G)ra	ISS	*18%		ı					
Project Manager	er	Tim Holt						b or	OLV								
Type of Event:									-	CH							
Single Daily	- 10 mm	Monthly Quarterly Semi-Annual	-Annual						-	LOF							
Date	Time	Sample Identification	ation	Matrix	Туре	No.	Pres	osite	LIDS	RIDE	NO3	N02					
2/28/2013	9:40am	Silver Valley Bridge (Downstream	ownstream)	water	plastic	-	NONE								N A		H
												e,				F	
	-	172				-	APP				L,			-			-
2/28/2013 9	9:55am	HWY 62-65 Bridge (Upstream)	Jpstream)	water	plastic	-	NONE	O	×	×		1.33		-			
													J.				
					The state of the s												
2/28/2013	9:25am	WWTP DISCHARGE POINT		water	plastic	-	NONE	Ö	×	×	×	×					
										1							
									+	4						+	_
		-41							+	-				+		+	1
	The second		To the same of						_					L			L
Preservatives: (3) Sodium Thio	(1) Nitric sulfate(N	Preservatives: (1) Nitric Acid(NH03) (2)Hydrochloric Acid(HCL) (3) Sodium Thiosulfa(etNa2S203) (4) Sodium Hydroxide(Na03)	Acid(HCL)	Client R	Client Remarks/Comments:	omments]							$\left\{ \right.$			
Reling	issing it B	Relinguished By (Sign)	1000	e/Company		9	Date / Time	2			dios	Received Ru (Sien		d			
1 des	Math		Tim Holt/City of Harrison	Harri	uo	2-28-	2-28-2013/10:00am	:00am			(-	_			
				7112					1	T	X		3	4	000	T	
				er vy		8							-				
Rec'd at Lab By:				Rec'd Da	Rec'd Date / Time:							Comments:					
													and the same of	The state of the s			

U



Memphis, Tennessee 38133 "A Laboratory Management Partner

(901) 213-2400

3/25/2013

Harrison Wastewater Treatment Plant Ms. Kathryn Catlin PO Box 1715 Harrison, AR, 72601

Ref:

Analytical Testing

ETC Report Number: 13-073-0220

Client Project Description: Crooked Creek Sampling

Dear Ms. Kathryn Catlin:

Environmental Testing and Consulting, Inc. received sample(s) on 3/14/2013 for the analyses presented in the following report.

The above referenced project has been analyzed per your instructions. The analyses were performed in accordance with the applicable analytical method.

The analytical data has been validated using standard quality control measures performed as required by the analytical method. Quality Assurance, method validations, instrumentation maintenance and calibration for all parameters (NELAP and non-NELAP) were performed in accordance with guidelines established by the USEPA and NELAC unless otherwise indicated. Any parameter for which the laboratory is not officially NELAP accredited is indicated by a '~' symbol. These are not included in the scope because NELAP accreditation is either not available or has not been applied for. Additional certifications may be held/are available for parameters, where NELAP accreditation is not required or applicable. A full list of certifications is available upon request.

The results are shown on the attached Report of Analysis(s). Results for solid matrices are reported on an asreceived basis unless otherwise indicated. This report shall not be reproduced except in full and relates only to the samples included in this report.

Please do not hesitate to contact me or client services if you have any questions or need additional information.

Sincerely,

Randy Thomas Project Manager

Rendell H. Thomas

Laboratory's liability in any claim relating to analyses performed shall be limited to, at laboratory's option, repeating the analysis in question at laboratory's expense, or the refund of the charges paid for performance of said analysis.



2790 Whitten Road

Memphis, Tennessee 38133

"A Laboratory Management Partner"

03322

Harrison Wastewater Treatment Plant

Ms. Kathryn Catlin

Project

Crooked Creek Sampling

PO Box 1715 Harrison, AR 72601 Information:

Report Date: 3/25/2013

Report Number: 13-073-0220

REPORT OF ANALYSIS

Received: 3/14/2013

Lab No:

96269

Sample ID: Silver Valley Bridge (Downstream)

Matrix: Aqueous

Sampled: 3/13/2013 9:40

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Chloride	8.65	mg/L	0.400	1	03/14/13 12:56	RQE	EPA-300.0
Total Dissolved Solids	163	mg/L	10	1	03/20/13 14:30	NRT	2540C
Sulfate	9.97	mg/L	1.00	1	03/14/13 12:56	RQE	EPA-300.0

Lab No:

96270

Sample ID: Hwy 62/65 Bridge (Upstream)

Matrix: Aqueous

Sampled: 3/13/2013 9:55

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Chloride	6.59	mg/L	0.400	1	03/14/13 13:14	RQE	EPA-300.0
Total Dissolved Solids	160	mg/L	10	1	03/20/13 14:30	NRT	2540C
Sulfate	8.45	mg/L	1.00	1	03/14/13 13:14	RQE	EPA-300.0

Lab No:

96271

Sample ID: WWTP Discharge Point

Matrix: Aqueous

Sampled: 3/13/2013 9:25

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Chloride	36.9	mg/L	4.00	10	03/21/13 14:05	RQE	EPA-300.0
Nitrate (NO3-N)	5.60	mg/L	0.100	1	03/14/13 13:31	RQE	EPA-300.0
Nitrite (NO2-N)	0.142	mg/L	0.100	1	03/14/13 13:31	RQE	EPA-300.0
Nitrate+Nitrite-N	5.74	mg/L	0.100	1	03/14/13 13:31		EPA-300.0
Total Dissolved Solids	265	mg/L	10	1	03/20/13 14:30	NRT	2540C
Sulfate	49.9	mg/L	1.00	1	03/14/13 13:31	RQE	EPA-300.0

Qualifiers/ **Definitions**

MQL

Outside QC limit

Method Quantitation Limit

DF



Customer Number: 03322

Environmental Testing & Consulting, Inc. 2790 Whitten Road Memphis, Tennessee 38133 (901) 213-2400 Fax (901) 213-2440

A Laboratory Management Partner

Cooler Receipt Form

Shippir	ng Method		
Fed Ex UPS US Postal Client	t C Lab	Ourier (Other:
Shipping container/cooler uncompromised?	Yes	○ No	
Custody seals intact on shipping container/cooler?	Yes	○ No	Not Required
Custody seals intact on sample bottles?	O Yes	○ No	Not Required
Chain of Custody (COC) present?	Yes	○ No	
COC agrees with sample label(s)?	Yes	○ No	
COC properly completed	Yes	○ No	
Samples in proper containers?	Yes	○ No	
Sample containers intact?	Yes	○ No	
Sufficient sample volume for indicated test(s)?	Yes	○ No	
All samples received within holding time?	Yes	○ No	
Cooler temperature in compliance?	Yes	○ No	
Cooler/Samples arrived at the laboratory on ice. Samples were considered acceptable as cooling process had begun.	Yes	○ No	
Water - Sample containers properly preserved	Yes	○ No	○ N/A
Water - VOA vials free of headspace	O Yes	○ No	● N/A
Trip Blanks received with VOAs	O Yes	○ No	N/A
Soil VOA method 5035 – compliance criteria met	O Yes	○ No	N/A
High concentration container (48 hr)	Low c	oncentration EnCo	re samplers (48 hr)
High concentration pre-weighed (methanol -14	d) Low c	onc pre-weighed v	ials (Sod Bis -14 d)
Special precautions or instructions included?	O Yes	● No	
Comments:			

Signature: Rebekah Ross

Date & Time: 03/14/2013 10:24:11

City Of Harrison

Client		Client City of Harrison		Projec	Project Number	je		Analysi	1 E	Harri	son Waste ked Creek	water Trea Samblind	Harrison Wastewater Treatment Franc Crooked Creek Sambling	2	
Address		1508 Silver Valley Road							2 8						
		Harriosn, AR 72601									-				
email address	38	hwwtp2@windstream_net	201000 20100 20100 20100 201000 20100		1 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1	Company of the compan	Pinn]							·
Phone No.		870-741-4426	#OE					TOT							-
FAX No.		870-741-5022	Purch	Purchase Order #	*			AL			-				
Project:		CROOKED CREEK SAMPLING					(G)r	DISS							******
Project Manager	ager	Tim Holt	_				ab c	SOL							
Type of Event:	nt:						or (C	VEI							
Single Daily	Market market	Monthly Quarterly Semi-Annual													
Date	Ттв	Sample identification	Matrix	Type	No	Prac	FAT posi		RID	NC	N				
3/13/2013	9:40am	Silver Valley Bridge (Downstream)	water	plastic		HNON	-	_	_		02				
1							-	+	:		+	1		1.2	\downarrow
			3		5						\vdash				
3/13/2013	9:55am	HWY 62-65 Bridge (Upstream)	water	plastic	_	NONE	9	×	×		+				
											H				
3/13/2013	9-75am	WWTD DISCUSSION				by.	\dashv	-							
		WWIT DISCHARGE POINT	water	plastic	-	NONE	× U	×	×	×	×				
							+	+		+	+	1			
							H			H					
10 CO CO							+	1		1	-	231			
reservatives.) Sodium Th.	: (1) Nitric	Preservatives: (1) Nitric Acid(NH03) (2)Hydrochloric Acid(HCL) (3) Sodium Thiosulfate(Na2S203) (4) Sodium Hydrochanana	Client R	emarks/C	Client Remarks/Comments;		+			+	-			-	
Reting	Relinquished By (Sign)	y (Sign) Print Name Commen		07770 -7447						200000000000000000000000000000000000000	Colors and Colors				
1 x	41.14	Tim Holt/O	11.9			mr / 3			Rec	eived	Received By (Sign)	3	Print Name / Company	ame/C	onipan
1-		THE LIGHT CITY	ity of Harrison	nos	3/13/2(3/13/2013/10:30am	30am	(
									Ũ			シーク	13-04	135	10
Rec'd at Lab By;	22		Rec'd Da	Rec'd Date / Time						+					
	-		The second second												



Memphis, Tennessee 38133 "A Laboratory Management Partner

(901) 213-2400

4/10/2013

Harrison Wastewater Treatment Plant Ms. Kathryn Catlin PO Box 1715 Harrison, AR, 72601

Ref:

Analytical Testing

ETC Report Number: 13-086-0222

Client Project Description: Crooked Creek Sampling

Dear Ms. Kathryn Catlin:

Environmental Testing and Consulting, Inc. received sample(s) on 3/27/2013 for the analyses presented in the following report.

The above referenced project has been analyzed per your instructions. The analyses were performed in accordance with the applicable analytical method.

The analytical data has been validated using standard quality control measures performed as required by the analytical method. Quality Assurance, method validations, instrumentation maintenance and calibration for all parameters (NELAP and non-NELAP) were performed in accordance with guidelines established by the USEPA and NELAC unless otherwise indicated. Any parameter for which the laboratory is not officially NELAP accredited is indicated by a '~' symbol. These are not included in the scope because NELAP accreditation is either not available or has not been applied for. Additional certifications may be held/are available for parameters, where NELAP accreditation is not required or applicable. A full list of certifications is available upon request.

The results are shown on the attached Report of Analysis(s). Results for solid matrices are reported on an asreceived basis unless otherwise indicated. This report shall not be reproduced except in full and relates only to the samples included in this report.

Please do not hesitate to contact me or client services if you have any questions or need additional information.

Sincerely,

Randy Thomas Project Manager

Rendell H. Thomas

Laboratory's liability in any claim relating to analyses performed shall be limited to, at laboratory's option, repeating the analysis in question at laboratory's expense, or the refund of the charges paid for performance of said analysis.

#TN00012

Kentucky UST #41

Kansas



2790 Whitten Road

Memphis, Tennessee 38133

(901) 213-2400

Fax (901) 213-2440

"A Laboratory Management Partner"

03322

Harrison Wastewater Treatment Plant

Ms. Kathryn Catlin

PO Box 1715 Harrison , AR 72601 Project

Crooked Creek Sampling

Information:

Report Date: 4/10/2013

Report Number: 13-086-0222

REPORT OF ANALYSIS

Received: 3/27/2013

Lab No: 98784

Sample ID : Silver Valley Bridge (Downstream)

Matrix: Aqueous

Sampled: 3/26/2013 12:15

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Alkalinity (as CaCO3)	113	mg/L	1	1	04/01/13 11:15	EWB	2320B
Chloride	9.49	mg/L	0.400	1	03/27/13 15:34	RQE	EPA-300.0
Total Dissolved Solids	165	mg/L	10	10	03/29/13 13:30	NRT	2540C
Total Calcium	55.1	mg/L	0.100	1	04/05/13 22:14	BKN	EPA-200.7
Total Magnesium	1.97	mg/L	0.100	1	04/05/13 22:14	BKN	EPA-200.7
Total Potassium	1.62	mg/L	0.100	1	04/10/13 13:48	JTR	EPA-200.7
Total Sodium	6.17	mg/L	0.500	1	04/10/13 13:48	JTR	EPA-200.7
Sulfate	11.8	mg/L	1.00	1	03/27/13 15:34	RQE	EPA-300.0

Lab No:

98785

Sample ID: Hwy 62/65 Bridge (Upstream)

Matrix: Aqueous

Sampled: 3/26/2013 12:25

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Alkalinity (as CaCO3)	109	mg/L	1	1	04/01/13 11:15	EWB	2320B
Chloride	6.57	mg/L	0.400	1	03/27/13 15:51	RQE	EPA-300.0
Total Dissolved Solids	147	mg/L	10	1	03/29/13 13:30	NRT	2540C
Total Calcium	52.4	mg/L	0.100	1	04/05/13 22:21	BKN	EPA-200.7
Fotal Magnesium	1.85	mg/L	0.100	1	04/05/13 22:21	BKN	EPA-200.7
Total Potassium	1.18	mg/L	0.100	1	04/10/13 13:51	JTR	EPA-200.7
Total Sodium	3.63	mg/L	0.500	1	04/10/13 13:51	JTR	EPA-200.7
Sulfate	9.79	mg/L	1.00	1	03/27/13 15:51	RQE	EPA-300.0

Qualifiers/ Definitions

* MQL Outside QC limit

Method Quantitation Limit

DF



2790 Whitten Road

Memphis, Tennessee 38133

(901) 213-2400

Fax (901) 213-2440

"A Laboratory Management Partner"

03322

Harrison Wastewater Treatment Plant

Ms. Kathryn Catlin

PO Box 1715 Harrison, AR 72601 Project

Crooked Creek Sampling

Information:

Report Date: 4/10/2013

Report Number : 13-086-0222

REPORT OF ANALYSIS

Received: 3/27/2013

Lab No:

98786

Sample ID : WWTP Discharge Point

Matrix: Aqueous

Sampled: 3/26/2013 12:00

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Alkalinity (as CaCO3)	69	mg/L	1	1	04/01/13 11:15	EWB	2320B
Chloride	40.4	mg/L	4.00	10	03/27/13 11:48	RQE	EPA-300.0
Nitrate (NO3-N)	12.2	mg/L	1.00	10	03/27/13 11:48	RQE	EPA-300.0
Nitrite (NO2-N)	<0.100	mg/L	0.100	1	03/27/13 11:30	RQE	EPA-300.0
Nitrate+Nitrite-N	12.2	mg/L	0.100	1	03/27/13 11:30		EPA-300.0
Total Dissolved Solids	288	mg/L	10	1	03/29/13 13:30	NRT	2540C
Total Calcium	45.9	mg/L	0.100	1	04/05/13 22:28	BKN	EPA-200.7
Total Magnesium	2.91	mg/L	0.100	1	04/05/13 22:28	BKN	EPA-200.7
Total Potassium	8.07	mg/L	0.100	1	04/10/13 13:55	JTR	EPA-200.7
Total Sodium	40.5	mg/L	0.500	1	04/10/13 13:55	JTR	EPA-200.7
Sulfate	46.0	mg/L	1.00	1	03/27/13 11:30	RQE	EPA-300.0

Qualifiers/ **Definitions**

MQL

Outside QC limit

Method Quantitation Limit

DF





*A Laboratory Management Partner

2790 Whitten Road

Memphis, Tennessee 38133

(901) 213-2400

Fax (901) 213-2440

Other:

Not Required

Not Required

Courier

() No

O No

O No

No

.

Yes

Yes

Cooler Receipt Form

Customer Number: 03322

Customer Name: Harrison Wastewater Treatment Plant
Report Number: 13-086-0222

Shipping Method

Fed Ex UPS US Postal Client Lab

Shipping container/cooler uncompromised? Yes

Custody seals intact on shipping container/cooler? Yes

Custody seals intact on sample bottles?

Chain of Custody (COC) present?

Yes () No COC agrees with sample label(s)? O No COC properly completed Yes Yes No Samples in proper containers? Sample containers intact? Yes O No Yes O No Sufficient sample volume for indicated test(s)? Yes () No All samples received within holding time? Cooler temperature in compliance? Yes () No Cooler/Samples arrived at the laboratory on ice. Yes O No Samples were considered acceptable as cooling process had begun. No N/A Water - Sample containers properly preserved Yes Yes No N/A Water - VOA vials free of headspace Yes No N/A Trip Blanks received with VOAs Yes No N/A Soil VOA method 5035 - compliance criteria met Low concentration EnCore samplers (48 hr) High concentration container (48 hr) Low conc pre-weighed vials (Sod Bis -14 d) High concentration pre-weighed (methanol -14 d) Yes Special precautions or instructions included? No Comments: Any regulatory non-compliance issues will be recorded on non-compliance report.

Signature: Rebekah Ross

Date & Time: 03/27/2013 10:02:05

City Of Harrison

13-086-0222 03322 03-27-2013 09:46:16

Harrison Wastewater Treatment Plant Crooked Greek Sampling

		City of Harrison	ison		Project	Project Number			Analysi	9								
Address		1508 Silver Valley Road	Road .									-						-
		Harriosn, AR 72601	10							-								
email address	S	hwwtp2@windstream.net	ream,net						8				то					
Phone No.		870-741-4426		FID#									TAI	_				
FAX No.		870-741-5022		Purcha	Purchase Order#	#		(Ċ					ı. Di					
Project:		CROOKED CREEK SAMPLING	3K SAMPLING		1			i)ral					SSC					
Project Manager	ger	Tim Holt				1		or or	P		MA							
Type of Event:	t									CA	AGN		-					
Single Daily	Bi-Weekly	B 122	Quarterly Semi-Annual							LCI	ESI	-						
880	Timo		Sample Identification	Matrix	1,000	ý	Press	osite	UM UM	IUM	ШM	ATE	IDE	itrite				
3/26/2013	12:15pm		Silver Valley Bridge (Downstream)	water	plastic	_	NONE	ပ				×	×	×				
						1	1		×	×								
									-				_					
3/26/2013	12:25pm		HWY 62-65 Bridge (Upstream)	water	plastic	_	NONE	ဗ				×	×	×				
						1	Ť		×	×				_				
3/26/2013	12:00pm		WWTP DISCHARGE POINT	water	plastic	-	NONE	g				×	×	×				
						-	f =		×	×								L d
									-				-	-				- 6
								\exists	+	4		1	+	\dashv			+	4
Droconvelivos	. (4) Mitrie	- Acidimion (C)	December of Mitter Anid/MUNO (2) Hadenchlode Acid/MC 1	Cliont	Markell	Client Democker(Commonte:			\dashv	_			-	-		1		-
(3) Sodlum Th	iosulfate(A	Va2S203) (4) Sodiu	(3) Sodium Thiosulfate(Na2S203) (4) Sodium Hydroxide(Na03)		- Culping							•						
Relini	quished	Relinquished By (Sign)		/ Company			Date / Time	16		Ĭ.	Received By (Sign)	18	(užis		Prim	Print Name / Company	Comy	yung
m	in Boll	4	Tim Holt/City of Harrison	f Harri	son	3-26-2	3-26-2013/12:45pm	:45pn	1 (X	((,		
	2					ECG	から	093	2	M	8	3			7	d	1	
Rec'd at Lab By:	1 3			Rec'd Di	Rec'd Date / Time:		gi byi		-			Comments:	ents:					
Chinand Illa		0100	NEVT DAV AID															
Snipped Va	Sin	ICED	NEAL DAT AIR					1			l	ľ	l					



2790 Whitten Road

Memphis, Tennessee 38133 "A Laboratory Management Partner"

(901) 213-2400

4/19/2013

Harrison Wastewater Treatment Plant Mr. Tim Holt PO Box 1715 Harrison, AR, 72601

Ref:

Analytical Testing

ETC Report Number: 13-102-0236

Client Project Description: Crooked Creek Sampling

Dear Mr. Tim Holt:

Environmental Testing and Consulting, Inc. received sample(s) on 4/12/2013 for the analyses presented in the following report.

The above referenced project has been analyzed per your instructions. The analyses were performed in accordance with the applicable analytical method.

The analytical data has been validated using standard quality control measures performed as required by the analytical method. Quality Assurance, method validations, instrumentation maintenance and calibration for all parameters (NELAP and non-NELAP) were performed in accordance with guidelines established by the USEPA and NELAC unless otherwise indicated. Any parameter for which the laboratory is not officially NELAP accredited is indicated by a '~' symbol. These are not included in the scope because NELAP accreditation is either not available or has not been applied for. Additional certifications may be held/are available for parameters, where NELAP accreditation is not required or applicable. A full list of certifications is available upon request.

The results are shown on the attached Report of Analysis(s). Results for solid matrices are reported on an asreceived basis unless otherwise indicated. This report shall not be reproduced except in full and relates only to the samples included in this report.

Please do not hesitate to contact me or client services if you have any questions or need additional information.

Sincerely,

Randy Thomas

Project Manager

Rendell H. Thomas

Laboratory's liability in any claim relating to analyses performed shall be limited to, at laboratory's option, repeating the analysis in question at laboratory's expense, or the refund of the charges paid for performance of said analysis.



"A Laboratory Management Partner"

2790 Whitten Road

Memphis, Tennessee 38133

(901) 213-2400

Fax (901) 213-2440

03322

Harrison Wastewater Treatment Plant

Mr. Tim Holt

PO Box 1715 Harrison, AR 72601 Project

Crooked Creek Sampling

Information:

Report Date: 4/19/2013

Report Number: 13-102-0236

REPORT OF ANALYSIS

Received: 4/12/2013

Lab No:

Matrix: Aqueous

91949

Sample ID: Silver Valley Bridge (Downstream)

Sampled: 4/11/2013 6:45

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Chloride	10.7	mg/L	0.400	1	04/16/13 14:37	ACS	EPA-300.0
Total Dissolved Solids	197	mg/L	10	1	04/15/13 14:00	NRT	2540C
Sulfate	11.4	mg/L	1.00	1	04/16/13 14:37	ACS	EPA-300.0

Lab No:

91950

Sample ID: Hwy 62/65 Bridge (Upstream)

Matrix: Aqueous

Sampled: 4/11/2013 7:30

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Chloride	7.50	mg/L	0.400	1	04/16/13 14:55	ACS	EPA-300.0
Total Dissolved Solids	184	mg/L	10	1	04/15/13 14:00	NRT	2540C
Sulfate	8.49	mg/L	1.00	1	04/16/13 14:55	ACS	EPA-300.0

Lab No:

91951

Sample ID: WWTP Discharge Point

Matrix: Aqueous

Sampled: 4/11/2013 7:00

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Chloride	54.8	mg/L	0.800	2	04/12/13 22:46	ACS	EPA-300.0
Nitrate (NO3-N)	7.16	mg/L	0.100	1	04/12/13 13:46	ACS	EPA-300.0
Nitrite (NO2-N)	<0.100	mg/L	0.100	1	04/12/13 13:46	ACS	EPA-300.0
Nitrate+Nitrite-N	7.16	mg/L	0.100	1	04/12/13 13:46		EPA-300.0
Total Dissolved Solids	349	mg/L	10	1	04/15/13 14:00	NRT	2540C
Sulfate	77.9	mg/L	2.00	2	04/12/13 22:46	ACS	EPA-300.0

Qualifiers/ **Definitions**

MQL

Outside QC limit

Method Quantitation Limit

DF



2790 Whitten Road

Memphis, Tennessee 38133

(901) 213-2400 *A Laboratory Management Partner

Fax (901) 213-2440

Cooler Receipt Form

○ Courier Other : ○ No Not Required ○ No Not Required ○ No No ○ No No
No No No Not Required No
No Not Required No Not Required No Not Required No No No No No No No No No No
No Not Required No
 No No No No No No No No
NoNoNoNoNoNoNo
No No No No No
No No No
○ No ○ No
○ No
○ N
○ No
○ No
○ No
○ No ○ N/A
○ No N/A
○ No N/A
○ No N/A
concentration EnCore samplers (48 hr)
conc pre-weighed vials (Sod Bis -14 d)
No

Any regulatory non-compliance issues will be recorded on non-compliance report.

Signature: Brooke Shoup

Date & Time: 04/12/2013 11:30:52

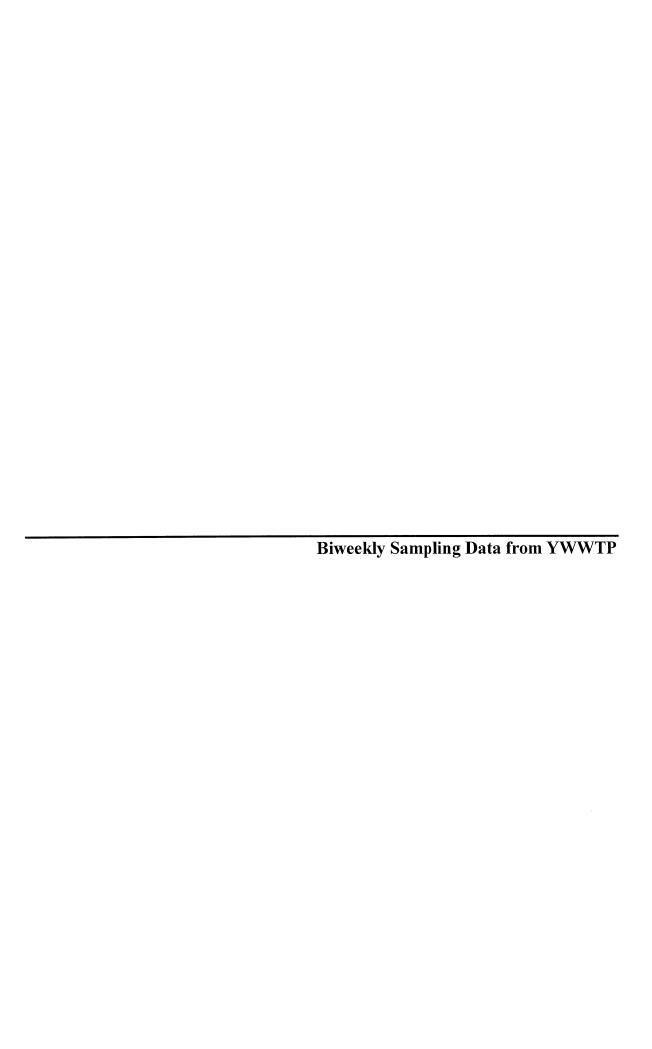
City Of Harrison

Chain of Custody

1508 Silvey Valley Road 1509 Silvey Valley Road 1509 Silvey Valley Road 1500 Silvey Valley Bidge (Downstream) 1500 Silvey (Downstream) 1500 Sil	1508 Harri Harri 1508 870- 870- CRO CRO CRO 6.45am 6.45am 6.45am 7.00am	(1)				TOT		Croop	on Wastewaler Tre			3322 4-12-2013 1-29-58
Harrison, AR 72601 Harrison, AR 72601 Horizon, AR 72601 Ho	Harri hww 100	(m)				ТОТ			policities sampling	5		90.67
### S70-741-435 ### S70-741-435 ### PUrchase Order ## S70-741-435 ### Purchase Order ## Durchase Or	## ### ###############################	(m)				тот						
Stro-741-4426	870- 870- CRO CRO CRO 	(m)				TC	_	_		9		
### STOCALED CREEK SAAPPLING ### Tim Holt CROOKED CREEK SAAPPLING	870- CRO CRO 6.45am 6.45am 7.00am	(m)				A						
CROOKED CREEK SAMPLING For Tim Holt Monthly Quarterly Semi-Annual Monthly Global Semi-Annual Monthly	6:45am 6:45am 7:00am 7:00am	m) water			***************************************	LD						
Monthly Ouarterly Semi-Annual	6:45am 6:45am 7:00am 7:00am	m) water () water				ISS						
Monthly Quarterly Semi-Annual Three Sample (decilification) Water plastic 1 NONE G X X X CONTROL OF The Sample (Downstream) Water plastic 1 NONE G X X X X CONTROL OF THE	6:45am 6:45am 7:00am 7:00am	Materix m) water) water		0.00 A		OLV			· · · · · · · · · · · · · · · · · · ·			
Time Sample Identification Matrix Type No. Press agreed BT OS DOS 6.45am Silver Valley Bridge (Downstream) water plastic 1 NONE G X X X 7.00am HWY 62-65 Bridge (Upstream) water plastic 1 NONE G X X X X 7.00am WWTP DISCHARGE POINT water plastic 1 NONE G X X X X X X 7.00am WWTP DISCHARGE POINT water plastic 1 NONE G X X X X X X 7.00am WWTP DISCHARGE POINT water plastic 1 NONE G X X X X X X 7.00am WWTP DISCHARGE POINT water plastic 1 NONE G X X X X X X 7.00am WWTP DISCHARGE POINT water plastic 1 NONE G X X X X X X 7.00am WWTP DISCHARGE POINT water plastic 1 NONE G X X X X X X 7.00am WWTP DISCHARGE POINT Water plastic 1 NONE G X X X X X X 7.00am WWTP DISCHARGE POINT Water plastic 1 NONE G X X X X X X 7.00am WWTP DISCHARGE POINT Water plastic 1 NONE G X X X X X X 7.00am WWTP DISCHARGE POINT Water plastic 1 NONE G X X X X X X 7.00am WWTP DISCHARGE POINT Water plastic 1 NONE G X X X X X X X 7.00am WWTP DISCHARGE POINT Water plastic 1 NONE G X X X X X X X X 7.00am WWTP DISCHARGE POINT Water plastic 1 NONE G X X X X X X X X X X X X X X X X X X	6:45am 6:45am 7:00am	m) water water				-	CH.					
Trine Sample identification Mater plastic I NONE G X X X X 30am HWY 62-65 Bridge (Upstream) water plastic I NONE G X X X X 7:30am WWTP DISCHARGE POINT water plastic I NONE G X X X X X X 7:30am WWTP DISCHARGE POINT water plastic I NONE G X X X X X X X 7:30am WWTP DISCHARGE POINT water plastic I NONE G X X X X X X X X 7:30am WWTP DISCHARGE POINT water plastic I NONE G X X X X X X X 7:30am WWTP DISCHARGE POINT water plastic I NONE G X X X X X X X 7:30am WWTP DISCHARGE POINT water plastic I NONE G X X X X X X X 8:40am WWTP DISCHARGE POINT water plastic I NONE G X X X X X X X 8:40am WWTP DISCHARGE POINT water plastic I NONE G X X X X X X X 8:40am WWTP DISCHARGE POINT water plastic I NONE G X X X X X X X 8:40am WWTP DISCHARGE POINT Water Plastic I NONE G X X X X X X X 8:40am WWTP DISCHARGE POINT Water Plastic I NONE G X X X X X X X 8:40am WWTP DISCHARGE POINT Water Plastic I NONE G X X X X X X X X 8:40am WWTP DISCHARGE POINT WATER Plastic I NONE G X X X X X X X X X X X X X X X X X X	6.45am 6.45am 7:30am 7:00am	Matrix water water		1000			LOF					
6.45am Silver Valley Bridge (Downstream) water plastic I NONE G X X X X 7.00am HWY 62-65 Bridge (Upstream) water plastic I NONE G X X X X X X X 7.00am WWTP DISCHARGE POINT water plastic I NONE G X X X X X X X X X X X X X X X X X X	6:45am 7:30am 7:00am	water water	plastic	NONE			NDE	NO3	N02			
30am HWY 62-65 Bridge (Upstream) water plastic 1 NONE G X X X X X X X X X X X X X X X X X X	7:30am 7:00am	water	plastic 1	NONE	-	-	×					- 12
HWY 62-65 Bridge (Upstream) water plastic 1 NONE G X X X X X 7:00am WWTP DISCHARGE POINT water plastic 1 NONE G X X X X X X 7:00am WWTP DISCHARGE POINT water plastic 1 NONE G X X X X X X 7:00am WWTP DISCHARGE POINT water plastic 1 NONE G X X X X X X 7:00am WWTP DISCHARGE POINT water plastic 1 NONE G X X X X X X 7:00am WWTP DISCHARGE POINT water plastic 1 NONE G X X X X X X 7:00am WWTP DISCHARGE POINT water plastic 1 NONE G X X X X X X 7:00am WWTP DISCHARGE POINT water plastic 1 NONE G X X X X X X 7:00am WWTP DISCHARGE POINT water plastic 1 NONE G X X X X X X X 7:00am WWTP DISCHARGE POINT water plastic 1 NONE G X X X X X X X X 7:00am WWTP DISCHARGE POINT Water Plastic 1 NONE G X X X X X X X X X 7:00am WWTP DISCHARGE POINT Water Plastic 1 NONE G X X X X X X X X X X X 7:00am WWTP DISCHARGE POINT Water Plastic 1 NONE G X X X X X X X X X X X X X X X X X X	7:30am 7:00am	water	plastic	NONE								27
HWY 62-65 Bridge (Upstream) water plastic 1 NONE G X X X X X 7:00am WWTP DISCHARGE POINT water plastic 1 NONE G X X X X X X 7:00am WWTP DISCHARGE POINT water plastic 1 NONE G X X X X X 7:00am WWTP DISCHARGE POINT water plastic 1 NONE G X X X X X 7:00am WWTP DISCHARGE POINT water plastic 1 NONE G X X X X X 7:00am WWTP DISCHARGE POINT water plastic 1 NONE G X X X X X 7:00am WWTP DISCHARGE POINT NONE G X X X X X 7:00am WWTP DISCHARGE POINT None Matrix 7:00am WWTP DISCHARGE POINT Water None Matrix 7:00am WWTP DISCHARGE POINT Water None Matrix 7:00am WWTP DISCHARGE POINT	7:30am 7:00am	water	plastic 1	NONE	И							
7:00am WWTP DISCHARGE POINT water plastic I NONE G X X X X X X X X X X X X X X X X X X	7:00аш	100		The Street of th	-	-	×				İ	-
7:00am WWTP DISCHARGE POINT water plastic I NONE G X X X X X X X X X X X X X X X X X X	7:00am				i i							
(1) Nitric Acid(NH03) (2) Hydrochloric Acid(HCL) sulfste(Na28203) (4) Sodium Hydroxide(Na03) (Sign) Tim Holt/City of Harrison Rec'd Date / Time: (1) — (2) — (2) — (2) — (3) — (3) — (4)	nigon./				_	-						Ř
(1) Nitric Acid(NH03) (2)Hydrochloric Acid(HCL) Sulfate(Na52203) (4) Sodium Hydroxide(Na03) Sisted Dis (Sign) Tim HolVCity of Harrison Tim HolVCity of Harrison Rec'd Date / Time:		water	piastic	NONE	_	+	×	×	×		-	+
(1) Nitric Acid(NH03) (2)Hydrochloric Acid(HCL) Sulfate(Na52203) (4) Sodium Hydroxide(Na03) USified Dis (Sign) Tim Holt/City of Harrison A-11-2013/9:00am Rec'd Date / Time:												+
(1) Nitric Acid(NH03) (2)Hydrochloric Acid(HCL) Sulfate(Na25203) (4) Sodium Hydroxide(Na03) (Sign) Tim Holl/City of Harrison Rec'd Date / Time A-11-2013/9:00am Rec'd Date / Time:					+	-						
ushed By (Sign) Tim HolVCity of Harrison 4-11-2013/9:00am Rec'd Date / Time Rec'd Date / Time Comments:					+	_						
Ished Di Signi Tim Holl/City of Harrison 4-11-2013/9:00am A Rec'd Date / Time: (1-1) - Comments	Preservatives: (1) Nitric Acid(NH03) (2)Hydrochloric Acid(HC (3) Sodium Thiosulfete(Na2S203) (4) Sodium Hydroxide(Na03)	3	marks/Commen	ıts:	1	-						
Hold Tim Hold City of Harrison 4-11-2013/9:00am EXCOCAL	Relinquished By (Sgn) Print Nat	H . 4	1	Date / Tim	•		180	river	By (Sign)	4	it Name	Company
RACIONA DATE / Time: Unit 12 DOLID		City of Harris		1-2013/9:)0am	4	R	0	3			
REC'd Date / Time: U - 12 DOI'D								1	>			
	Rec'd as Lab By: PHOT A	Rec'd Dat	e / Time:	7	4	K	1	F	omments.			

 s

|--|





"A Laboratory Management Partner"

2790 Whitten Road

Memphis, Tennessee 38133

(901) 213-2400

10/1/2012

Harrison Wastewater Treatment Plant Ms. Kathryn Catlin PO Box 1715 Harrison, AR, 72601

Ref:

Analytical Testing

ETC Report Number: 12-269-0231

Client Project Description: Yellville Sampling

Dear Ms. Kathryn Catlin:

Environmental Testing and Consulting, Inc. received sample(s) on 9/25/2012 for the analyses presented in the following report.

The above referenced project has been analyzed per your instructions. The analyses were performed in accordance with the applicable analytical method.

The analytical data has been validated using standard quality control measures performed as required by the analytical method. Quality Assurance, method validations, instrumentation maintenance and calibration for all parameters (NELAP and non-NELAP) were performed in accordance with guidelines established by the USEPA and NELAC unless otherwise indicated. Any parameter for which the laboratory is not officially NELAP accredited is indicated by a '~' symbol. These are not included in the scope because NELAP accreditation is either not available or has not been applied for. Additional certifications may be held/are available for parameters, where NELAP accreditation is not required or applicable. A full list of certifications is available upon request.

The results are shown on the attached Report of Analysis(s). Results for solid matrices are reported on an asreceived basis unless otherwise indicated. This report shall not be reproduced except in full and relates only to the samples included in this report.

Please do not hesitate to contact me or client services if you have any questions or need additional information.

Sincerely,

Randy Thomas

Rendell H. Thomas

Project Manager

Laboratory's liability in any claim relating to analyses performed shall be limited to, at laboratory's option, repeating the analysis in question at laboratory's expense, or the refund of the charges paid for performance of said analysis.



2790 Whitten Road

(901) 213-2400

Fax (901) 213-2440

"A Laboratory Management Partner"

03322

Harrison Wastewater Treatment Plant

Ms. Kathryn Catlin

PO Box 1715

Harrison, AR 72601

Project

Yellville Sampling

Information:

Report Date: 10/1/2012

Report Number : 12-269-0231

REPORT OF ANALYSIS

Received: 9/25/2012

Lab No:

97268

Sample ID: WWTP Effluent

Matrix: Aqueous

Sampled: 9/24/2012 9:00

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
 Chloride	36.9	mg/L	0.400	1	09/25/12 21:49	RQE	EPA-300.0
Total Dissolved Solids	328	mg/L	10	1	09/28/12 14:00	NRT	2540C
Sulfate	23.1	mg/L	1.00	1	09/25/12 21:49	RQE	EPA-300.0

Qualifiers/ **Definitions**

MQL

Outside QC limit

Method Quantitation Limit

DF





"A Laboratory Management Partner"

2790 Whitten Road

Memphis, Tennessee 38133

(901) 213-2400

Fax (901) 213-2440

Cooler Receipt Form

Customer Number: 03322

Customer Name: Harrison Wastewater Treatment Plant

Report Number:

12-269-0231

Shipping Method							
Lab	O Courier	Other:					
Yes	○ No						
O Yes	○ No	Not Required					
O Yes	○ No	Not Required					
Yes	○ No						
Yes	○ No						
Yes	○ No						
Yes	○ No						
Yes	○ No						
Yes	○ No						
Yes	○ No						
Yes	○ No						
Yes	○ No						
Yes	○ No	○ N/A					
O Yes	○ No	● N/A					
O Yes	○ No	N/A					
O Yes	○ No	N/A					
Low	concentration EnC	ore samplers (48 hr)					
d) Low	conc pre-weighed	vials (Sod Bis -14 d)					
O Yes	No						
II be recorde	d on non-complian	ce report.					
	Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes	Lab Courier Yes No Low concentration EnC d) Low conc pre-weighed Yes No	Lab Courier Other: Yes No Not Required Yes No Not Required Yes No Not Required Yes No Not Required Yes No Yes Yes No No N/A Yes No No N/A Yes No No N/A Low concentration EnCore samplers (48 hr) do Low conc pre-weighed vials (Sod Bis -14 d)				

Signature: Brooke Shoup

Date & Time: 09/25/2012 10:21:07



Environmental Testing & Consulting, Inc. 2790 Whitten Road Memphis, Tennessee 38133 (901) 213-2400 Fax (901) 213-2440

RUSH ICE

FID Number

and Plant 20				
0000015984	20:48			
Company Name Harrison Wastewater Treatment Plant		Custor	ner Number	Tolomb
Site Name	Project Com	03322		Telephone (870) 741-5527
Yellville Sampling Project	. roject con	iment		
Harrison - Bi-weekly	Project Num	iber	PO Number	
Project Manager / Contact Mr. Tim Holt		E-mail	windstream.net	

Sample ID	Container Type	Collected Date / Time	Cont	Preservative	Grab / Comp	Matrix	Analyses
Upstream	Plastic Pint	NO WATER	1	NONE	6	Aqueous	SO4/TDS/CI
Downstream	Plastic - Pint	NUMTTE	1	NONE	6	Aqueous	SO4/TDS/CI
NWTP Effluerit	Plastic - Pint	9-24-20/2 9-00/1/m	1	NONE	12	Aqueous	SO4/TDS/CI

Method of Shipment UPS - ICED 1027	Blank / Cooler Camperature	
Date / Time	Received By (sign)	Date / Time
Date / Time	Received By (sign)	Date / Time
Date / Time	Received by Lab (sign)	Date/Time
	Date / Time Date / Time	Date / Time Received By (sign) Date / Time Received By (sign)



"A Laboratory Management Partner

2790 Whitten Road

Memphis, Tennessee 38133

(901) 213-2400

10/16/2012

Harrison Wastewater Treatment Plant Ms. Kathryn Catlin PO Box 1715 Harrison, AR, 72601

Ref:

Analytical Testing

ETC Report Number: 12-283-0212

Client Project Description: Yellville Sampling

Dear Ms. Kathryn Catlin:

Environmental Testing and Consulting, Inc. received sample(s) on 10/9/2012 for the analyses presented in the following report.

The above referenced project has been analyzed per your instructions. The analyses were performed in accordance with the applicable analytical method.

The analytical data has been validated using standard quality control measures performed as required by the analytical method. Quality Assurance, method validations, instrumentation maintenance and calibration for all parameters (NELAP and non-NELAP) were performed in accordance with guidelines established by the USEPA and NELAC unless otherwise indicated. Any parameter for which the laboratory is not officially NELAP accredited is indicated by a '~' symbol. These are not included in the scope because NELAP accreditation is either not available or has not been applied for. Additional certifications may be held/are available for parameters, where NELAP accreditation is not required or applicable. A full list of certifications is available upon request.

The results are shown on the attached Report of Analysis(s). Results for solid matrices are reported on an asreceived basis unless otherwise indicated. This report shall not be reproduced except in full and relates only to the samples included in this report.

Please do not hesitate to contact me or client services if you have any questions or need additional information.

Sincerely,

Randy Thomas Project Manager

Rendell H. Thomas

Laboratory's liability in any claim relating to analyses performed shall be limited to, at laboratory's option, repeating the analysis in question at laboratory's expense, or the refund of the charges paid for performance of said analysis.

#TN00012

Kentucky UST #41



2790 Whitten Road

Memphis, Tennessee 38133

(901) 213-2400

Fax (901) 213-2440

A Laboratory Management Partner

03322

Harrison Wastewater Treatment Plant

Ms. Kathryn Catlin

PO Box 1715

Harrison , AR 72601

Project

Yellville Sampling

Information:

Report Date: 10/16/2012

Report Number : 12-283-0212

REPORT OF ANALYSIS

Received: 10/9/2012

Lab No:

89151

Sample ID: WWTP Discharge Point

Matrix: Aqueous

Sampled: 10/8/2012 9:00

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Chloride	38.6	mg/L	0.400	1	10/10/12 19:23	RQE	EPA-300.0
Total Dissolved Solids	347	mg/L	10	1	10/12/12 14:20	NRT	2540C
Sulfate	19.0	mg/L	1.00	1	10/10/12 19:23	RQE	EPA-300.0





2790 Whitten Road

Memphis, Tennessee 38133

(901) 213-2400

Fax (901) 213-2440

A Laboratory Management Partner

Cooler Receipt Form

Customer Number: 03322 Customer Name: Harrison Wastewater Treatm Report Number: 12-283-0212	ent Plant		
(oportition)	ng Method		
Fed Ex UPS US Postal Client	◯ Lab	Ourier (Other:
Shipping container/cooler uncompromised?	Yes	○ No	
Custody seals intact on shipping container/cooler?	O Yes	○ No	Not Required
Custody seals intact on sample bottles?	O Yes	○ No	Not Required
Chain of Custody (COC) present?	Yes	○ No	
COC agrees with sample label(s)?	Yes	○ No	
COC properly completed	Yes	○ No	
Samples in proper containers?	Yes	○ No	
Sample containers intact?	Yes	○ No	
Sufficient sample volume for indicated test(s)?	Yes	○ No	
All samples received within holding time?	Yes	○ No	
Cooler temperature in compliance?	Yes	○ No	
Cooler/Samples arrived at the laboratory on ice. Samples were considered acceptable as cooling process had begun.	Yes	○ No	
Water - Sample containers properly preserved	Yes	○ No	○ N/A
Water - VOA vials free of headspace	O Yes	○ No	● N/A
Trip Blanks received with VOAs	O Yes	○ No	● N/A
Soil VOA method 5035 – compliance criteria met	O Yes	○ No	● N/A
High concentration container (48 hr)	Low	concentration EnC	ore samplers (48 hr)
High concentration pre-weighed (methanol -14	d) Low	conc pre-weighed	vials (Sod Bis -14 d)
Special precautions or instructions included?	O Yes	No	
Comments:			

Any regulatory non-compliance issues will be recorded on non-compliance report.

Signature: Rebekah Ross

Date & Time: 10/09/2012 09:49:59



2790 Whitten Road

Memphis. Tennessee 38133 (901) 213-2400 Fax (901) 213-2440



Yellville Sampling

12-283-0212 03322 2012-10-09

ICE RUSH Telephone **Customer Number** Company Name (870) 741-5527 03322 Harrison Wastewater Treatment Plant FID Number **Project Comment** Site Name Every 2 Weeks Yellville Sampling PO Number Project Number Project Harrison - Bi-weekly E-mail Project Manager / Contact hwwtp2@windstream.net City of YellvilleC/O Mr. Stuart Oxford

Grab Collected Date Analyses Container Matrix Preservative Sample ID Time Cont Type Comp SO4/TDS/CI NONE G Aqueous 1 Plastic - Pint Upstream 504/TD5/CI Aqueous NONE G 1 Plastic - Pint Downstream 10-8 2012 SO4/TDS/CI Aqueous G 1 NONE Plastic - Pint WWTP Efficient 9 aun **UPS Return Label** Aqueous NONE 1 NA UPS Next Day Label

STUART OXFORD	Method of Shipment UPS TUP METION	Blank / Cooler Temperature	
Relinquished By (sign)		Received By (sign)	Date / Time
Relinquished By (sign)	Date / Time	Received By (sign)	Date / Time
Relinquished By (sign)	Date / Time	Received by Lab (sign)	(0/9 Q-0930



2790 Whitten Road

Memphis, Tennessee 38133 "A Laboratory Management Partner"

(901) 213-2400

Fax (901) 213-2440

10/29/2012

Harrison Wastewater Treatment Plant Ms. Kathryn Catlin PO Box 1715 Harrison, AR, 72601

Ref:

Analytical Testing

ETC Report Number: 12-296-0259

Client Project Description: Yellville Sampling

Dear Ms. Kathryn Catlin:

Environmental Testing and Consulting, Inc. received sample(s) on 10/22/2012 for the analyses presented in the following report.

The above referenced project has been analyzed per your instructions. The analyses were performed in accordance with the applicable analytical method.

The analytical data has been validated using standard quality control measures performed as required by the analytical method. Quality Assurance, method validations, instrumentation maintenance and calibration for all parameters (NELAP and non-NELAP) were performed in accordance with guidelines established by the USEPA and NELAC unless otherwise indicated. Any parameter for which the laboratory is not officially NELAP accredited is indicated by a '~' symbol. These are not included in the scope because NELAP accreditation is either not available or has not been applied for. Additional certifications may be held/are available for parameters, where NELAP accreditation is not required or applicable. A full list of certifications is available upon request.

The results are shown on the attached Report of Analysis(s). Results for solid matrices are reported on an asreceived basis unless otherwise indicated. This report shall not be reproduced except in full and relates only to the samples included in this report.

Please do not hesitate to contact me or client services if you have any questions or need additional information.

Sincerely,

Randy Thomas Project Manager

Rendell H. Thomas

Laboratory's liability in any claim relating to analyses performed shall be limited to, at laboratory's option, repeating the analysis in question at laboratory's expense, or the refund of the charges paid for performance of said analysis.



Initiated By: Rebekah Ross



2790 Whitten Road

Memphis, Tennessee 38133

(901) 213-2400

Fax (901) 213-2440

Non-Compliance Login Summary Report

Tu side ut Date.	10 22 2012 12:51 pm		
Incident Date:	10-22-2012 12:51 pm	01247 01240	
Report number:	12-296-0259 Lab Number(s):	91347-91348	
Customer number:	03322		
Customer Name:	Harrison Wastewater Treatment Plant		
Contact Name:	Harrison Wastewater Treatment P		
Project ID:	Harrison - Bi-weekly		
means that the data gener	rated from the analysis of this project may not	otocol was not followed for the above referenced sample(be suitable for Regulatory compliance. gency. The actual problems encountered are listed below	
	Description of Login I	Non-Compliance	
✓ Sample Tempera	ture Non-compliant		
Cooler Tempera	ature: 14 degrees Celsius		
Required Tempera	ature: 2-6 degrees Celsius		
Sample Received	in Improper Container		
Ana	alysis:		
Received Conta	ainer:		
Required Conta	ainer:		
Sample Imprope	rly Preserved		
	alysis:		
Received Preserv			
Required Preserv			
		- L. D	
-		ate Received: 10-22-2012 00:00	
	alysis:		
Sampled Date and			
Required Holding	Time:		
Other:			
	Corrective	Action	
Client Notified: Yes	No Date Client Notified: 10/22/12	Contact Name: Kathryn Catlin	
Client Directive:			
Approval to analyze samples p	er Kathryn Catlin.		

Project manager: Randall Thomas

QAO: Richard Medina



2790 Whitten Road

Memphis, Tennessee 38133

(901) 213-2400

Fax (901) 213-2440

A Laboratory Management Partner

03322

Harrison Wastewater Treatment Plant

Ms. Kathryn Catlin PO Box 1715

Harrison, AR 72601

Project

Yellville Sampling

Information:

Report Date: 10/29/2012

Report Number : 12-296-0259

REPORT OF ANALYSIS

Received: 10/22/2012

Lab No: **91347**

Sample ID : Upstream

Matrix: **Aqueous**

Sampled: 10/19/2012 9:00

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Chloride	8.63	mg/L	0.400	1	10/25/12 20:53	RQE	EPA-300.0
Total Dissolved Solids	179	mg/L	10	1	10/24/12 14:30	NRT	2540C
Sulfate	7.78	mg/L	1.00	1	10/25/12 20:53	RQE	EPA-300.0

Lab No:

91348

Sample ID: WWTP Effluent

Matrix: Aqueous

Sampled: 10/19/2012 8:45

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Chloride	28.9	mg/L	0.400	1	10/25/12 21:11	RQE	EPA-300.0
Total Dissolved Solids	307	mg/L	10	1	10/24/12 14:30	NRT	2540C
Sulfate	21.7	mg/L	1.00	1	10/25/12 21:11	RQE	EPA-300.0

Qualifiers/ Definitions * MQL Outside QC limit

Method Quantitation Limit

DF





2790 Whitten Road

Memphis, Tennessee 38133

(901) 213-240

Fax (901) 213-2440

A Laboratory Management Partner

Cooler Receipt Form Customer Number: 03322

Customer Name: Harrison Wastewater Treatment Plant

Report Number: 12-296-0259

Shipping Method

	Отпррп	19 11101110		
○ Fed Ex	UPS US Postal Client	Lab	Ourier (Other:
Shipping conta	iner/cooler uncompromised?	Yes	○ No	
Custody seals	intact on shipping container/cooler?	O Yes	○ No	Not Required
Custody seals	intact on sample bottles?	O Yes	○ No	Not Required
Chain of Custo	dy (COC) present?	Yes	○ No	
COC agrees w	rith sample label(s)?	Yes	○ No	
COC properly	completed	Yes	○ No	
Samples in pro	oper containers?	Yes	○ No	
Sample contain	ners intact?	Yes	○ No	
Sufficient samp	ple volume for indicated test(s)?	Yes	○ No	
All samples red	ceived within holding time?	Yes	○ No	
Cooler temper	ature in compliance?	O Yes	● No	
Cooler/Sample Samples were process had be	es arrived at the laboratory on ice. considered acceptable as cooling egun.	Yes	○ No	
Water - Sampl	le containers properly preserved	Yes	○ No	○ N/A
Water - VOA v	rials free of headspace	O Yes	○ No	● N/A
Trip Blanks red	ceived with VOAs	O Yes	○ No	N/A
Soil VOA meth	nod 5035 – compliance criteria met	O Yes	○ No	N/A
High conce	entration container (48 hr)	Low	concentration EnC	ore samplers (48 hr)
High conce	entration pre-weighed (methanol -14	d) Low	conc pre-weighed	vials (Sod Bis -14 d)
Special precar	utions or instructions included?	O Yes	No	
Comments:	Cooler temp = 14 degrees C upon r	eceipt.		

Any regulatory non-compliance issues will be recorded on non-compliance repor

Signature: Rebekah Ross

Date & Time: 10/22/2012 10:32:53



2790 Whitten Road

Memphis, Tennessee 38133 (901) 213-2400 Fax (901) 213-2440

Hamson Wastewater Treatment Plant	

Yellville Sampling

12-296-0259 03922 2012-10-22

Company Name Harrison Wastewater Treatme		Customer Number 03322 Project Comment Every 2 Weeks		Telephone (870) 741-5527		RUSH	ICE		
Site Name Yellville Sampling	-						FID No	FID Number	
Project Harrison - Bi-weekly		Project Number PO Number						erenen se ^{0lene i} e	
Project Manager / Con City of YellvilleC/O Mr. Stu				-mail wwtp2@winc	İstream net				
Sample ID	Container Type	Collected Date Time	/ # Cont	Preserva	Gra ative /		Matrix	Analyses	
Upstream	Plastic - Pint	10-19-200 9:00 Am	1	NON	E G		Aqueous	SO4/TDS/C	I
Downstream	Plastic - Pint	NO	1	NON	E G		Aqueous	5O4/TDS/C	3
WWTP Effluent	Plastic - Pint	10-19-20 8:45 Am	1	NON	E G	i	Aqueous	SO4/TDS/C	1
UPS Next Day Label	NA	And the second s	1	иои	E		Aqueous	UPS Return La	bel

Approval to analyze per K. Catlin.

Sampled By STUART OXFORD	Method of Shipment UPS NexT day	Blank / Cooler Temperature	
Relinquished By (sign)	Date / Time	Received By (sign)	Date / Time
Relinquished By (sign)	Date / Time	Received By (sign)	Date / Time
Relinquished By (sign)	Date / Time	Received by Lab (sign)	Date / Time



2790 Whitten Road

Memphis, Tennessee 38133 "A Laboratory Management Partner"

(901) 213-2400

Fax (901) 213-2440

11/13/2012

Harrison Wastewater Treatment Plant Ms. Kathryn Catlin PO Box 1715 Harrison, AR, 72601

Ref:

Analytical Testing

ETC Report Number: 12-311-0215

Client Project Description: Yellville Sampling

Dear Ms. Kathryn Catlin:

Environmental Testing and Consulting, Inc. received sample(s) on 11/6/2012 for the analyses presented in the following report.

The above referenced project has been analyzed per your instructions. The analyses were performed in accordance with the applicable analytical method.

The analytical data has been validated using standard quality control measures performed as required by the analytical method. Quality Assurance, method validations, instrumentation maintenance and calibration for all parameters (NELAP and non-NELAP) were performed in accordance with guidelines established by the USEPA and NELAC unless otherwise indicated. Any parameter for which the laboratory is not officially NELAP accredited is indicated by a '~' symbol. These are not included in the scope because NELAP accreditation is either not available or has not been applied for. Additional certifications may be held/are available for parameters, where NELAP accreditation is not required or applicable. A full list of certifications is available upon request.

The results are shown on the attached Report of Analysis(s). Results for solid matrices are reported on an asreceived basis unless otherwise indicated. This report shall not be reproduced except in full and relates only to the samples included in this report.

Please do not hesitate to contact me or client services if you have any questions or need additional information.

Sincerely,

Randy Thomas Project Manager

Rendell H. Thomas

Laboratory's liability in any claim relating to analyses performed shall be limited to, at laboratory's option, repeating the analysis in question at laboratory's expense, or the refund of the charges paid for performance of said analysis.



2790 Whitten Road

Memphis, Tennessee 38133

(901) 213-2400

Fax (901) 213-2440

"A Laboratory Management Partner"

03322

Harrison Wastewater Treatment Plant

Ms. Kathryn Catlin

PO Box 1715

Harrison, AR 72601

Project

Yellville Sampling

Information:

Report Date: 11/13/2012

Report Number: 12-311-0215

REPORT OF ANALYSIS

Received: 11/6/2012

Lab No : 93875

Sample ID : WWTP Effluent

Matrix: Aqueous

Sampled: 11/5/2012 8:30

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Chloride	39.3	mg/L	0.400	1	11/06/12 13:43	RQE	EPA-300.0
Total Dissolved Solids	254	mg/L	10	1	11/08/12 08:00	NRT	2540C
Sulfate	20.2	mg/L	1.00	1	11/06/12 13:43	RQE	EPA-300.0

MQL



2790 Whitten Road

Memphis, Tennessee 38133

(901) 213-2400

Fax (901) 213-2440

"A Laboratory Management Partner"

Cooler Receipt Form

Customer Number: 03322

Customer Name: Harrison Wastewater Treatment Plant

Report Number: 12-311-0215

Shipping Method

UPS US Postal Clien	nt C Lab	O Courier	Other:
niner/cooler uncompromised?	Yes	○ No	
intact on shipping container/cooler	? O Yes	○ No	Not Required
intact on sample bottles?	O Yes	○ No	Not Required
ody (COC) present?	Yes	○ No	
vith sample label(s)?	Yes	○ No	
completed	Yes	○ No	
oper containers?	Yes	○ No	
ners intact?	Yes	○ No	
ple volume for indicated test(s)?	Yes	○ No	
ceived within holding time?	Yes	○ No	
ature in compliance?	Yes	○ No	20070-00-01-0019-00-00-01
es arrived at the laboratory on ice. considered acceptable as cooling egun.	Yes	○ No	
le containers properly preserved	Yes	○ No	○ N/A
vials free of headspace	○ Yes	○ No	● N/A
ceived with VOAs	O Yes	No	N/A
nod 5035 – compliance criteria met	O Yes	○ No	N/A
entration container (48 hr)	Low	concentration EnC	Core samplers (48 hr)
entration pre-weighed (methanol -1	4 d) Low (conc pre-weighed	vials (Sod Bis -14 d)
utions or instructions included?	O Yes	No	
	intact on shipping container/cooler intact on sample bottles? ody (COC) present? oth sample label(s)? completed oper containers? ners intact? ple volume for indicated test(s)? ceived within holding time? ature in compliance? es arrived at the laboratory on ice. considered acceptable as cooling egun. le containers properly preserved vials free of headspace ceived with VOAs and 5035 – compliance criteria metentration container (48 hr) entration pre-weighed (methanol -14)	intact on shipping container/cooler? intact on sample bottles? ody (COC) present? oth sample label(s)? completed oper containers? ners intact? ple volume for indicated test(s)? ceived within holding time? ature in compliance? es arrived at the laboratory on ice. considered acceptable as cooling egun. le containers properly preserved vials free of headspace ceived with VOAs results free of headspace ceived with VOAs results free of headspace ceived with VOAs results free of headspace ceived with VOAs results free of headspace ceived with VOAs results free of headspace ceived with VOAs results free of headspace ceived with VOAs results free of headspace ceived with VOAs results free of headspace ceived with VOAs results free of headspace ceived with VOAs results free of headspace ceived with VOAs results free of headspace ceived with VOAs results free of headspace ceived with VOAs results free of headspace ceived with VOAs results free of headspace ceived with VOAs results free of headspace ceived with VOAs results free of headspace results	intact on shipping container/cooler? Yes No intact on sample bottles? Yes No intact on sample bottles? Yes No intact on sample bottles? Yes No intact on sample bottles? Yes No intact on sample bottles? Yes No intact on sample bottles? Yes No intact on sample bottles? Yes No intact on sample bottles? Yes No intact on sample bottles? Yes No completed Yes No oper containers? Yes No inters intact? Yes No inters intact? Yes No inters intact? Yes No ceived within holding time? Yes No inters in compliance? Yes No inters inters properly preserved Yes No intact on sample bottles? Yes No inters intact? Yes No inters int

Any regulatory non-compliance issues will be recorded on non-compliance report.

Signature: Rebekah Ross

Date & Time: 11/06/2012 10:23:07



2790 Whitten Road Memphis, Tennessee 38133 (901) 213-2400 Fax (901) 213-2440



Yellville Sampling

12-311-0215 03322 2012-11-**0**6 10:22 13

Company Name Harrison Wastewater Tres	atment Plant			istomer Numbe 322		Felephone 870) 741-5527	RUSH	ICE
Site Name Yellville Sampling		Project Comment Every 2 Weeks						imber
Project Harrison - Bi-weekly		Project N	umber	PO Nur	nber			
Project Manager / C		•		mail wtp2@windstream	net			
Sample ID	Container Type	Collected Date /	# Cont	Preservative	Grab / Comp	Matrix	Analyses	
Upstream	Plastic - Pint	Water	1	NONE	G	Aqueous	SO4/TDS/C	ı
Downstream	Plastic - Pint	No	1	NONE	G	Aquéous	SO4/TDS/C	1
WWTP Effluent	Plastic - Pint	11-5-2012 830 AM	1	NONE	G	Aqueous	SO4/TDS/C	1
UPS Next Day Label	ŃΑ		1	NONE		Aqueous	UPS Return La	abel

Sampled By STUART OXFord	Method of Shipment	Blank / Cooler Temperature	
Relinquished By (sign)	Date / Time 1/-5-20R 9:30 Am.	Received By (sign)	Date / Time
Relinquished By (sign)	Date / Time	Received By (sign)	Date / Time
Relinquished By (sign)	Date / Time	Received by tab (sign)	Date / Time



2790 Whitten Road

Memphis, Tennessee 38133 "A Laboratory Management Partner

(901) 213-2400

11/30/2012

Harrison Wastewater Treatment Plant Ms. Kathryn Catlin PO Box 1715 Harrison, AR, 72601

Ref:

Analytical Testing

ETC Report Number: 12-325-0213

Client Project Description: Yellville Sampling

Dear Ms. Kathryn Catlin:

Environmental Testing and Consulting, Inc. received sample(s) on 11/20/2012 for the analyses presented in the following report.

The above referenced project has been analyzed per your instructions. The analyses were performed in accordance with the applicable analytical method.

The analytical data has been validated using standard quality control measures performed as required by the analytical method. Quality Assurance, method validations, instrumentation maintenance and calibration for all parameters (NELAP and non-NELAP) were performed in accordance with guidelines established by the USEPA and NELAC unless otherwise indicated. Any parameter for which the laboratory is not officially NELAP accredited is indicated by a '~' symbol. These are not included in the scope because NELAP accreditation is either not available or has not been applied for. Additional certifications may be held/are available for parameters, where NELAP accreditation is not required or applicable. A full list of certifications is available upon request.

The results are shown on the attached Report of Analysis(s). Results for solid matrices are reported on an asreceived basis unless otherwise indicated. This report shall not be reproduced except in full and relates only to the samples included in this report.

Please do not hesitate to contact me or client services if you have any questions or need additional information.

Sincerely,

Randy Thomas Project Manager

Rendell H. Thomas

Laboratory's liability in any claim relating to analyses performed shall be limited to, at laboratory's option, repeating the analysis in question at laboratory's expense, or the refund of the charges paid for performance of said analysis.



2790 Whitten Road

Memphis, Tennessee 38133

(901) 213-2400

Fax (901) 213-2440

"A Laboratory Management Partner"

03322

Harrison Wastewater Treatment Plant

Ms. Kathryn Catlin

Harrison, AR 72601

PO Box 1715

Project

Yellville Sampling

Information:

Report Date: 11/30/2012

Report Number: 12-325-0213

REPORT OF ANALYSIS

Received: 11/20/2012

Lab No: 96553

Sample ID: WWTP Effluent

Matrix: Aqueous

Sampled: 11/19/2012 9:15

Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
181	mg/L	1	1	11/28/12 11:05	EWB	2320B
39.2	mg/L	0.400	1	11/27/12 23:34	RQE	EPA-300.0
293	mg/L	10	1	11/26/12 14:30	NRT	2540C
44.6	mg/L	0.100	1	11/29/12 01:16	BKN	EPA-200.7
18.0	mg/L	0.100	1	11/29/12 01:16	BKN	EPA-200.7
7.82	mg/L	0.100	1	11/30/12 12:01	JTR	EPA-200.7
25.1	mg/L	0.500	1	11/29/12 01:16	BKN	EPA-200.7
19.2	mg/L	1.00	1	11/28/12 12:40	RQE	EPA-300.0
	181 39.2 293 44.6 18.0 7.82 25.1	181 mg/L 39.2 mg/L 293 mg/L 44.6 mg/L 18.0 mg/L 7.82 mg/L 25.1 mg/L	181 mg/L 1 39.2 mg/L 0.400 293 mg/L 10 44.6 mg/L 0.100 18.0 mg/L 0.100 7.82 mg/L 0.100 25.1 mg/L 0.500	181 mg/L 1 1 39.2 mg/L 0.400 1 293 mg/L 10 1 44.6 mg/L 0.100 1 18.0 mg/L 0.100 1 7.82 mg/L 0.100 1 25.1 mg/L 0.500 1	Analyzed 181 mg/L 1 1 11/28/12 11:05 39.2 mg/L 0.400 1 11/27/12 23:34 293 mg/L 10 1 11/26/12 14:30 44.6 mg/L 0.100 1 11/29/12 01:16 18.0 mg/L 0.100 1 11/29/12 01:16 7.82 mg/L 0.100 1 11/30/12 12:01 25.1 mg/L 0.500 1 11/29/12 01:16	Analyzed 181 mg/L 1 1 11/28/12 11:05 EWB 39.2 mg/L 0.400 1 11/27/12 23:34 RQE 293 mg/L 10 1 11/26/12 14:30 NRT 44.6 mg/L 0.100 1 11/29/12 01:16 BKN 18.0 mg/L 0.100 1 11/29/12 01:16 BKN 7.82 mg/L 0.100 1 11/30/12 12:01 JTR 25.1 mg/L 0.500 1 11/29/12 01:16 BKN

Qualifiers/ Definitions Outside QC limit

MQL

Method Quantitation Limit

DF

Dilution Factor



A Laboratory Management Partner

2790 Whitten Road

Memphis, Tennessee 38133

(901) 213-2400

Fax (901) 213-2440

Cooler Receipt Form

Customer Number: 03322				
Customer Name: Harrison Wastewater Treatm Report Number: 12-325-0213	ent Plant			
	g Method			
○ Fed Ex ● UPS ○ US Postal Client	_	Courier	Other:	
Shipping container/cooler uncompromised?	Yes	○ No		
Custody seals intact on shipping container/cooler?	O Yes	○ No	Not Required	
Custody seals intact on sample bottles?	O Yes	○ No	Not Required	
Chain of Custody (COC) present?	Yes	○ No		
COC agrees with sample label(s)?	Yes	○ No		
COC properly completed	Yes	○ No		
Samples in proper containers?	Yes	○ No		
Sample containers intact?	Yes	○ No		
Sufficient sample volume for indicated test(s)?	Yes	○ No		
All samples received within holding time?	Yes	○ No		
Cooler temperature in compliance?	Yes	○ No		
Cooler/Samples arrived at the laboratory on ice. Samples were considered acceptable as cooling process had begun.	Yes	○ No		
Water - Sample containers properly preserved	Yes	○ No	○ N/A	
Water - VOA vials free of headspace	O Yes	○ No	● N/A	
Trip Blanks received with VOAs	O Yes	○ No	● N/A	
Soil VOA method 5035 – compliance criteria met	O Yes	○ No	N/A	
High concentration container (48 hr)	Low	concentration EnC	ore samplers (48 hr)	
High concentration pre-weighed (methanol -14	d) Low	conc pre-weighed	vials (Sod Bis -14 d)	
Special precautions or instructions included?	O Yes	No		
Comments:				

Any regulatory non-compliance issues will be recorded on non-compliance report.

Signature: Rebekah Ross

Date & Time: 11/20/2012 09:53:31



Environmental Testing & Consulting, Inc. 2790 Whitten Road Memphis, Tennessee 38133 (901) 213-2400 Fax (901) 213-2440



Yellville Sampling

12-325-0213 03322 2012-11-20 09:53:01

Company Name Jarrison Wastewater Trea	tment Plant			st No	Kit ID 0000018		elephone 870) 741-5527		RUSH	ICE
Site Name Yellville Sampling		Project Comment FID Nur Every 2 Months							ımbe	
Project Harrison - Bi-weekly - Cr	ooked Creek Sampli		ect Number		PO Num	ber		-	,	
Project Manager / C			-	mail vwtp2@w	indstream.1	iet				
Sample ID	Container Type	Collected I	1974 OF	Prese	rvative	Grab / Comp	Matrix		Analyse	5
Upstream	Plastic - Pint	NO	1	N	ONE	G	Aqueous	so	4/TD5/Cl/	'Alk
Upstream	Plastic - Pint	Wate		HNO3 -	Nitric Acid	G	Aqueous	١	Na/K/Ca/N	1g
Downstream	Plastic - Pint	War	er 1	N	ONE	G	Aqueous	so	4/TDS/CI/	'Alk
Downstream	Plastic - Pint	No	er 1	HNO3 -	Nitric Acid	G	Aqueous	١	Na/K/Ca/N	Ag .
WWTP Effluent	Plastic - Pint	11-19-	2012	N	IONE	G	Aqueous	50	04/TDS/ĆI	/Alk
WWTP Effluent	Plastic - Pint		2012-1	HNO3 -	Nitric Acid	G	Aqueous		Na/K/Ca/I	Vig

Sampled By STUART Oxford		Blank / Cooler Temperature	
Relinquished By (sign)	Date / Time 11-19-2012 9:15/9M	Received By (sign)	Date / Time
Relinquished By (sign)	Date / Time	Received By (sign)	Date / Time
Relinquished By (sign)	Date / Time	Received by Lab (sign)	Date / Time



"A Laboratory Management Partner"

2790 Whitten Road

Memphis, Tennessee 38133

(901) 213-2400

12/12/2012

Harrison Wastewater Treatment Plant Ms. Kathryn Catlin PO Box 1715 Harrison, AR, 72601

Ref:

Analytical Testing

ETC Report Number: 12-339-0214

Client Project Description: Yellville Sampling

Dear Ms. Kathryn Catlin:

Environmental Testing and Consulting, Inc. received sample(s) on 12/4/2012 for the analyses presented in the following report.

The above referenced project has been analyzed per your instructions. The analyses were performed in accordance with the applicable analytical method.

The analytical data has been validated using standard quality control measures performed as required by the analytical method. Quality Assurance, method validations, instrumentation maintenance and calibration for all parameters (NELAP and non-NELAP) were performed in accordance with guidelines established by the USEPA and NELAC unless otherwise indicated. Any parameter for which the laboratory is not officially NELAP accredited is indicated by a '~' symbol. These are not included in the scope because NELAP accreditation is either not available or has not been applied for. Additional certifications may be held/are available for parameters, where NELAP accreditation is not required or applicable. A full list of certifications is available upon request.

The results are shown on the attached Report of Analysis(s). Results for solid matrices are reported on an asreceived basis unless otherwise indicated. This report shall not be reproduced except in full and relates only to the samples included in this report.

Please do not hesitate to contact me or client services if you have any questions or need additional information.

Sincerely,

Randy Thomas Project Manager

Rendell H. Thomas

Laboratory's liability in any claim relating to analyses performed shall be limited to, at laboratory's option, repeating the analysis in question at laboratory's expense, or the refund of the charges paid for performance of said analysis.



2790 Whitten Road

Memphis, Tennessee 38133

(901) 213-2400

Fax (901) 213-2440

"A Laboratory Management Partner"

03322

Harrison Wastewater Treatment Plant

Ms. Kathryn Catlin

PO Box 1715

Harrison , AR 72601

Project

Yellville Sampling

Information:

Report Date: 12/12/2012

Report Number: 12-339-0214

REPORT OF ANALYSIS

Received: 12/4/2012

Lab No:

98667

Sample ID : WWTP Discharge Point

Matrix: Aqueous

Sampled: 12/3/2012 8:30

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Chloride	43.1	mg/L	2.00	5	12/11/12 21:38	RQE	EPA-300.0
Total Dissolved Solids	276	mg/L	10	1	12/05/12 13:00	NRT	2540C
Sulfate	18.7	mg/L	1.00	1	12/10/12 18:09	RQE	EPA-300.0

DF



"A Laboratory Management Partner"

2790 Whitten Road

Memphis, Tennessee 38133

(901) 213-2400

Fax (901) 213-2440

Other:

Not Required Not Required

Customer Number: 03322 Customer Name: Harrison Wastewater Treatm Report Number: 12-339-0214	eceipt Form ent Plant	
Shippin	g Method	
○ Fed Ex ● UPS ○ US Postal ○ Client	◯ Lab	O Couri
Shipping container/cooler uncompromised?	Yes	○ No
Custody seals intact on shipping container/cooler?	O Yes	○ No
Custody seals intact on sample bottles?	O Yes	○ No
Chain of Custody (COC) present?	Yes	○ No
COC agrees with sample label(s)?	Yes	○ No
COC properly completed	Yes	○ No
Samples in proper containers?	Yes	○ No
Sample containers intact?	Yes	○ No
Sufficient sample volume for indicated test(s)?	Yes	○ No
All samples received within holding time?	Yes	○ No

N/A Water - Sample containers properly preserved Yes O No Yes No N/A Water - VOA vials free of headspace Yes No N/A Trip Blanks received with VOAs Soil VOA method 5035 - compliance criteria met Yes () No N/A Low concentration EnCore samplers (48 hr) High concentration container (48 hr) Low conc pre-weighed vials (Sod Bis -14 d) High concentration pre-weighed (methanol -14 d)

Yes

Yes

Yes

No

No

No

Special precautions or instructions included? Comments:

Any regulatory non-compliance issues will be recorded on non-compliance report.

Cooler temperature in compliance?

process had begun.

Cooler/Samples arrived at the laboratory on ice.

Samples were considered acceptable as cooling

Signature: Rebekah Ross

Date & Time: 12/04/2012 09:51:56



2790 Whitten Road

Memphis, Tennessee 38133 (901) 213-2400 Fax (901) 213-2440



Hamson Wastewater Trealment Plant Yellville Samolinu

12-339-0214 63322 2012-12-04 09 51 33

Company Name Harrison Wastewater Trea	tment Plant		Cu 033	stomer Numbe		Telephone (870) 741-5527	RUSH	ICE
Site Name		Project Co		nt			FID No	ımber
Yellville Sampling Project Harrison - Bi-weekly - Cre	noked Creek Sampli.	Project N		PO Nu	nber			
Project Manager / C City of YellvilleC/O Mr. S				mail wtp2@windstream	ı.ncı			
Sample ID	Container Type	Collected Date /	# Cont	Preservative	Grab / Comp	Matrix	Analyses	5
Upstream	Plastic - Pint	howater	1	NONE	G	Aqueous	SO4/TDS/C	
Downstream	Plastic - Pint	ho water	1	NONE	G	Aqueous	SO4/TD5/0	3 1
WWTP Effluent	Plastic - Pint	12-3-06/2 12-3-06/2 8:300	1	NONE	G	Aqueous	SO4/TDS/G	CI
UPS Next Day Label	NA		1	NONE		Aqueous	UPS Return L	abel

Sampled By	Method of Shipment	Blank / Cooler Remarks	
STUART OXFORD	UPS DENT AN	Temperature	
Relinquished By (sign)	Date / Time	Received By (sign)	Date / Time
Street Oxford Relinquished By (sign)	Date / Time	Received By (sign)	Date / Time
Relinquished By (sign)	Date / Time	Received by Lab (sign)	Date / Time



"A Laboratory Management Partner

Memphis, Tennessee 38133

(901) 213-2400

12/20/2012

Harrison Wastewater Treatment Plant Ms. Kathryn Catlin PO Box 1715 Harrison, AR, 72601

Ref:

Analytical Testing

ETC Report Number: 12-353-0211

Client Project Description: Yellville Sampling

Dear Ms. Kathryn Catlin:

Environmental Testing and Consulting, Inc. received sample(s) on 12/18/2012 for the analyses presented in the following report.

The above referenced project has been analyzed per your instructions. The analyses were performed in accordance with the applicable analytical method.

The analytical data has been validated using standard quality control measures performed as required by the analytical method. Quality Assurance, method validations, instrumentation maintenance and calibration for all parameters (NELAP and non-NELAP) were performed in accordance with guidelines established by the USEPA and NELAC unless otherwise indicated. Any parameter for which the laboratory is not officially NELAP accredited is indicated by a '~' symbol. These are not included in the scope because NELAP accreditation is either not available or has not been applied for. Additional certifications may be held/are available for parameters, where NELAP accreditation is not required or applicable. A full list of certifications is available upon request.

The results are shown on the attached Report of Analysis(s). Results for solid matrices are reported on an asreceived basis unless otherwise indicated. This report shall not be reproduced except in full and relates only to the samples included in this report.

Please do not hesitate to contact me or client services if you have any questions or need additional information.

Sincerely,

Rendell H. Thomas

Randy Thomas **Project Manager**

Laboratory's liability in any claim relating to analyses performed shall be limited to, at laboratory's option, repeating the analysis in question at laboratory's expense, or the refund of the charges paid for performance of said analysis.

Tennessee #TN02027 EPA

Kentucky UST #41

#9311



2790 Whitten Road

Memphis, Tennessee 38133

(901) 213-2400

ax (901) 213-2440

A Laboratory Management Partner

03322

Harrison Wastewater Treatment Plant

Ms. Kathryn Catlin

PO Box 1715

Harrison , AR 72601

Project

Yellville Sampling

Information:

Report Date: 12/20/2012

Report Number: 12-353-0211

REPORT OF ANALYSIS

Received: 12/18/2012

Lab No:

90956

Sample ID : WWTP Effluent

Matrix: Aqueous

Sampled: 12/17/2012 8:30

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Chloride	42.4	mg/L	4.00	10	12/18/12 14:41	RQE	EPA-300.0
Nitrate (NO3-N)	0.723	mg/L	0.100	1	12/18/12 11:51	RQE	EPA-300.0
Nitrite (NO2-N)	<0.100	mg/L	0.100	1	12/18/12 11:51	RQE	EPA-300.0
Nitrate+Nitrite-N	0.723	mg/L	0.100	1	12/18/12 11:51		EPA-300.0
Total Dissolved Solids	292	mg/L	10	1	12/19/12 14:00	NRT	2540C
Sulfate	22.3	mg/L	1.00	1	12/18/12 11:51	RQE	EPA-300.0



2790 Whitten Road

Memphis, Tennessee 38133

(901) 213-2400

Fax (901) 213-2440

"A Laboratory Management Partner"

Cooler Receipt Form

Customer Number: 03322

Customer Name: Harrison Wastewater Treatment Plant

Report Number: 12-353-0211

Shipping Method

Fed Ex UPS US Postal Client	◯ Lab	Ocurier (Other:
Shipping container/cooler uncompromised?	Yes	○ No	
Custody seals intact on shipping container/cooler?	O Yes	○ No	Not Required
Custody seals intact on sample bottles?	O Yes	○ No	Not Required
Chain of Custody (COC) present?	Yes	○ No	
COC agrees with sample label(s)?	Yes	○ No	
COC properly completed	Yes	○ No	
Samples in proper containers?	Yes	○ No	
Sample containers intact?	Yes	○ No	
Sufficient sample volume for indicated test(s)?	Yes	○ No	
All samples received within holding time?	Yes	○ No	
Cooler temperature in compliance?	Yes	○ No	
Cooler/Samples arrived at the laboratory on ice. Samples were considered acceptable as cooling process had begun.	Yes	○ No	
Water - Sample containers properly preserved	Yes	○ No	○ N/A
Water - VOA vials free of headspace	O Yes	○ No	N/A
Trip Blanks received with VOAs	O Yes	○ No	N/A
Soil VOA method 5035 – compliance criteria met	O Yes	○ No	N/A
High concentration container (48 hr)	Low	concentration EnCo	re samplers (48 hr)
High concentration pre-weighed (methanol -14	d) Low	conc pre-weighed v	ials (Sod Bis -14 d)
Special precautions or instructions included?	O Yes	No	
Comments:			

Signature: Rebekah Ross

Date & Time: 12/18/2012 10:10:22



2790 Whitten Road

Memphis, Tennessee 38133 (901) 213-2400 Fax (901) 213-2440



Harrison Waslewater Treatment Plant Yellville Sampling

12-353-0211 03322 2012-12-18 10:06:27

Company Name Harrison Wastewater Trea	tment Plant				ustomer 3322	Numbe	· 1	Felephone 870) 741-5527		RUSH	ICE
Site Name Yellville Sampling			oject Co ery 2 Wee		ent					FID N	ımber
Project Harrison - Bi-weekly - Cri	rrison - Bi-weekly - Crooked Creek Sampling			ect Number PO Number							
Project Manager / C City of YellvilleC/O Mr. S	ontact				-mail wwtp2@w	indstream	.net				
Sample ID	Container Type	Collected		# Cont		rvative	Grab / Comp	Matrix		Analyse	5
Upstream	Plastic - Pint	Now	ęr	1	N	ONE	G	Aqueous		SO4/TDS/	31
Downstream	Plastic - Pint	Nowa	rer	1	N	ONE	G	Aqueous		SO4/TDS/	CI .
WWTP Effluent	Plastic - Pint	8:30	-2012 Ami	1	N	ONE	G	Aqueous		SO4/TDS/	ci/NOQ/N
UPS Next Day Label	NA			1	N	ONE		Aqueous	UP	S Return L	abel

Sampled By	Method of Shipment	Blank / Cooler Remarks	
STUART OXFORD	UPS hext Day		
Relinquished By (sign)	Date / Time q ' 00	Received By (sign)	Date / Time
Strad Oxford	12-17-2012		
Relinquished By (sign)	Date / Time	Received By (sign)	Date / Time
			Date / Time
Relinquished By (sign)	Date / Time	Received by Lab (sign)	19/18/12-094



"A Laboratory Management Partner

2790 Whitten Road

Memphis, Tennessee 38133

(901) 213-2400

1/8/2013

Harrison Wastewater Treatment Plant Ms. Kathryn Catlin PO Box 1715 Harrison, AR, 72601

Ref:

Analytical Testing

ETC Report Number: 13-003-0225

Client Project Description: Yellville Sampling

Dear Ms. Kathryn Catlin:

Environmental Testing and Consulting, Inc. received sample(s) on 1/3/2013 for the analyses presented in the following report.

The above referenced project has been analyzed per your instructions. The analyses were performed in accordance with the applicable analytical method.

The analytical data has been validated using standard quality control measures performed as required by the analytical method. Quality Assurance, method validations, instrumentation maintenance and calibration for all parameters (NELAP and non-NELAP) were performed in accordance with guidelines established by the USEPA and NELAC unless otherwise indicated. Any parameter for which the laboratory is not officially NELAP accredited is indicated by a '~' symbol. These are not included in the scope because NELAP accreditation is either not available or has not been applied for. Additional certifications may be held/are available for parameters, where NELAP accreditation is not required or applicable. A full list of certifications is available upon request.

The results are shown on the attached Report of Analysis(s). Results for solid matrices are reported on an asreceived basis unless otherwise indicated. This report shall not be reproduced except in full and relates only to the samples included in this report.

Please do not hesitate to contact me or client services if you have any questions or need additional information.

Sincerely,

Randy Thomas Project Manager

Rendell H. Thomas

Laboratory's liability in any claim relating to analyses performed shall be limited to, at laboratory's option, repeating the analysis in question at laboratory's expense, or the refund of the charges paid for performance of said analysis.



2790 Whitten Road

Memphis, Tennessee 38133

(901) 213-2400

Fax (901) 213-2440

"A Laboratory Management Partner"

03322

Harrison Wastewater Treatment Plant

Ms. Kathryn Catlin PO Box 1715 Harrison , AR 72601

Project

Yellville Sampling

Information:

Report Date: 1/8/2013

Report Number: 13-003-0225

REPORT OF ANALYSIS

Received: 1/3/2013

Lab No : 92861

Matrix: A

Matrix: Aqueous

 ${\sf Sample\ ID: Upstream}$

Sampled: 1/2/2013 9:00

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Chloride	9.10	mg/L	0.400	1	01/04/13 10:14	RQE	EPA-300.0
Total Dissolved Solids	183	mg/L	10	1	01/04/13 14:00	NRT	2540C
Sulfate	8.82	mg/L	1.00	1	01/04/13 10:14	RQE	EPA-300.0

Lab No:

92862

Sample ID: WWTP Effluent

Matrix: Aqueous

Sampled: 1/2/2013 8:45

Chloride 43.2 mg/L 2.00 5 01/04/13 18:05 RQE EPA Nitrate (NO3-N) 1.35 mg/L 0.100 1 01/03/13 13:41 RQE EPA Nitrite (NO2-N) <0.100 mg/L 0.100 1 01/03/13 13:41 RQE EPA Nitrate+Nitrite-N 1.35 mg/L 0.100 1 01/03/13 13:41 EPA Total Dissolved Solids 280 mg/L 10 1 01/04/13 14:00 NRT 25								
Nitrate (NO3-N) 1.35 mg/L 0.100 1 01/03/13 13:41 RQE EPA Nitrite (NO2-N) <0.100 mg/L 0.100 1 01/03/13 13:41 RQE EPA Nitrate+Nitrite-N 1.35 mg/L 0.100 1 01/03/13 13:41 EPA Total Dissolved Solids 280 mg/L 10 1 01/04/13 14:00 NRT 25	ot .	Results	Units	MQL	DF		Ву	Analytical Method
Nitrite (NO2-N) <0.100 mg/L 0.100 1 01/03/13 13:41 RQE EPA Nitrate+Nitrite-N 1.35 mg/L 0.100 1 01/03/13 13:41 EPA Total Dissolved Solids 280 mg/L 10 1 01/04/13 14:00 NRT 25	oride	43.2	mg/L	2.00	5	01/04/13 18:05	RQE	EPA-300.0
Nitrate+Nitrite-N 1.35 mg/L 0.100 1 01/03/13 13:41 EPA Total Dissolved Solids 280 mg/L 10 1 01/04/13 14:00 NRT 25	ate (NO3-N)	1.35	mg/L	0.100	1	01/03/13 13:41	RQE	EPA-300.0
Total Dissolved Solids 280 mg/L 10 1 01/04/13 14:00 NRT 25	ite (NO2-N)	<0.100	mg/L	0.100	1	01/03/13 13:41	RQE	EPA-300.0
10 1 61/0 1/15 1/10 1/10 1/10 1/10 1/10 1/10 1	ate+Nitrite-N	1.35	mg/L	0.100	1	01/03/13 13:41		EPA-300.0
Sulfate 26.5 mg/L 1.00 1 01/03/13 13:41 RQE EPA	al Dissolved Solids	280	mg/L	10	1	01/04/13 14:00	NRT	2540C
	fate	26.5	mg/L	1.00	1	01/03/13 13:41	RQE	EPA-300.0

Qualifiers/ Definitions

* MQL Outside QC limit

Method Quantitation Limit

DF

Dilution Factor



2790 Whitten Road

Memphis, Tennessee 38133

(901) 213-2400

Fax (901) 213-2440

A Laboratory Management Partner

Cooler Receipt Form

Customer Number: 03322	ant Dlant		
Customer Name: Harrison Wastewater Treatm Report Number: 13-003-0225	ent Fiant		
	ng Method		
Fed Ex UPS US Postal Client	◯ Lab	Ourier (Other:
Shipping container/cooler uncompromised?	Yes	○ No	
Custody seals intact on shipping container/cooler?	O Yes	○ No	Not Required
Custody seals intact on sample bottles?	O Yes	○ No	Not Required
Chain of Custody (COC) present?	Yes	○ No	
COC agrees with sample label(s)?	Yes	○ No	
COC properly completed	Yes	○ No	
Samples in proper containers?	Yes	○ No	
Sample containers intact?	Yes	○ No	
Sufficient sample volume for indicated test(s)?	Yes	○ No	
All samples received within holding time?	Yes	○ No	
Cooler temperature in compliance?	Yes	○ No	
Cooler/Samples arrived at the laboratory on ice. Samples were considered acceptable as cooling process had begun.	Yes	○ No	
Water - Sample containers properly preserved	Yes	○ No	○ N/A
Water - VOA vials free of headspace	O Yes	○ No	● N/A
Trip Blanks received with VOAs	O Yes	○ No	● N/A
Soil VOA method 5035 – compliance criteria met	O Yes	○ No	N/A
High concentration container (48 hr)	Low	concentration EnCo	ore samplers (48 hr)
High concentration pre-weighed (methanol -14	d) Low	conc pre-weighed	vials (Sod Bis -14 d)
Special precautions or instructions included?	O Yes	● No	
Comments:			

Any regulatory non-compliance issues will be recorded on non-compliance report.

Signature: Rebekah Ross

Date & Time: 01/03/2013 09:44:22



2790 Whitten Road Memphis. Tennessee 38133 (901) 213-2400 Fax (901) 213-2440



Yellville Sampling

03322 2013-01-03 09:35:45

Company Name				0	Cust No	Kit II)	Telephone		RUSH	ICE
Harrison Wastewater Tre	atment Plant			d	Parameter Control			(870) 741-5527		102	
Site Name		P	roject C	omm	ent					FID Nu	mber
Yellville Sampling		E	very 2 We	eks							
Project Harrison - Bi-weekly - C	rooked Creek Sampl		roject N	umbe	er	PO Nur	nber		p ²⁷		
Project Manager / City of YellvilleC/O Mr.					-mail wwtp2@w	ndstream	.net				
Sample ID	Container Type	Collecte Tir	and the second second	# Cont	Preser	vative	Grab / Comp	Matrix	Ą	nalyses	
Jpstream	Plastic - Pint	1-2-1 9:00	3 2 AM	1	NO	NE	G	Aqueous	Sc	D4/TDS/Ci	***************************************
Downstream	Plastic - Pint	NO	rigic	1	NO	NE	G	Aqueous	50	04/TDS/CI	
NWTP Effluent	Plastic - Pint	1-2-	13 15AM	1	NO	NE	G	Aqueous	SC	04/TDS/CI/	NO
IPS Next Day Label	NA			1	NO	VF		Aqueous	LIDE	Return Lab	-1

Sampled By	Method of Shipment	Blank / Cooler Temperature	
STUART Oxford	Edd Wp5	l°C	
Relinguished By (sign) Stuart Oxford	Date / Time 1-2-2013 9:00Am	Received By (sign)	Date / Time
Relinquished By (sign)	Date / Time	Received By (sign)	Date / Time
Relinquished By (sign)	Date / Time	Received by Lab (sign)	Date / Time



2790 Whitten Road

Memphis, Tennessee 38133 "A Laboratory Management Partner"

(901) 213-2400

1/24/2013

Harrison Wastewater Treatment Plant Ms. Kathryn Catlin PO Box 1715 Harrison, AR, 72601

Ref:

Analytical Testing

ETC Report Number: 13-015-0222

Client Project Description: Yellville Sampling

Dear Ms. Kathryn Catlin:

Environmental Testing and Consulting, Inc. received sample(s) on 1/15/2013 for the analyses presented in the following report.

The above referenced project has been analyzed per your instructions. The analyses were performed in accordance with the applicable analytical method.

The analytical data has been validated using standard quality control measures performed as required by the analytical method. Quality Assurance, method validations, instrumentation maintenance and calibration for all parameters (NELAP and non-NELAP) were performed in accordance with guidelines established by the USEPA and NELAC unless otherwise indicated. Any parameter for which the laboratory is not officially NELAP accredited is indicated by a '~' symbol. These are not included in the scope because NELAP accreditation is either not available or has not been applied for. Additional certifications may be held/are available for parameters, where NELAP accreditation is not required or applicable. A full list of certifications is available upon request.

The results are shown on the attached Report of Analysis(s). Results for solid matrices are reported on an asreceived basis unless otherwise indicated. This report shall not be reproduced except in full and relates only to the samples included in this report.

Please do not hesitate to contact me or client services if you have any questions or need additional information.

Sincerely,

Randy Thomas

Rendell H. Thomas

Project Manager

Laboratory's liability in any claim relating to analyses performed shall be limited to, at laboratory's option, repeating the analysis in question at laboratory's expense, or the refund of the charges paid for performance of said analysis.



2790 Whitten Road

Memphis, Tennessee 38133

(901) 213-2400

Fax (901) 213-2440

A Laboratory Management Partner

03322

Harrison Wastewater Treatment Plant

Ms. Kathryn Catlin PO Box 1715 Harrison , AR 72601 Project

Yellville Sampling

Information:

Report Date: 1/24/2013

Report Number : 13-015-0222

REPORT OF ANALYSIS

Received: 1/15/2013

Lab No : **94742**Sample ID : **Upstream**

Matrix: Aqueous

Sampled: 1/14/2013 8:45

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Alkalinity (as CaCO3)	161	mg/L	1	1	01/16/13 09:13	EWB	2320B
Chloride	8.16	mg/L	0.400	1	01/15/13 16:41	RQE	EPA-300.0
Total Dissolved Solids	194	mg/L	10	1	01/21/13 14:00	NRT	2540C
Total Calcium	56.7	mg/L	0.100	1	01/17/13 20:54	BKN	EPA-200.7
Total Magnesium	10.1	mg/L	0.100	1	01/17/13 20:54	BKN	EPA-200.7
Total Potassium	1.59	mg/L	0.100	1	01/19/13 00:20	JTR	EPA-200.7
Total Sodium	4.05	mg/L	0.500	1	01/19/13 00:20	JTR	EPA-200.7
Sulfate	9.23	mg/L	1.00	1	01/15/13 16:41	RQE	EPA-300.0

Lab No : **94743**Sample ID : **Downstream**

Matrix: Aqueous

Sampled: 1/14/2013 9:00

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method	
Alkalinity (as CaCO3)	165	mg/L	1	1	01/16/13 09:13	EWB	2320B	
Chloride	7.50	mg/L	0.400	1	01/15/13 16:58	RQE	EPA-300.0	
Total Dissolved Solids	203	mg/L	10	1	01/21/13 14:00	NRT	2540C	
Total Calcium	55.7	mg/L	0.100	1	01/17/13 21:01	BKN	EPA-200.7	
Total Magnesium	13.3	mg/L	0.100	1	01/17/13 21:01	BKN	EPA-200.7	
Total Potassium	1.60	mg/L	0.100	1	01/19/13 00:26	JTR	EPA-200.7	
Total Sodium	3.84	mg/L	0.500	1	01/19/13 00:26	JTR	EPA-200.7	
Sulfate	10.6	mg/L	1.00	1	01/15/13 16:58	RQE	EPA-300.0	

Qualifiers/ Definitions * MQL Outside QC limit

Method Quantitation Limit

DF

Dilution Factor



2790 Whitten Road

Memphis, Tennessee 38133

(901) 213-2400

Fax (901) 213-2440

A Laboratory Management Partner

03322

Harrison Wastewater Treatment Plant

Ms. Kathryn Catlin

PO Box 1715 Harrison , AR 72601 Project

Yellville Sampling

Information:

Report Date: 1/24/2013

Report Number: 13-015-0222

REPORT OF ANALYSIS

Received: 1/15/2013

Lab No: 94744

Sample ID: WWTP Effluent

Matrix: Aqueous

Sampled: 1/14/2013 8:30

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Alkalinity (as CaCO3)	217	mg/L	1	1	01/16/13 09:13	EWB	2320B
Chloride	39.7	mg/L	4.00	10	01/15/13 11:04	RQE	EPA-300.0
Nitrate (NO3-N)	0.601	mg/L	0.100	1	01/15/13 10:25	RQE	EPA-300.0
Nitrite (NO2-N)	<0.100	mg/L	0.100	1	01/15/13 10:25	RQE	EPA-300.0
Nitrate+Nitrite-N	0.601	mg/L	0.100	1	01/15/13 10:25		EPA-300.0
Total Dissolved Solids	309	mg/L	10	1	01/21/13 14:00	NRT	2540C
Total Calcium	51.7	mg/L	0.100	1	01/17/13 21:07	BKN	EPA-200.7
Total Magnesium	20.6	mg/L	0.100	1	01/17/13 21:07	BKN	EPA-200.7
Total Potassium	9.67	mg/L	0.100	1	01/19/13 00:33	JTR	EPA-200.7
Total Sodium	30.2	mg/L	0.500	1	01/19/13 00:33	JTR	EPA-200.7
Sulfate	26.0	mg/L	1.00	1	01/15/13 10:25	RQE	EPA-300.0

Qualifiers/ Definitions

↑ MQL Outside QC limit

Method Quantitation Limit

DF

Dilution Factor



2790 Whitten Road

Memphis, Tennessee 38133

(901) 213-2400

Fax (901) 213-2440

A Laboratory Management Partner

Cooler Receipt Form

Customer Name: Harrison Wastewater Treatm Report Number: 13-015-0222	ent Plant		
	ng Method		
Fed Ex UPS US Postal Client	◯ Lab	Ourier (Other:
Shipping container/cooler uncompromised?	Yes	○ No	
Custody seals intact on shipping container/cooler?	O Yes	○ No	Not Required
Custody seals intact on sample bottles?	○ Yes	○ No	Not Required
Chain of Custody (COC) present?	Yes	○ No	
COC agrees with sample label(s)?	Yes	○ No	
COC properly completed	Yes	○ No	
Samples in proper containers?	Yes	○ No	
Sample containers intact?	Yes	○ No	
Sufficient sample volume for indicated test(s)?	Yes	○ No	2
All samples received within holding time?	Yes	○ No	
Cooler temperature in compliance?	Yes	○ No	
Cooler/Samples arrived at the laboratory on ice. Samples were considered acceptable as cooling process had begun.	Yes	○ No	
Water - Sample containers properly preserved	Yes	○ No	○ N/A
Water - VOA vials free of headspace	O Yes	○ No	N/A
Trip Blanks received with VOAs	O Yes	○ No	N/A
Soil VOA method 5035 – compliance criteria met	O Yes	○ No	● N/A
High concentration container (48 hr)	Low	concentration EnCo	re samplers (48 hr)
High concentration pre-weighed (methanol -14	d) Low	conc pre-weighed v	ials (Sod Bis -14 d)
Special precautions or instructions included?	O Yes	No	
Comments:			

Any regulatory non-compliance issues will be recorded on non-compliance report.

Signature: Rebekah Ross

Date & Time: 01/15/2013 09:54:39



2790 Whitten 9-

mphis, Tennessee 38133 (901) 213-2400 Fax (901) 213-2440



Company Name	atment Plant			ustomer Numbe	r	Telephone (870) 741-5527		RUSH	ICE
Site Name Yellville Sampling - Ever		Project Co	omme		***		FID Number		
Project Harrison - Bi-weekly		Project N	oject Number PO Number						
Project Manager / City of YellvilleC/O Mr.			7	mail vwtp2@windstream.	net				
Sample ID	Container Type	Collected Date / Time	# Cont	Preservative	Grab / Comp	Matrix	Analyses		
Upstream	Plastic - Pint	1-14-2013 MAZP18	1	1 NONE G Aqueous SO4/TE		SO4/TDS/CI/Alk			
Upstream.	Plastic - Pint	1-14-2513 8:45 Am	1	HNO3 - Nitric Acid	G	Aqueous	N	a/K/Ca/M _l	g
Downstream	Plastic - Pint	1-14-8013	1	NONE	G	Aqueous	SO	4/TDS/CI/A	lk
Downstream	Plastic - Pint	1-14-0013 9:00Am	1	HNO3 - Nitric Acid	G	Aqueous	N	a/K/Ca/M	B
WWTP Effluent	Plastic - Pint	1-14-19 8:30AL	1	NONE	G	Aqueous	SO4/TDS	S/CI/AIk/N	O3/NO2
WWTP Effluent	Plastic - Pint	1-14-13 8:30 Mm	1	HNO3 - Nitric Acid	G	Aqueous	N	ia/K/Ca/M	g
UPS Next Day Label	NA		. 1	NONE		Aqueous	UPS	Return La	bel

Sampled By STUART OXFORD	Method of Shipment UDS NEXT Day	Blank / Cooler Temperature	
Relinquished By (sign)	Date (Time 13 9:30 Am	Received By (sign)	Date / Time
Relinquished By (sign)	Date / Time	Received By (sign)	Date / Time
Relinquished By (sign)	Date / Time	Received by Lab (sign)	Date / Time



Memphis, Tennessee 38133 "A Laboratory Management Partner"

(901) 213-2400

2/7/2013

Harrison Wastewater Treatment Plant Ms. Kathryn Catlin PO Box 1715 Harrison, AR, 72601

Ref:

Analytical Testing

ETC Report Number: 13-030-0220

Client Project Description: City of Yellville Sampling

Dear Ms. Kathryn Catlin:

Environmental Testing and Consulting, Inc. received sample(s) on 1/30/2013 for the analyses presented in the following report.

The above referenced project has been analyzed per your instructions. The analyses were performed in accordance with the applicable analytical method.

The analytical data has been validated using standard quality control measures performed as required by the analytical method. Quality Assurance, method validations, instrumentation maintenance and calibration for all parameters (NELAP and non-NELAP) were performed in accordance with guidelines established by the USEPA and NELAC unless otherwise indicated. Any parameter for which the laboratory is not officially NELAP accredited is indicated by a '~' symbol. These are not included in the scope because NELAP accreditation is either not available or has not been applied for. Additional certifications may be held/are available for parameters, where NELAP accreditation is not required or applicable. A full list of certifications is available upon request.

The results are shown on the attached Report of Analysis(s). Results for solid matrices are reported on an asreceived basis unless otherwise indicated. This report shall not be reproduced except in full and relates only to the samples included in this report.

Please do not hesitate to contact me or client services if you have any questions or need additional information.

Sincerely,

Randy Thomas

Rendell H. Thomas

Project Manager

Laboratory's liability in any claim relating to analyses performed shall be limited to, at laboratory's option, repeating the analysis in question at laboratory's expense, or the refund of the charges paid for performance of said analysis.

Kentucky UST #41



2790 Whitten Road

Memphis, Tennessee 38133

(901) 213-2400

Fax (901) 213-2440

"A Laboratory Management Partner"

03322

Harrison Wastewater Treatment Plant

Ms. Kathryn Catlin PO Box 1715 Project

City of Yellville Sampling

Information:

Report Date: 2/7/2013

Harrison , AR 72601

Received: 1/30/2013

Report Number: 13-030-0220

REPORT OF ANALYSIS

Lab No : **97632** Sample ID : **Upstream** Matrix: Aqueous

Sampled: 1/29/2013 9:30

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Chloride	8.46	mg/L	0.400	1	02/05/13 16:25	RQE	EPA-300.0
Total Dissolved Solids	207	mg/L	10	1	02/01/13 14:30	NRT	2540C
Sulfate	9.11	mg/L	1.00	1	02/05/13 16:25	RQE	EPA-300.0

Lab No:

97633

Sample ID : WWTP Effluent

Matrix: Aqueous

Sampled: 1/29/2013 9:00

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Chloride	39.3	mg/L	0.400	1	01/30/13 15:06	RQE	EPA-300.0
Nitrate (NO3-N)	0.405	mg/L	0.100	1	01/30/13 15:06	RQE	EPA-300.0
Nitrite (NO2-N)	<0.100	mg/L	0.100	1	01/30/13 15:06	RQE	EPA-300.0
Nitrate+Nitrite-N	0.405	mg/L	0.100	1	01/30/13 15:06		EPA-300.0
Total Dissolved Solids	312	mg/L	10	1	02/01/13 14:30	NRT	2540C
Sulfate	24.5	mg/L	1.00	1	01/30/13 15:06	RQE	EPA-300.0

Qualifiers/ Definitions

*

Outside QC limit

MQL

Method Quantitation Limit

DF

Dilution Factor



A Laboratory Management Partner

2790 Whitten Road

Memphis, Tennessee 38133

(901) 213-2400

Fax (901) 213-2440

Not Required Not Required

N/A

N/A

N/A

Cooler Receipt Form Customer Number: 03322 Customer Name: **Harrison Wastewater Treatment Plant** 13-030-0220 Report Number: **Shipping Method** Courier Other: Fed Ex UPS US Postal Client () Lab () No Yes Shipping container/cooler uncompromised? Custody seals intact on shipping container/cooler? Yes () No Yes () No Custody seals intact on sample bottles? () No Chain of Custody (COC) present? Yes Yes () No COC agrees with sample label(s)? O No COC properly completed Yes Yes () No Samples in proper containers? O No Sample containers intact? Yes Yes () No Sufficient sample volume for indicated test(s)? Yes () No All samples received within holding time? Cooler temperature in compliance? No Yes Cooler/Samples arrived at the laboratory on ice. Yes No Samples were considered acceptable as cooling process had begun. Yes No Water - Sample containers properly preserved Yes O No Water - VOA vials free of headspace Yes No

Yes O No N/A Soil VOA method 5035 - compliance criteria met Low concentration EnCore samplers (48 hr) High concentration container (48 hr) High concentration pre-weighed (methanol -14 d) Low conc pre-weighed vials (Sod Bis -14 d) Special precautions or instructions included? Yes No Comments:

Any regulatory non-compliance issues will be recorded on non-compliance report.

Signature: Susan Simpson

Date & Time: 01/30/2013 09:53:51

Trip Blanks received with VOAs



2790 Whitten Road Memphis, Tennessee 38133 (901) 213-2400 Fax (901) 213-2440



Harnson Wastewater Treatment Plant City of Yellyille Sampling

13-030-0220 03322 2013-01-30 09-53 23

Company Name Harrison Wastewater Trea	tment Plant			ustomer Numb	er	Telephone (870) 741-5527		RUSH	ICE
Site Name Yellville Sampling		Project Co Every 2 We		nt		L		FID Number	
Project Harrison - Bi-weekly		Project N	umbe	r PO Nu	mber			1	
Project Manager / C City of YellvilleC/O Mr. S				-mail wwtp2@windstrean	ı.net		***************************************		
Sample ID	Container Type	Collected Date /	# Cont	Preservative	Grab / Comp	Matrix Ana		Analyses	
Upstream	Plastic - Pint	930/179-13	1	NONE	G	Aqueous	S	O4/TDS/C	1
Downstream	Plastic - Pint	No motte	1	NONE	G	Aqueous	S	O4/TDS/C]
WWTP Effluent	Plastic - Pint	9.00 m / 125 1	1	NONE	G	Aqueous	SO4/TI	DS/CI/NO:	3/NO2
UPS Next Day Label	NA		1	NONE		Aqueous	UPS	Return La	abel

STUART OXFORD	Method of Shipment	Blank / Cooler Remarks	
STUMKI OXFORD	Ups next Day	Temperature U	
Relinquished By (sign)	Date/Time 1-29-2013 10:00 AM	Received By (sign)	Date / Time
Relinquished By (sign)	Date / Time	Received By (sign)	Date / Time
Relinquished By (sign)	Date / Time	Received by Lab-(sign)	Date / Time 130 13 0935



Memphis, Tennessee 38133 "A Laboratory Management Partner

(901) 213-2400

2/18/2013

Harrison Wastewater Treatment Plant Mr. Stuart Oxford PO Box 1715 Harrison, AR, 72601

Ref:

Analytical Testing

ETC Report Number: 13-043-0217

Client Project Description: Yellville Sampling

Dear Mr. Stuart Oxford:

Environmental Testing and Consulting, Inc. received sample(s) on 2/12/2013 for the analyses presented in the following report.

The above referenced project has been analyzed per your instructions. The analyses were performed in accordance with the applicable analytical method.

The analytical data has been validated using standard quality control measures performed as required by the analytical method. Quality Assurance, method validations, instrumentation maintenance and calibration for all parameters (NELAP and non-NELAP) were performed in accordance with guidelines established by the USEPA and NELAC unless otherwise indicated. Any parameter for which the laboratory is not officially NELAP accredited is indicated by a '~' symbol. These are not included in the scope because NELAP accreditation is either not available or has not been applied for. Additional certifications may be held/are available for parameters, where NELAP accreditation is not required or applicable. A full list of certifications is available upon request.

The results are shown on the attached Report of Analysis(s). Results for solid matrices are reported on an asreceived basis unless otherwise indicated. This report shall not be reproduced except in full and relates only to the samples included in this report.

Please do not hesitate to contact me or client services if you have any questions or need additional information.

Sincerely,

Randy Thomas Project Manager

Rendell H. Thomas

Laboratory's liability in any claim relating to analyses performed shall be limited to, at laboratory's option, repeating the analysis in question at laboratory's expense, or the refund of the charges paid for performance of said analysis.

Kansas



2790 Whitten Road

Memphis, Tennessee 38133

(901) 213-2400

Fax (901) 213-2440

A Laboratory Management Partner

03322

Harrison Wastewater Treatment Plant

Mr. Stuart Oxford PO Box 1715 Harrison , AR 72601 Project

Yellville Sampling

Information:

Report Date: 2/18/2013

Report Number: 13-043-0217

REPORT OF ANALYSIS

Received: 2/12/2013

Lab No: **89711**

Sample ID : **Upstream**

Matrix: Aqueous

Sampled: 2/11/2013 8:30

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Chloride	6.51	mg/L	0.400	1	02/14/13 21:43	RQE	EPA-300.0
Total Dissolved Solids	210	mg/L	10	1	02/13/13 14:30	NRT	2540C
Sulfate	8.94	mg/L	1.00	1	02/14/13 21:43	RQE	EPA-300.0

Lab No:

89712

Sample ID : Downstream

Matrix: Aqueous

Sampled: 2/11/2013 8:45

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Chloride	6.28	mg/L	0.400	1	02/14/13 22:00	RQE	EPA-300.0
Total Dissolved Solids	215	mg/L	10	1	02/13/13 14:30	NRT	2540C
Sulfate	9.69	mg/L	1.00	1	02/14/13 22:00	RQE	EPA-300.0

Lab No:

89713

Sample ID: WWTP Effluent

Matrix: Aqueous

Sampled: 2/11/2013 8:15

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Chloride	18.6	mg/L	0.400	1	02/12/13 12:44	RQE	EPA-300.0
Nitrate (NO3-N)	<0.100	mg/L	0.100	1	02/12/13 12:44	RQE	EPA-300.0
Nitrite (NO2-N)	<0.100	mg/L	0.100	1	02/12/13 12:44	RQE	EPA-300.0
Nitrate+Nitrite-N	<0.100	mg/L	0.100	1	02/12/13 12:44		EPA-300.0
Total Dissolved Solids	301	mg/L	10	1	02/13/13 14:30	NRT	2540C
Sulfate	30.0	mg/L	1.00	1	02/12/13 12:44	RQE	EPA-300.0

Qualifiers/ Definitions

* MQL Outside QC limit

Method Quantitation Limit

DF

Dilution Factor





2790 Whitten Road

Memphis, Tennessee 38133 "A Laboratory Management Partner"

(901) 213-2400

Fax (901) 213-2440

Cooler Receipt Form

Customer Number: 0	3322				
	Harrison Wastewater Treatm	ent Plant			
Report Number: 1	3-043-0217				
	Shippin	ng Method		gazacensi sakusinahasinahasinahasinahasinahasinahasinahasinah	
Fed Ex UP	S US Postal Client	Lab	Ourier (Other:	
Shipping container/co	ooler uncompromised?	Yes	○ No		
Custody seals intact	on shipping container/cooler?	O Yes	○ No	Not Required	
Custody seals intact	on sample bottles?	O Yes	○ No	Not Required	
Chain of Custody (Co	OC) present?	Yes	○ No		
COC agrees with sar	nple label(s)?	Yes	○ No	-	
COC properly comple	eted	Yes	○ No		
Samples in proper co	ontainers?	Yes	○ No		
Sample containers in	itact?	Yes	○ No		
Sufficient sample vol	ume for indicated test(s)?	Yes	○ No		
All samples received	within holding time?	Yes	○ No		
Cooler temperature i	n compliance?	Yes	○ No		
Cooler/Samples arriv Samples were consi- process had begun.	ved at the laboratory on ice. dered acceptable as cooling	Yes	○ No		
Water - Sample cont	tainers properly preserved	Yes	○ No	○ N/A	
Water - VOA vials from	ee of headspace	O Yes	○ No	● N/A	
Trip Blanks received	with VOAs	O Yes	○ No	● N/A	
Soil VOA method 50	35 – compliance criteria met	O Yes	○ No	● N/A	
High concentration	on container (48 hr)	Low co	ncentration EnC	ore samplers (48 hr)	
High concentration	on pre-weighed (methanol -14	d) Low co	onc pre-weighed	vials (Sod Bis -14 d)	
Special precautions	or instructions included?	O Yes	No		
Comments:					

Any regulatory non-compliance issues will be recorded on non-compliance report.

Signature: Susan Simpson

Date & Time: 02/12/2013 10:00:27



Environmental Testing & Consulting, Inc.

2790 Whitten Road

Memphis, Tennessee 38133 (901) 213-2400 Fax (901) 213-2440



Harrison Wastewater Treatment Plant Yellviile Sampling

13-043-0217 03322 2013-02-12 09:59:09

Company Name Harrison Wastewater Trea	tment Plant			ustomer Nu 322	ımber	Telephone (870) 741-552		ICE
Site Name		Project C	comme	nt		<u> </u>	FID No	ımber
Yellville Sampling		Every 2 W	eeks					
Project Harrison - Bi-weekly	and the second s	Project N	Numbe	nber PO Number				
Project Manager / C City of YellvilleC/O Mr. S Sample ID		Collected Date	hv	-mail wwtp2@winds Preserva	Grab	Matrix	Analyses	i
Upstream	Plastic - Pint	2-11-2013 8130 Am	1	NONE	Comp	Aqueous	SO4/TDS/0	1
Downstream	Plastic - Pint	2-11-2013 8:45AM	1	NONE	G	Aqueous	SO4/TDS/0]
WWTP Effluent	Plastic - Pint	2-11-2013 8:15Am	1	NONE	G	Aqueous	504/TDS/CI/NO	3/NO2
UPS Next Day Label	NA		1	NONE	Table	Aqueous	UPS Return L	abel

Sampled By STUARTOXFORD	Method of Shipment UPS NEXT Day	Blank / Cooler Cooler Remarks	
Relinquished By (sign)	Date/Time 2-11-2013 9:30 A.M.	Received By (sign)	Date / Time
Relinquished By (sign)	Date / Time	Received By (sign)	Date / Time
Relinquished By (sign)	Date / Time	Received by Lab (sign)	Date / Time 21213 092



Memphis, Tennessee 38133

(901) 213-2400

3/6/2013

Harrison Wastewater Treatment Plant Ms. Kathryn Catlin PO Box 1715 Harrison, AR, 72601

Ref:

Analytical Testing

ETC Report Number: 13-058-0225

Client Project Description: Yellville Sampling

Dear Ms. Kathryn Catlin:

Environmental Testing and Consulting, Inc. received sample(s) on 2/27/2013 for the analyses presented in the following report.

The above referenced project has been analyzed per your instructions. The analyses were performed in accordance with the applicable analytical method.

The analytical data has been validated using standard quality control measures performed as required by the analytical method. Quality Assurance, method validations, instrumentation maintenance and calibration for all parameters (NELAP and non-NELAP) were performed in accordance with guidelines established by the USEPA and NELAC unless otherwise indicated. Any parameter for which the laboratory is not officially NELAP accredited is indicated by a '~' symbol. These are not included in the scope because NELAP accreditation is either not available or has not been applied for. Additional certifications may be held/are available for parameters, where NELAP accreditation is not required or applicable. A full list of certifications is available upon request.

The results are shown on the attached Report of Analysis(s). Results for solid matrices are reported on an asreceived basis unless otherwise indicated. This report shall not be reproduced except in full and relates only to the samples included in this report.

Please do not hesitate to contact me or client services if you have any questions or need additional information.

Sincerely,

Randy Thomas

Rendell H. Thomas

Project Manager

Laboratory's liability in any claim relating to analyses performed shall be limited to, at laboratory's option, repeating the analysis in question at laboratory's expense, or the refund of the charges paid for performance of said analysis.



2790 Whitten Road

Memphis, Tennessee 38133

(901) 213-2400

Fax (901) 213-2440

*A Laboratory Management Partner

03322

Harrison Wastewater Treatment Plant

Ms. Kathryn Catlin PO Box 1715 Harrison , AR 72601 Project

Yellville Sampling

Information:

Report Date: 3/6/2013

Report Number: 13-058-0225

REPORT OF ANALYSIS

Received: 2/27/2013

Lab No: 92768

Sample ID: Upstream

Matrix: Aqueous

Sampled: 2/26/2013 8:15

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Chloride	5.75	mg/L	0.400	1	03/04/13 12:53	RQE	EPA-300.0
Total Dissolved Solids	170	mg/L	10	1	03/04/13 13:35	NRT	2540C
Sulfate	7.72	mg/L	1.00	1	03/04/13 12:53	RQE	EPA-300.0

Lab No:

92769

Sample ID : **Downstream**

Matrix: Aqueous

Sampled: 2/26/2013 8:30

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Chloride	5.67	mg/L	0.400	1	03/04/13 13:11	RQE	EPA-300.0
Total Dissolved Solids	175	mg/L	10	1	03/04/13 13:35	NRT	2540C
Sulfate	8.63	mg/L	1.00	1	03/04/13 13:11	RQE	EPA-300.0

Lab No:

92770

Sample ID: WWTP Effluent

Matrix: Aqueous

Sampled: 2/26/2013 8:00

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Chloride	22.4	mg/L	0.400	1	02/27/13 11:31	RQE	EPA-300.0
Nitrate (NO3-N)	1.86	mg/L	0.100	1	02/27/13 11:31	RQE	EPA-300.0
Nitrite (NO2-N)	<0.100	mg/L	0.100	1	02/27/13 11:31	RQE	EPA-300.0
Nitrate+Nitrite-N	1.86	mg/L	0.100	1	02/27/13 11:31		EPA-300.0
Total Dissolved Solids	261	mg/L	10	1	03/04/13 13:35	NRT	2540C
Sulfate	27.1	mg/L	1.00	1	02/27/13 11:31	RQE	EPA-300.0

Qualifiers/ **Definitions**

MQL

Outside QC limit

Method Quantitation Limit

DF

Dilution Factor



"A Laboratory Management Partner"

2790 Whitten Road

Memphis, Tennessee 38133

(901) 213-2400

Fax (901) 213-2440

Cooler Receipt Form

Shippin	g Method		
Fed Ex UPS US Posta Client	◯ Lab	Ourier (Other:
Shipping container/cooler uncompromised?	Yes	○ No	
Custody seals intact on shipping container/cooler?	O Yes	○ No	Not Required
Custody seals intact on sample bottles?	O Yes	○ No	Not Required
Chain of Custody (COC) present?	Yes	○ No	
COC agrees with sample label(s)?	Yes	○ No	
COC properly completed	Yes	○ No	
Samples in proper containers?	Yes	○ No	
Sample containers intact?	Yes	○ No	
Sufficient sample volume for indicated test(s)?	Yes	○ No	
All samples received within holding time?	Yes	○ No	
Cooler temperature in compliance?	Yes	○ No	
Cooler/Samples arrived at the laboratory on ice. Samples were considered acceptable as cooling process had begun.	Yes	○ No	
Water - Sample containers properly preserved	Yes	○ No	○ N/A
Water - VOA vials free of headspace	O Yes	○ No	● N/A
Trip Blanks received with VOAs	O Yes	○ No	N/A
Soil VOA method 5035 – compliance criteria met	O Yes	○ No	N/A
High concentration container (48 hr)	Low c	oncentration EnCo	ore samplers (48 hr)
High concentration pre-weighed (methanol -14	d) Low c	onc pre-weighed	vials (Sod Bis -14 d)
Special precautions or instructions included?	O Yes	No	
Comments:			

Signature: Susan Simpson

Date & Time: 02/27/2013 10:32:57



2790 Whitten Road Memphis, Tennessee 38133 (901) 213-2400 Fax (901) 213-2440



Harrison Wastewater Treatment Plant Yellville Samoling

13-058-0225 03322 2013-02-27 10:31 17

Company Name Harrison Wastewater Tre	eatment Plant		Customer Number 03322				e 527	RUSH	ICE
Site Name		Project (omme	ent				FID Nu	mbei
Yellville Sampling		Every 2 W	eeks						
Project Harrison - Bi-weekly		Project N	lumbe	r PO	Number				***************************************
Project Manager / (City of YellvilleC/O Mr.				-mail wwtp2@winds	tream.net				
Sample ID	Container Type	Collected Date , Time	# Cont	Preservat	Grab tive / Comp	Matrix	Analyses		
Upstream	Plastic - Pint	8:15 Am 2-26-203	1	NONE	G	Aqueous	\$04	/TDS/CI	
Downstream	Plastic - Pint	5-28-2013 5-28-2013 8:30AM	1	NONE	G	Aqueous	504,	/TDS/CI	
WWTP Effluent	Plastic - Pint	3:00 AM	1	NONE	G	Aqueous	SO4/TDS/	/CI/NO3/	NO2
JPS Next Day Label	NA		1	NONE		Aqueous	UPS Re	turn Labi	el

STURRT OXER	Method of Shipment UPS NEXT Day 2-26-2013	Blank / Cooler Temperature	
Relinquished By (sign)	Date / Time タンタ AM シームし 2013	Received By (sign)	Date / Time
Relinquished By (sign)	Date / Time	Received By (sign)	Date / Time
Relinquished By (sign)	Date / Time	Received by Lab (sign)	Date/Time



2790 Whitten Road

Memphis, Tennessee 38133 "A Laboratory Management Partner"

(901) 213-2400

Fax (901) 213-2440

3/20/2013

Harrison Wastewater Treatment Plant Ms. Kathrvn Catlin PO Box 1715 Harrison, AR, 72601

Ref:

Analytical Testing

ETC Report Number: 13-071-0211

Client Project Description: Yellville Sampling

Dear Ms. Kathryn Catlin:

Environmental Testing and Consulting, Inc. received sample(s) on 3/12/2013 for the analyses presented in the following report.

The above referenced project has been analyzed per your instructions. The analyses were performed in accordance with the applicable analytical method.

The analytical data has been validated using standard quality control measures performed as required by the analytical method. Quality Assurance, method validations, instrumentation maintenance and calibration for all parameters (NELAP and non-NELAP) were performed in accordance with guidelines established by the USEPA and NELAC unless otherwise indicated. Any parameter for which the laboratory is not officially NELAP accredited is indicated by a '~' symbol. These are not included in the scope because NELAP accreditation is either not available or has not been applied for. Additional certifications may be held/are available for parameters, where NELAP accreditation is not required or applicable. A full list of certifications is available upon request.

The results are shown on the attached Report of Analysis(s). Results for solid matrices are reported on an asreceived basis unless otherwise indicated. This report shall not be reproduced except in full and relates only to the samples included in this report.

Please do not hesitate to contact me or client services if you have any questions or need additional information.

Sincerely,

Randy Thomas **Project Manager**

Rendell H. Thomas

Laboratory's liability in any claim relating to analyses performed shall be limited to, at laboratory's option, repeating the analysis in question at laboratory's expense, or the refund of the charges paid for performance of said analysis.



2790 Whitten Road

Memphis, Tennessee 38133

A Laboratory Management Partner

03322

Harrison Wastewater Treatment Plant

Ms. Kathryn Catlin

PO Box 1715

Harrison, AR 72601

Project

Yellville Sampling

Information:

Report Date: 3/20/2013

Report Number: 13-071-0211

REPORT OF ANALYSIS

Received: 3/12/2013

Lab No:

95570

Matrix: Aqueous

Sampled: 3/11/2013 8:45

Sample ID : **Upstream**

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Chloride	5.12	mg/L	0.400	1	03/19/13 10:52	RQE	EPA-300.0
Total Dissolved Solids	157	mg/L	10	1	03/13/13 16:00	NRT	2540C
Sulfate	6.91	mg/L	1.00	1	03/19/13 10:52	RQE	EPA-300.0

Lab No:

95571

Sample ID: Downstream

Matrix: Aqueous

Sampled: 3/11/2013 9:00

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Chloride	5.09	mg/L	0.400	1	03/19/13 11:10	RQE	EPA-300.0
Total Dissolved Solids	174	mg/L	10	1	03/13/13 16:00	NRT	2540C
Sulfate	7.24	mg/L	1.00	1	03/19/13 11:10	RQE	EPA-300.0

Lab No:

95572

Sample ID : WWTP Effluent

Matrix: Aqueous

Sampled: 3/11/2013 8:30

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Chloride	17.7	mg/L	0.400	1	03/12/13 12:01	RQE	EPA-300.0
Nitrate (NO3-N)	0.973	mg/L	0.100	1	03/12/13 12:01	RQE	EPA-300.0
Nitrite (NO2-N)	<0.100	mg/L	0.100	1	03/12/13 12:01	RQE	EPA-300.0
Nitrate+Nitrite-N	0.973	mg/L	0.100	1	03/12/13 12:01		EPA-300.0
Total Dissolved Solids	256	mg/L	10	1	03/13/13 16:00	NRT	2540C
Sulfate	24.2	mg/L	1.00	1	03/12/13 12:01	RQE	EPA-300.0

Qualifiers/ **Definitions**

MQL

Outside QC limit

Method Quantitation Limit

DF

Dilution Factor





2790 Whitten Road

Memphis, Tennessee 38133

(901) 213-2400

Fax (901) 213-2440

A Laboratory Management Partner

Cooler Receipt Form

Customer Number: 03322			
Customer Name: Harrison Wastewater Treatm	nent Plant		
Report Number: 13-071-0211 Shippin	ng Method		
	_	Courier	Other
Fed Ex UPS US Postal Client	t () Lab	Courier	Other:
Shipping container/cooler uncompromised?	Yes	○ No	
Custody seals intact on shipping container/cooler?	O Yes	○ No	Not Required
Custody seals intact on sample bottles?	○ Yes	○ No	Not Required
Chain of Custody (COC) present?	Yes	○ No	
COC agrees with sample label(s)?	Yes	○ No	
COC properly completed	Yes	○ No	
Samples in proper containers?	Yes	○ No	
Sample containers intact?	Yes	○ No	
Sufficient sample volume for indicated test(s)?	Yes	○ No	
All samples received within holding time?	Yes	○ No	
Cooler temperature in compliance?	Yes	○ No	
Cooler/Samples arrived at the laboratory on ice. Samples were considered acceptable as cooling process had begun.	Yes	○ No	
Water - Sample containers properly preserved	Yes	○ No	○ N/A
Water - VOA vials free of headspace	Yes	○ No	N/A
Trip Blanks received with VOAs	O Yes	○ No	N/A
Soil VOA method 5035 – compliance criteria met	O Yes	○ No	N/A
High concentration container (48 hr)	Low	concentration EnCo	ore samplers (48 hr)
High concentration pre-weighed (methanol -14	d) Low	conc pre-weighed v	vials (Sod Bis -14 d)
Special precautions or instructions included?	O Yes	No	
Comments:			

Any regulatory non-compliance issues will be recorded on non-compliance report.

Signature: Rebekah Ross

Date & Time: 03/12/2013 10:06:51



2790 Whitten Road

Memphis, Tennessee 38133 (901) 213-2400 Fax (901) 213-2440



Harrison Wastewater Treatment Plant Yellville Sampling

13-071-0211 03322 2013-03-12 10:06:25

Company Name Harrison Wastewater Trea	arrison Wastewater Treatment Plant			Customer Number 03322		Telephone (870) 741-552	7 RUSH	ICE
Site Name Yellville Sampling		Project Co Every 2 Wes		nt			FID N	umber
Project Harrison - Bi-weekly		Project N	umber	PO Nun	nber			
Project Manager / C City of YellvilleC/O Mr.				mail wtp2@windstream	net			
Sample ID	Container Type	Collected Date /	# Cont	Preservative /		Matrix	Analyses	
Upstream	Plastic - Pint	3-11-2013 2:45 Am	1	NONE	G	Aqueous	SO4/TDS/CI	
Downstream	Plastic - Pint	9:00 Am	1	NONE	G	Aqueous	SO4/TDS	/Cl
WWTP Effluent	Plastic - Pint	3-11-2013 8:30 AM	1	NONE	G	Aqueous	SO4/TDS/CI/N	O3/NO2
UPS Next Day Label	NA	West Day	1	NONE	-	Aqueous	UPS Return	Label

Sampled By STUARTOXFORM	Method of Shipment	Blank / Cooler Remarks Temperature	
Relinquished By (sign)	Date / Time 3-11-2013 9:30 PM	Received By (sign)	Date / Time
Relinquished By (sign)	Date / Time	Received By (sign)	Date / Time
Relinquished By (sign)	Date / Time	Received by Lab (sign)	Date / Time



"A Laboratory Management Partner

2790 Whitten Road

Memphis, Tennessee 38133

(901) 213-2400

4/11/2013

Harrison Wastewater Treatment Plant Ms. Kathryn Catlin PO Box 1715 Harrison, AR, 72601

Ref:

Analytical Testing

ETC Report Number: 13-085-0231

Client Project Description: Yellville Sampling

Dear Ms. Kathryn Catlin:

Environmental Testing and Consulting, Inc. received sample(s) on 3/26/2013 for the analyses presented in the following report.

The above referenced project has been analyzed per your instructions. The analyses were performed in accordance with the applicable analytical method.

The analytical data has been validated using standard quality control measures performed as required by the analytical method. Quality Assurance, method validations, instrumentation maintenance and calibration for all parameters (NELAP and non-NELAP) were performed in accordance with guidelines established by the USEPA and NELAC unless otherwise indicated. Any parameter for which the laboratory is not officially NELAP accredited is indicated by a '~' symbol. These are not included in the scope because NELAP accreditation is either not available or has not been applied for. Additional certifications may be held/are available for parameters, where NELAP accreditation is not required or applicable. A full list of certifications is available upon request.

The results are shown on the attached Report of Analysis(s). Results for solid matrices are reported on an asreceived basis unless otherwise indicated. This report shall not be reproduced except in full and relates only to the samples included in this report.

Please do not hesitate to contact me or client services if you have any questions or need additional information.

Sincerely,

Randy Thomas **Project Manager**

Rendell H. Thomas

Laboratory's liability in any claim relating to analyses performed shall be limited to, at laboratory's option, repeating the analysis in question at laboratory's expense, or the refund of the charges paid for performance of said analysis.

Tennessee #TN02027 EPA

Kentucky UST #41

#9311



2790 Whitten Road

Memphis, Tennessee 38133

(901) 213-240

Fax (901) 213-2440

"A Laboratory Management Partner"

03322

Harrison Wastewater Treatment Plant

Ms. Kathryn Catlin

PO Box 1715 Harrison , AR 72601 Project

Yellville Sampling

Information:

Report Date: 4/11/2013

Report Number: 13-085-0231

REPORT OF ANALYSIS

Received: 3/26/2013

Lab No:

Sample ID: Upstream

98507

Matrix: Aqueous

Sampled: 3/25/2013 8:15

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Alkalinity (as CaCO3)	167	mg/L	1	1	04/01/13 11:15	EWB	2320B
Chloride	6.12	mg/L	0.400	1	03/26/13 18:07	RQE	EPA-300.0
Total Dissolved Solids	207	mg/L	10	1	03/28/13 14:00	NRT	2540C
Total Calcium	64.3	mg/L	0.100	1	04/06/13 05:54	BKN	EPA-200.7
Total Magnesium	9.48	mg/L	0.100	1	04/06/13 05:54	BKN	EPA-200.7
Total Potassium	1.33	mg/L	0.100	1	04/10/13 15:49	JTR	EPA-200.7
Total Sodium	3.28	mg/L	0.500	1	04/10/13 15:49	JTR	EPA-200.7
Sulfate	7.42	mg/L	1.00	1	03/26/13 18:07	RQE	EPA-300.0

Lab No:

98508

Sample ID : **Downstream**

Matrix: Aqueous

Sampled: 3/25/2013 8:30

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Alkalinity (as CaCO3)	171	mg/L	1	1	04/01/13 11:15	EWB	2320B
Chloride	6.02	mg/L	0.400	1	03/26/13 18:24	RQE	EPA-300.0
Total Dissolved Solids	205	mg/L	10	1	03/28/13 14:00	NRT	2540C
Total Calcium	66.1	mg/L	0.100	1	04/06/13 06:01	BKN	EPA-200.7
Total Magnesium	10.8	mg/L	0.100	1	04/06/13 06:01	BKN	EPA-200.7
Total Potassium	1.31	mg/L	0.100	1	04/10/13 15:52	JTR	EPA-200.7
Total Sodium	3.19	mg/L	0.500	1	04/10/13 15:52	JTR	EPA-200.7
Sulfate	7.46	mg/L	1.00	1	03/26/13 18:24	RQE	EPA-300.0

Qualifiers/ Definitions

*

Outside QC limit

MQL

Method Quantitation Limit

DF

Dilution Factor



2790 Whitten Road

Memphis, Tennessee 38133

"A Laboratory Management Partner"

03322

Harrison Wastewater Treatment Plant

Ms. Kathryn Catlin

PO Box 1715

Harrison, AR 72601

Project

Yellville Sampling

Information:

Report Date: 4/11/2013

Report Number: 13-085-0231

REPORT OF ANALYSIS

Received: 3/26/2013

Lab No:

98509

Sample ID: WWTP Effluent

Matrix: Aqueous

Sampled: 3/25/2013 8:00

•							
Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Alkalinity (as CaCO3)	227	mg/L	1	1	04/01/13 11:15	EWB	2320B
Chloride	21.3	mg/L	0.400	1	03/26/13 12:54	RQE	EPA-300.0
Nitrate (NO3-N)	0.600	mg/L	0.100	1	03/26/13 12:54	RQE	EPA-300.0
Nitrite (NO2-N)	<0.100	mg/L	0.100	1	03/26/13 12:54	RQE	EPA-300.0
Nitrate+Nitrite-N	0.600	mg/L	0.100	1	03/26/13 12:54		EPA-300.0
Total Dissolved Solids	293	mg/L	10	1	03/28/13 14:00	NRT	2540C
Total Calcium	60.3	mg/L	0.100	1	04/06/13 06:29	BKN	EPA-200.7
Total Magnesium	29.3	mg/L	0.100	1	04/06/13 06:29	BKN	EPA-200.7
Total Potassium	4.23	mg/L	0.100	1	04/10/13 15:55	JTR	EPA-200.7
Total Sodium	15.1	mg/L	0.500	1	04/10/13 15:55	JTR	EPA-200.7
Sulfate	27.4	mg/L	1.00	1	03/26/13 12:54	RQE	EPA-300.0

Qualifiers/ **Definitions**

Outside QC limit

MQL

Method Quantitation Limit

DF

Dilution Factor



COC agrees with sample label(s)?

Sufficient sample volume for indicated test(s)?

Cooler/Samples arrived at the laboratory on ice.

Samples were considered acceptable as cooling

Water - Sample containers properly preserved

Soil VOA method 5035 - compliance criteria met

High concentration pre-weighed (methanol -14 d)

High concentration container (48 hr)

Special precautions or instructions included?

All samples received within holding time?

Cooler temperature in compliance?

Water - VOA vials free of headspace

Trip Blanks received with VOAs

Samples in proper containers?

COC properly completed

Sample containers intact?

process had begun.

Comments:

Environmental Testing & Consulting, Inc.

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

() Yes

() Yes

Yes

Yes

2790 Whitten Road

(901) 213-2400 *A Laboratory Management Partner

Fax (901) 213-2440

Courier Other:

Not Required

Not Required

N/A

N/A

N/A

N/A

O No

() No

() No

O No

() No

No

No

() No

() No

No

No

No

No

No

No

Low concentration EnCore samplers (48 hr)

Low conc pre-weighed vials (Sod Bis -14 d)

() No

No

Cooler Receipt Form Customer Number: 03322 Customer Name: **Harrison Wastewater Treatment Plant** 13-085-0231 Report Number: Shipping Method UPS US Postal Client Fed Ex () Lab Yes Shipping container/cooler uncompromised? Custody seals intact on shipping container/cooler? Yes Yes Custody seals intact on sample bottles? Chain of Custody (COC) present? Yes

Any regulatory non-compliance issues will be recorded on non-compliance report.

Signature: Rebekah Ross

Date & Time: 03/26/2013 10:16:17



2790 Whitten Road

Memphis, Tennessee 38133 (901) 213-2400 Fax (901) 213-2440



Harrison Wastewater Treatment Plant Crooked Creek Sampling

13-085-0231 03322 03-26-2013 10:16.04

0000020120

Company Name Harrison Wastewater Treat	ment Plant				Customer Number 03322		Telephone (870) 741-5527		RUSH	ICE
Site Name Yellville Sampling - Every		T T	Project Co Every 2 Mon		t				FID No	ımber
Project Harrison - Bi-weekly			Project Nu	ımber	PO Num	ber				
Project Manager / Co					mail wtp2@windstream.	net				
Sample ID	Container Type		ted Date / Time	# Cont	Preservative	Grab / Comp	Matrix		Analyse	s
Upstream	Plastic - Pint	2:19	5-2013 SAM	1	NONE	G	Aqueous	sc	4/TDS/CI	/Alk
Upstream	Plastic - Pint	3-2	5-2013 Am	1	HNO3 - Nitric Acid	G	Aqueous	ľ	Na/K/Ca/N	/lg
Downstream	Plastic - Pint	3+2	5-2013	1	NONE	G	Aqueous	SC	14/TDS/CI	/Alk
Downstream	Plastic - Pint	6 -3	5-2013 0 AM 25-2113	1	HNO3 - Nitric Acid	G	Aqueous		Na/K/Ca/N	Лg
WWTP Effluent	Plastic - Pint	8	MAKIN		NONE	G	Aqueous	SO4/TE	s/ci/alk/	NO3/NO
WWTP Effluent	Plastic - Pint	3-2	5-2013 00 AM	1	HNO3 - Nitric Acid	G	Aqueous		Na/K/Ca/	Mg
UPS Next Day Label	NA			1	NONE		Aqueous	UI	S Return	Label

Method of Shipment	Blank / Cooler Remarks	
UPS next Day	Temperature (
Date / Time 2013	Received By (sign)	Date / Time
Pate / Time	Received By (sign)	Date / Time
Date / Time	Received by Lab (sign)	Date / Time 3 2 (d) 3 - 09 3 5
	Date / Time 3-2013 9:30 Am. Date / Time	Date / Time Received By (sign) Date / Time Received By (sign)



"A Laboratory Management Partner

2790 Whitten Road

Memphis, Tennessee 38133

(901) 213-2400

5/6/2013

Harrison Wastewater Treatment Plant Ms. Kathryn Catlin PO Box 1715 Harrison, AR, 72601

Ref:

Analytical Testing

ETC Report Number: 13-099-9220

Client Project Description: Yellville Sampling

Dear Ms. Kathryn Catlin:

Environmental Testing and Consulting, Inc. received sample(s) on 4/9/2013 for the analyses presented in the following report.

The above referenced project has been analyzed per your instructions. The analyses were performed in accordance with the applicable analytical method.

The analytical data has been validated using standard quality control measures performed as required by the analytical method. Quality Assurance, method validations, instrumentation maintenance and calibration for all parameters (NELAP and non-NELAP) were performed in accordance with guidelines established by the USEPA and NELAC unless otherwise indicated. Any parameter for which the laboratory is not officially NELAP accredited is indicated by a '~' symbol. These are not included in the scope because NELAP accreditation is either not available or has not been applied for. Additional certifications may be held/are available for parameters, where NELAP accreditation is not required or applicable. A full list of certifications is available upon request.

The results are shown on the attached Report of Analysis(s). Results for solid matrices are reported on an asreceived basis unless otherwise indicated. This report shall not be reproduced except in full and relates only to the samples included in this report.

Please do not hesitate to contact me or client services if you have any questions or need additional information.

Sincerely,

Randy Thomas Project Manager

Rendell H. Thomas

Laboratory's liability in any claim relating to analyses performed shall be limited to, at laboratory's option, repeating the analysis in question at laboratory's expense, or the refund of the charges paid for performance of said analysis.

Kansas



Environmental Testing & Consulting, Inc. 2790 Whitten Road Memphis, Tennessee 38133 (901) 213-2400 Fax (901) 213-2440

"A Laboratory Management Partner"

CASE NARRATIVE

Client: Harrison Wastewater Treatment Plant

Project: Yellville Sampling Lab Report Number: 13-099-9220 Date: 5/6/2013

Revised report due to correction of sample names.



2790 Whitten Road

Memphis, Tennessee 38133

A Laboratory Management Partner

03322

Harrison Wastewater Treatment Plant

Ms. Kathryn Catlin

PO Box 1715 Harrison, AR 72601 Project

Yellville Sampling

Information:

Revised Report Date: 5/6/2013

Report Number: 13-099-9220

REPORT OF ANALYSIS

Received: 4/9/2013

Lab No:

91134

Matrix: Aqueous

Sample ID: Upstream

Sampled: 4/8/2013 9:45

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Chloride	6.18	mg/L	0.400	1	04/09/13 13:04	ACS	EPA-300.0
Total Dissolved Solids	210	mg/L	10	1	04/10/13 14:00	NRT	2540C
Sulfate	7.61	mg/L	1.00	1	04/09/13 13:04	ACS	EPA-300.0

Lab No:

91135

Sample ID: Downstream

Matrix: Aqueous

Sampled: 4/8/2013 10:00

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Chloride	6.21	mg/L	0.400	1	04/09/13 13:22	ACS	EPA-300.0
Total Dissolved Solids	223	mg/L	10	1	04/10/13 14:00	NRT	2540C
Sulfate	7.65	mg/L	1.00	1	04/09/13 13:22	ACS	EPA-300.0

Lab No:

91136

Sample ID: WWTP Effluent

Matrix: Aqueous

Sampled: 4/8/2013 9:30

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Chloride	30.3	mg/L	0.400	1	04/09/13 09:38	ACS	EPA-300.0
Nitrate (NO3-N)	0.176	mg/L	0.100	1	04/09/13 09:38	ACS	EPA-300.0
Nitrite (NO2-N)	<0.100	mg/L	0.100	1	04/09/13 09:38	ACS	EPA-300.0
Nitrate+Nitrite-N	0.176	mg/L	0.100	1	04/09/13 09:38		EPA-300.0
Total Dissolved Solids	336	mg/L	10	1	04/10/13 14:00	NRT	2540C
Sulfate	24.6	mg/L	1.00	1	04/09/13 09:38	ACS	EPA-300.0

Qualifiers/ **Definitions** DF

Dilution Factor

MQL

Method Quantitation Limit



2790 Whitten Road

Memphis, Tennessee 38133

(901) 213-2400

Fax (901) 213-2440

A Laboratory Management Partner

Cooler Receipt Form

	son Wastewater Treatm 9-0220			
	Shippin	g Method		-
Fed Ex UPS	US Postal Client	○ Lab	Ourier (Other:
Shipping container/cooler	uncompromised?	Yes	○ No	
Custody seals intact on sh	ipping container/cooler?	O Yes	○ No	Not Required
Custody seals intact on sa	mple bottles?	O Yes	○ No	Not Required
Chain of Custody (COC) p	resent?	Yes	○ No	
COC agrees with sample I	abel(s)?	Yes	○ No	
COC properly completed		Yes	○ No	
Samples in proper contain	ers?	Yes	○ No	
Sample containers intact?		Yes	○ No	
Sufficient sample volume f	for indicated test(s)?	Yes	○ No	
All samples received within	n holding time?	Yes	○ No	
Cooler temperature in com	pliance?	Yes	○ No	
Cooler/Samples arrived at Samples were considered process had begun.		Yes	○ No	
Water - Sample containers	s properly preserved	Yes	○ No	○ N/A
Water - VOA vials free of h	neadspace	O Yes	○ No	N/A
Trip Blanks received with	VOAs	O Yes	○ No	N/A
Soil VOA method 5035 – o	compliance criteria met	O Yes	○ No	N/A
High concentration cor	tainer (48 hr)	Low c	oncentration EnCo	ore samplers (48 hr)
High concentration pre	-weighed (methanol -14	d) Low c	onc pre-weighed v	ials (Sod Bis -14 d)
Special precautions or ins	tructions included?	O Yes	No	=
Comments:				

Any regulatory non-compliance issues will be recorded on non-compliance report.

Signature: Rebekah Ross

Date & Time: 04/09/2013 09:16:32



2790 Whitten Road

Memphis, Tennessee 38133

(901) 213-2400 Fax (901) 213-2440



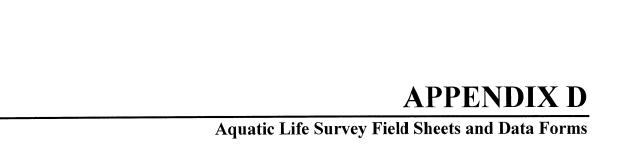
Harrison Wastewater Treatment Plant

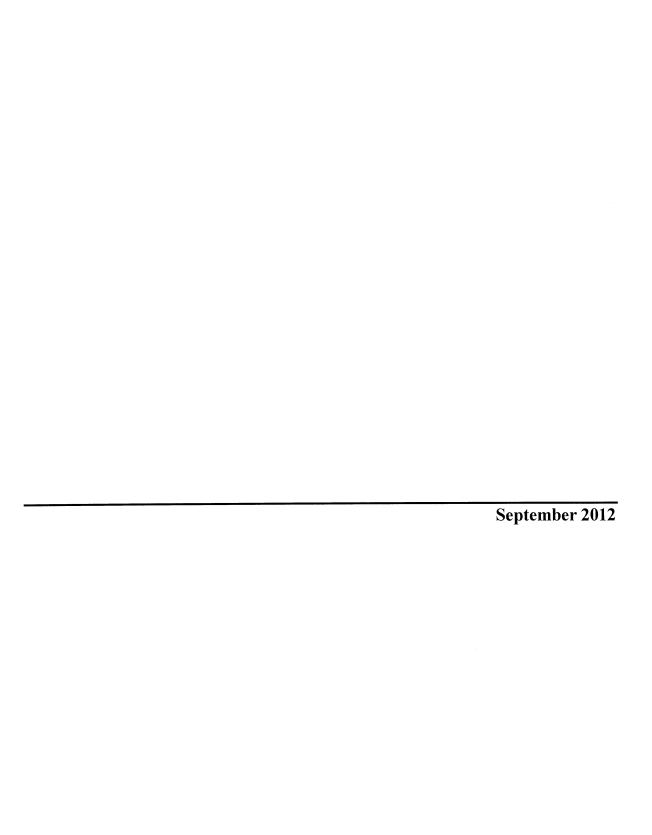
13-099-0220 03322 04-09-2013 09 16 21

Yellville Sampling

ICE RUSH Telephone **Customer Number** Company Name 870) 741-5527 Harrison Wastewater Treatment Plant **FID Number Project Comment** Site Name Every 2 Weeks Yellville Sampling PO Number **Project Number** Project Harrison - Bi-weekly Project Manager / Contact hwwtp2@windstream.net City of YellvilleC/O Mr. Stuart Oxford Grab Collected Date / Container **Analyses** Matrix Preservative 1 Sample ID Cont Time Type Comp 4-8-8013 SO4/TDS/CI NONE G Aqueous Plastic - Pint Upstream 17-18-5013 SO4/TDS/CI Aqueous NONE G Plastic - Pint Downstream 10:00 Am 4-8-2013 SO4/TDS/CI/NO3/NO2 G Aqueous NONE WWTP Effluent Plastic - Pint 9:30 AM Aqueous **UPS Return Label** NONE 1 NA UPS Next Day Label

Sampled By STUART DIFFORD	Method of Shipment UPS NEXT Day	Blank / Cooler Remarks Temperature	
Relinquished By (sign)	Date / Time 1-8-2013	Received By (sign)	Date / Time
Relinquished By (sign)	Date / Time	Received By (sign)	Date / Time
Relinquished By (sign)	Date / Time	Received by Lab (sign)	Date / Time 4 9 3 7 9 0 9





570						Crooked Great at 1001 is day except for minor				1145	ACK			1200	cach							
	7	S/s	pipe	-1137		except b		1131		Hydrolab FTX# 7 SN 45796 deplayed at 1145	immediately upstraw of the CC-O reach	1133		SN 48171 deployed at 1200	immediately upstraw of the CC-1 reach	1135						
	573.7	1	Grab Sample from effluent pipe	7611-11211 Estate		is day	ation	1811 - 8611 Soloha		796 dep	of the	photos 1132-1133		71 deplo	of the	photos 1134-1135			377.9	9.6		
	560	00	from es	phot		+ Y00/	pooding at outfall location	photo		51 45	sheam	short		18H NS	asheam	photo			Spc	00		
You @ 1015	Tenp 23.62	PH 7.37	Sample	36,22059	-92.66341	Preek	g at ou	2115	8545	PTN#	iately u	00	298	Hydrolab FTN#8	ately	1157	613	CC-1 @ 1730	Temp 20.51	7.47 HO	179	855
You @ 1015	Temp	Md	Grab	36.	-92.6	rookool	pandin	36. 22115	-92.66458	drolab	immed	36. 23188	-93,07860	delcolob	immed	36.241157	-93.07613	@) 	Temp	-	36.24179	-93.07558

B						tion					Programme and the second					-					-	1
りをインとうら		356.1	9.70			at this locar	17		Spc 619.2	6.80	151				Spc 277.2	10.86				273.5		
D SEP 13		Spc	00			taken o	0 6 18		Spc	8	1511 otoyd		6 1936		Spc	00				Spc	8	
NAA 20		20.63	7.17			and flow	on CC-		23.49	6.80			om cc-		18.81	7.93				18.04	7.43	
CROOKED CREEK WAY 20 SEP 13	CC-0 @ 1853	Temp	Hd	36. 23187	-93,07815	Grab Sample and flow taken at this location	Hydrolab pulled from CC-0 @ 1847	H001 & 1908	Temp	Ho	36.23804	-93.074698	Hydrolab pulled from cc-1	8 2132	Temp	НФ	36.25787	-92. 47450	WR-1 @ 2213	Temp	HO	36.303810
CROOK	500			8	9	G,	Hydrole	1001			3	6-	Hydrola	WR-0	A second	To be a second of the second o	64	ĭ	WR-1			, ,



page <u>1</u> of <u>4</u>

CTDEALS	ME					LOCATIO	NI.			_						_		
STREAM NA	C/00		RIVERMILE LONG MR/ BJG JMR/ BJ6			LOCATIC STREAM		<u>.c -</u>	- (U	tegi	reau	10	part	204			
STATION #_ LAT						RIVER B												
STORET#						AGENCY							_					
INVESTIGATION IN	TORS ~	TOLA !	2-1-2-1															
FORM COM		/ M/K/_	P1 (2-			DATE 20	SEP IS	2	The co			RE	ASO	N FOR	SUF	RVEY		
		JM	r/BJ	6		TIME		,	(M)	PM				AA				
	***			**	No.		A CONTRACTOR OF THE PARTY OF TH						91	AZ	-			
SAMPLE		How we	ere the fis	h capture	ed?		a back pa	ck		t	ote ba	arge		ot.	her_			
COLLECT	ION			•								_						
		Block n	ets used?	•	尸	Yes			lo									
		Samnlin	ng Durati	ion S	Start Ti	me		En	d Tim	ıe.				Dura	tion	18	12 sec	
		ļ ,	9	•		* 44-14-1-1-1			- ****									
		Stream	width (in	meters)			Max _					N	1ean			_		
AT V D TOD V W	TYPEC	Indiant	o tho ====	onto-o of	ooch L	abitat to	0 880222											
HABITAT	IYPES	8	e the perc es	entage of		ols	-	□ F	Runs					☐ Sr	nags		%	
				crophytes					Other (()		0	_%		
GENERAL																	,	
COMMEN	TS	Pas	is /															ı
		Δ.		7 - Ll	a . I -	<i>- سا</i> سه ه												
		/1 no	mary c	z = b/c	acks	por											· · · · · · · · · · · · · · · · · · ·	
SPECIES	TOTAL	OPTIO	NAL: LE	NGTH (n	nm)/W	EIGHT (g)					ANO)MA	LIES				
	(COUNT)	(25 S)	PECIME	NT MAX	SUBSA	AMPLE)	D		E		F	L		M		S	Т	Z
	156																	X
largescale								図	X	図	図	Ø	Ø	Ø	Ø	Ø	eri di i	· · · · · ·
stonerolle	5				ļ				X				1177					
Camposto	ma_				<u> </u>			*				•						
oligolep	is											·			- pulsano		·	
•	52																	Х
rainbow a	larter						8	Ø	Ø	8	Ø			 	210			A 7 1
								-,		,		·Jr						
Etheostom																		
caeruleui	~ _							,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,			فة إستناسي		ø.			į.		
	13		New Charles					floor										X
banded s	culain														7			
PRINTER SEASON S. MAR.		4																
Cottus			packet in the second															
carolinae											47 mil 1 mm		_ was vale	ari			- 1900 -	and transmit
	39		Marie Administration															Х
duebuch							N	N	N.	ולו				et des		ا,ا		
duskystr shiner	700						- 101		!Al	لكا	-							
Luxilus pi	Ishowi		J200		110011100													
Chaires b.	Y'																	
	127-256-33-35			B		- L	mark Tariffee	_		- NAME OF THE					19881			

SPECIES	TOTAL			H (mm)/WEIGH					ANOM	ALIES	1 7	201	
	(COUNT)	(25 SPEC	IMENT M	AX SUBSAMPL	E)	D	E	F	L	M	S	T	Z
	14												
Ozark mi	Cuonn					Ø	• •		net zonemieni Trikuliji				
	(max 400 to					3 4 4 1 5						A CONTRACTOR	1 - 2 - 9 - 16.
Notropis n	ubilus					ر در ایک و د در در ایک در			erik Mariantan	Sea at a constant of			Takir s
D 1 10000 - 100000000	7												
slender m	adom					П			to degrad to the degrad of the second	seken o en			
Notivus.	exilis							* 1	ine milita Griff e ev				
	. 3							T		*			T x
black red							L	i	- 1085 h.L.		7		
Moxostom								tu mining	- 1 # 1. ·				
duquesn	Annual Straige Pol Co.							1	n e la ellerare		1 27 2 22 32	T	T 52
						***************************************	<u></u>					<u> </u>	X
northern Sucker	hos						er er er er er er	de Villege () () Per e Wilster		A Company of the Comp		iii ii Ma	min ta
Hypenteli	am. S									10 mg	upon en 11 - 14		Mark).
	I 1	1000000										,	X
smallmou	th bass					11.		481	ha ji oznaka	Ep Pit			6 111
AA						\$ 4 \$50 mag "-1"	ter er engels	0 - 12 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		al amag	an a state of the second		COMPANIES
Micropten dolomieu				· · · · · ·		* •		· · · · · · · · · · · · · · · · · · ·					
169 (3.5 100)(2.00.3	17												X
Ozark b	155					Ø	П					*************************************	1970 PMP 1
Amblopli constelli	tes this						ž V - , ·			mage: or memory or might	and ending		
	2					34		1	T	<u> </u>		<u> </u>	V V
bluntnose						,		1 2					
Pimephal notatus				2000			in the second of	gestelder i dige gestelder i dige si	nggriger Johanne in Sp g	or to the all the property of the second of			Ariago, em 1935.
	6						T		1				X
rosyfue						۲.			- Control of the cont	7			
Notropis 1	The state of the s									And the second			ganga kabatan • e ra nan

ANOMALY CODES: D=deformities; E=eroded fins; F=fungus; L=lesions; M=multiple DELT anomalies; S=emaciated; Z=other



page <u>3</u> of <u>4</u>

STREAM NA	AME Croo	ked Cree	K		LOCATIO	N CC-	· I Cui	strea	m por	tion)		_	
STATION#			MILE_		STREAM	CLASS			-1				
LAT		LONG	}		RIVER BA	ASIN							
STORET#					AGENCY								
INVESTIGA	TORS 3	MR/ B	16										
FORM COM	PLETED BY	JMR/				1 SEP 12 1800	AM) P	М		ON FOR	SURVEY	,	
SAMPLE COLLECT	TION	How were	the fish	captured?		≾ back pack		tote ba	arge	oth	er		•
		Block net	s used?		Yes	. 0	No						
		Sampling	Duratio	n Star	t Time	I	End Time		1.00	Durat	ion <u>189</u>	2 sec.	
		Stream w	idth (in 1	neters)		Max		_	Mea	n			
HABITAT	TYPES	☐ Riffles	9	6 O	ch habitat typ Pools	% □	Runs)_	☐ Sna	ags%		
GENERAI COMMEN		Pass	. 1		ackspot								
SPECIES	TOTAL (COUNT)	OPTION	AL: LEN	GTH (mm)/WEIGHT (g BSAMPLE)		E	F	ANOM	IALIES M	S	Т	Z
	1	(23 51 1	CIVIEN	I WAX SC	DSAMI LE)			 	-	171	3		
blacksport	Hed ow					•							
Fundulu.	5												
	2												X
longear s	unfish					-:							
Leponis	5												
	2												X
striped.	shiner					-:							
Luxilus Chrysocoph	nalus							1					
													X
banded a	later			2		•							
Etheostor	neu												

SPECIES	TOTAL				ım)/WEIG			· · · · · · · · · · · · · · · · · · ·		ANOM		· 	4 of	
	(COUNT)	(25 S	PECIMEN	T MAX	SUBSAMP	LE)	D	E	F	L	M	S	T	Z
	2													X
greenside	dorter							rd.		• • •			13 6-14	
				***			9. 7							
Etheostor							1999			. Sin				17.
blenniois							Toral as	- 		Commission of the control of the con		Total Care	ng na alika Ng	
Dienniois	Authora .							r Andrewson (Con-		ordening participation	TOWN TO THE SE	T-	L	
												1		<u></u>
	**** . 1									am the contract of				
							,	an accept to						59
	***					VI.				. 4	i a i i			
<u> </u>	^								T			T	8.0	Π
ž	Ţ								L			<u> </u>	<u> </u>	<u> </u>
							-		* **	and Education				
											4			
							<u>.</u>					es es es es es es es es es es es es es e		
in over m	garaja ayan karya											and the second		
***************************************													!	!
				-			1						1 1 1	14 c 14 .
							1				all controls		t in i	
							-							
4							<u> </u>		***************************************	.,			· T	
						11 (100 mm) (100 mm mm mm mm mm mm mm mm mm mm mm mm m						1/4	<u> </u>	
	2 (2007) T 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2								art e j	1 11		14.5		3, 4
i de la compania	ana i Risaa i isan waxi						Street September	remando Maria				Maria Maria Maria Maria	· 5]	
*	THE WAY OF STATE			,				7	· ·					
								<u> </u>	T	T T			1	
	J		1								1986694	1	I	
												į ė		
the service of the service of	· La escentra de la companya de la companya de la companya de la companya de la companya de la companya de la comp						4			100		1 10 1		
. At	and the second second second						4						1	
							1	10	<u> </u>	1				one of
											,	E	-	
										-		1 5 2 2		
	And the second second second second		-							1.435				
					-		1	******			** ***			
	1							1						9 02 2 .06
		<u> </u>					ļ.,	L						
												*		
Lagrand BANG	a salas produktor in 1						1			sales de			ta in a seign-	ing ship to the same of
			I	T	1		1	ng angs wa		7 -1 7	1. F . F .			

 $ANOMALY\ CODES:\ D=deformities;\ E=eroded\ fins;\ F=fungus;\ L=lesions;\ M=multiple\ DELT\ anomalies;\ S=emaciated;\ Z=other$



page <u>/</u> of <u>4</u>

OTDELLA	NAT A				LOCATION								
STREAM NA	UIU	oked Co			LOCATION	CC-	1 (upstre	am po	(hear)			
STATION#_		The State of the S	RMILE_		STREAM CI		_						
LAT		LONG	G		RIVER BAS	IN							
STORET#	-000				AGENCY								
INVESTIGA	71	IR / 83	G		D. 1777 54 4	Ca in			T 0710	ONFOR	OLIDITE:		
FORM COM	PLETED BY	JMR/	BJ6		DATE 20 S	A A I I COLOR OF THE PARTY OF T	am p	M		ON FOR	SURVEY	<u></u>	
SAMPLE COLLECT	TION	How wer		captured?	⊠ Yes	pack pack		tote ba	rge	othe	er		
		Sampling		n Start	Time					Durati	on <u>14</u>	18 sec	: .
		Stream w	vidth (in 1	meters)		Max			Mea	an	_		
HABITAT	TYPES	☐ Riffles	9		h habitat type p Pools%		Runs Other ()_	☐ Sna	ıgs%	%	
GENERAI COMMEN			s 2 naly 8	c = bla	ickspot								
SPECIES	TOTAL (COUNT)				/WEIGHT (g) BSAMPLE)	D	E	F	ANOM	IALIES M	S	т	z
	172												X
largesco	le							区区区区			図	X)	
campost oligolepi													
	7												
Ozark mi	won					Ц							
Notropis	nubilus												
	77												X
rainbow d								N N		a C	e len se		
Etheosto													
	35	/E-24-							2 1 1 2 2				×
duskyst shiner	ripe					ØØ	M	1:					
Luxilus													

SPECIES	TOTAL	OPTIONAL:							ANOM	IALIES		2ge 2	_
1100	(COUNT)	(25 SPECI	MENT MA	X SUBSAMPI	LE)	D	E	F	L	М	s	T	Z
	5									***************************************			X
rosyface	shiner		-			1:			- 10.1			1	
عن المكت ما	'=											•	
Notropis 1	rubellus					170 11 4	\$		E CONTRACTOR OF THE STATE OF TH		er standen i valua v		
, a	ere programme de la compansa de la compansa de la compansa de la compansa de la compansa de la compansa de la c						Terefore .					- 1	\$14.54 61
	4		·										X
hornyhead	l chub					, .							
The second second	***************************************					• •							
Nocomis	e in the reference appropries.							1					
biguttot	که								T 8 €			1444	1967
	. 1				<u>-</u>				-				
northern s	tudfish				-	•			, v.n			L	- I
										* 1 :			
Fundulus		200000000000000000000000000000000000000								100			
catenat	.		******										1
	6												X
longear s	unfish					Г.	_5	a direct of Last		Total S	- ** «Seese	I	
										-		14.4	I syn l
Lepamis						-						\$774.1	M.Frei
megalotis	again -ea									*			
	5												X
Ozark bo	ي					جنب		ni Najara	1 14 2 1	1 d d	Art E.E.	THE WINDS	1
,							A P	Jana San San San San San San San San San					
Ambloplit constellat	r.s					m	- 27 La 28 - 2		7 84				
constellat	VS							*		19		*	
	4												X
black rea	Chorse.					00							
						P 19			- 1	. 1			
Moxoston	ام				•		1,1 (4,1,1 (4)						
duquesni					9101.				î				
-110	2												X
northern				1		2 >	i	1					
sucker			-				1		· · · · · · · · · · · · · · · · · · ·	1			
Hypenteli	um		- 1993000 (A) (1993)				1 1 7 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		5 m s ²⁵	and the second			
nigricans	organization ages												
47	3							, , , , , , , , , , , , , , , , , , ,	Í				×
creek ci	Commission Commission					• •	-					***************************************	
. Tilandar ' Ti l	eszer Johnson			 		• §			¥.				
Semotilus		Western, I.				, 3 - 4 2	a particular	All supremental and the second	r r i inje				
atromaci	Jatus			+				4.0			in garage		

 $ANOMALY\ CODES:\ D=deformities;\ E=eroded\ fins;\ F=fungus;\ L=lesions;\ M=multiple\ DELT\ anomalies;\ S=emaciated;\ Z=other$



page 3 of 4

STREAM N	AME Cros	ked Cres	k			LOCATI	ON CC	-1 (upstre	am D	ortion)		
STATION#		RIVER	MILE.		-	STREAM	1 CLASS		'					
LAT		LONG	3		_	RIVER E	BASIN							
STORET#						AGENC	Υ							
INVESTIGA	TORS	JMR/ F	356							Nag-till				
FORM COM	IPLETED BY	JMR	1 85	6			1000	(M) F	PM		ON FOR			
SAMPLE COLLECT	TION	How were	the fis	h captu	red?		back pack		tote b	arge	otl	ner		
		·Block nets	s used?			Yes		No						
		Sampling	Durati	on	Start 7	ime	1	End Time			Durat	tion	198 sec	٠.
		Stream wi	idth (in	meters	s)		Max		-	Me	an			
HABITAT	TYPES	☐ Riffles	•	%	☐ P	ools					□ Sn		%	
GENERAI COMMEN	-ac-v	Pass						o mer (
		Anom	valy i	2 =	blaci	kspot								
SPECIES	TOTAL (COUNT)	OPTIONA (25 SPE				VEIGHT (E	F	ANON	MALIES	s	Т	z
	丩													Х
banded d							-							
P. PILLETT BY	arter													
Etheoston														
Etheoslon zonal c	1													
Etheosion zonale mosquita	na I Ash										I	<u> </u>		
Etheosion zonale mosquita	Ash-affins									I .				
Etheoston zonale mosquita Gambusia	Ash- affinis					7								Γ X
Etheoston zonale mosquita Gambusia banded s	Ash affins Gulpin													
Etheoston zonale mosquito Gambusia banded s	Ash affins Gulpin													L X
Etheoston zonale mosquito Gambusia banded s	Ash- affinis 6 culpin													

											page	. 4 of	
SPECIES	TOTAL (COUNT)		L: LENGTI			-				IALIES			
T. Stages	(COUNT)	(25 SPEC	CIMENT M	AX SUBSA	AMPLE)	D	E	F	L	M	s	T	Z
	1												X
greenside	darter	Table 11 Table 12 Tab				•							a. > 3/7
9						a 2004			11.00	, r ia			1. 1
Etheosto	100												
blennioidi						1	2		e een contr			* \$10 july 1 = 200	 : 4 5 1 1
DENTIVIA	: 3						31.				JOHN COLD A		
				300000000000000000000000000000000000000									
							. 1				3727.32	19 2.01. (27)	LI Ender.
= 	er sa sa		22411002										
	e e e e					1				177	· .		
		· · · · · · · · · · · · · · · · · · ·				4			18 8			4	1811
								-,				1012 ()	1330
		·											
										I.			
	4					1		* .					
				Lawrence Lawrence		1							
	. w					-							
i - 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1.				- Serbina		1		The second	**************************************		5.11 1.00		* * *
									To the state of th				
							1	4. A. E.	i u				
						1				400		17.5	1413
										,		+14 5 4	8166
		-				1					ilia -		
!	100 - 10					<u> </u>			T	3_		ľ	1
The second second	/ Manager (20.6) - 22-	- Miles											
						2415.15	La	4) d	14,4000	Tree [13,551		**************************************
						- 4. · · ·	April 1 de	10			1.1		
		1	00000								- 0.3.0.0	E 1 818 M. 1 XV	40
. # 43	Colorada o Colorado de Colorad					1	1	9	1	e nas ann andi			
<u> </u>	T					,	i		1	<u> </u>		1	
	l					(a) toward (c)	L		<u></u>	<u> </u>		<u> </u>	
						1		1. 4.					
17.11.20	and the same supplies had							0					
									7	no company			
						1							
	1					-		1	1				T
						4	L						<u></u>
						1			Transfer of the Man				
and the second second second	n Milly v. st. vomanie – an						4. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1.	i i Servejenski	- 120 T - 12 (12)				
												and the second	
						-							
					_		T	T	1].		1	****
				-			<u> </u>		15	L			1 :
							- 4	i. Se					
i Barladan ing 1, 11,54 s	aki ngosilikosi (j.)						gu . Le id	egas al		ta wa a sa sa sa sa sa		ens grown stage in	
			T										
		1 1	l		1	-		Į.	j.	was 1			

ANOMALY CODES: D=deformities; E=eroded fins; F=fungus; L=lesions; M=multiple DELT anomalies; S=emaciated; Z=other



page <u>|</u> of <u>4</u>

STREAM NA	AME C.	ked Cr	oole		LOCA	TION	_		-1	6	de.	nael	· -			Hon)	22-11-
STATION#_	U100		ERMILE			AM CLAS				•	AOL	1162	rea	~~	POL	7102		-
LAT			NG		RIVE	R BASIN												
STORET#					AGEN	ICY												
INVESTIGA	TORS J	MR/1	356															
FORM COM	PLETED BY					19 SEP						R	EAS	ON F	OR S	SURVE	Y	
		JMR	1856	P	TIME	1345			AM	M)			UA	4	•••		
SAMPLE COLLECT	ION	How w	ere the fis	sh captured	?	D back	pac	k		0	tote b	arge			othe	er		
		·Block n	ets used?		Yes		(10									
		Sampli	ng Durat	ion St	art Time	_		En	d Tin	ne_		_		Di	urati	on <u>20</u>	08 <u>sec</u>	•
		Stream	width (ir	meters)		Ma	x		-				Mea	in	-			
HABITAT	TYPES	☐ Riffl	es	_%	ach habitat Pools%	%			Runs _)_	0			%	
GENERAL COMMEN		Pas Anor		= blac	kspot													
CDECIEC	TOTAL					T (a)	-1007	-	-	-		A :	NOM	1 4 7 11	re.	imno	-	
SPECIES	TOTAL (COUNT)				m)/WEIGH SUBSAMPL	H. Commercial Commerci	D		E	T	F	1	L	IALII M	-	S	T	Z
	264										***************************************							X
large scale											N N							
Camposton oligolepis	na							Ø	X	X		X		5-4	KN.			
	101							T		T								X
rainbow a	larter						XI.	Ø	×	×	M	Ø	M	Ø	Ø	Ø		
Etheoston																		
	9											Π						×
northern . sucker	hog						Z											
Hypenteli nigrican	um																	
	9			1			-			T		T		9			1	X
longear Si							0	i i			HAIR BALL					MATERIAL ST		e Teach Inc.
Lepomis megaloti	5																	

SPECIES	TOTAL	OPTIONAL: LENGTH (mm)/WEIGHT (g)				ANON	IALIES	page	- X	
	(COUNT)	(25 SPECIMENT MAX SUBSAMPLE)	D	E	F	L	M	S	T	Z
	14									X
greenside.	darter		⋈:						7075	
				1					7 A 5	EVE AT
Etheostom	a-		1 84.1 1	,1		کورور				4 /
blennioid	15		Maria de la compansión	e since	, to a part tool	harman i			şa 	198.
	18									l ý
Ozark bo			Øt				,	. += D)	unt 199, 7	1,63
ONTH PE			101.1							
Ambloplis	les				10.00	etan petrat i gritis				
constelle	atus				HAN HE	riarit gray	- Profit P			Milde Ser Ba
	. 1					T			*** 1 . *.	
			,	<u> </u>			- side			
Creek c	nue		-			l o foks				
Semotilu	S				, vege c.	rijeth i ee e				
atromac	ulatus									
<u></u>	5				F					×
smallmout			. 1 .	L		Militaria de la Companio del Companio de la Companio del Companio de la Companio	4 . 1 5-45		Acceptable Control of the Control of	$\perp \triangle$
STIGHTION	n cum		1:		AND A SEC				11.4) 1990 t
Micropte	rus								1 4 4 4 1 5 1 5 1 5 1 5 1 5 1 5 1 5 1 5	
dolomie	w.		1				+			
	3						₹		*	
hornyhei	August		* *	L Hay	12 T 1 1 1 1 1 1	<u> </u>		jeray		\perp_{X}
no nym-	er Dride		4	3 4	e a tab			Age a		
Nocomis			Temper d files	Buzzeti and :	rincerens).	an er be av E	. 1896 i seille 👸	Service of the service of	9 4	15 - 5 FAR 2 - 1
biguttat	ي ه				1	1	e. L			
<u> </u>	13				ř –		. 0			
banded s	منمانیت									
Dannen 3	cuipm		Ø		1		,			
Cottus						A	4			
Carolina	æ					1	1		,	
	15		1		1					
slendur n				<u> </u>	<u> </u>	1				J
JIENOUS !	reuser/FC		Ø	Par .	+ 2 t		·			
. 1 1	. /.			ng griffing pro-	* * * * * * * * * * * * * * * * * * *	* '''' 2 } ;	eren ing	100	980 Tales on	
Noturus	exilis					* · · · · · · · · · · · · · · · · · · ·	4			
	3							, ,	* isser.	1
yellow b	- Notes		, »		1	1			***************************************	1
yenow e	water cores		- 1							
Ameiuru	S		10.70 24 00		amenda — ter	and the same	83 · , · sens.		er e green en T	
natalis			1	12.0	+ 1				4.	

ANOMALY CODES: D=deformities; E=eroded fins; F=fungus; L=lesions; M=multiple DELT anomalies; S=emaciated; Z=other



page <u>3</u> of <u>4</u>

STREAM N	AME Co	poked Cree	.1-	LOCA	TION CC	-1 (d	dono				-
STATION #		RIVERM	ILE		AM CLASS	-1 (SMCMOIN	TICKW	par	nur)		
LAT				RIVER	BASIN							
STORET#				AGEN				_	with .		-	
INVESTIGA	TORS	MR/BJ	r-									
	IPLETED BY	JMR/ B			19 SEP 13 1345	_	€ E	REAS	SON FOR	SURVEY	-	
SAMPLE COLLECT	TION	How were th	ne fish capture	d?	back pack	ck .	☐ tote ba	arge	☐ oth	ner		* (Wax = 12 **
		Block nets u	sed?	✓ Yes		□ No						
		Sampling Do	uration S	start Time		End Time	e		Durat	ion <u>20</u> 0	08 <u>se</u> c	•
		Stream widt	h (in meters)		Max	- W	<u> </u>	Me	an	-		
HABITAT	TYPES	☐ Riffles	percentage of% d Macrophytes	☐ Pools	%	☐ Runs _)	☐ Sn	ags	%	
GENERAL COMMEN			1 1y Z = 1			*						
		Anoma	14 Z = 1	blacksp	+							
SPECIES	TOTAL (COUNT)		: LENGTH (m			E	F	ANON	MALIES M	s	Т	z
	3											X
banded d	arter				-:							
Etheosto	ma											
	3											X
blumhose	minnow.				::							
Pimephali												
	2											X
striped sl					_;							
Luxilus chrysocep	halus											
	52							110-07	1			X
duskystn	pe shiner									ONT MINISTER		
Luxilus p	Isbryi											

SPECIES	TOTAL	OPTION	AL: LEN	GTH (n	nm)/WEI	GHT (g)				ANOM	ALIES	7 3		of 4
	(COUNT)				SUBSAN		D	E	F	L	M	S	Т	Z
														X
black rea	thorse						*				Ú.		ye ka	130.7 (
	este di						4 3 5				lv'	e de la caracte		
Moxostor	ma-						1			1, 140				
duquesi	nil .							1 4.4.		J. 101 W.	e jaron en en en			11.5
	38												, k	
							K7 K	70 50	Prince .				1 1 1/2	
Ozork n	ninnow						י נצו נו		Ц					
	777.2							· who s						
Notropis 1	1401/US					 	1000							7144 1
- Avenue	. 3				_		£.2	,					G &	TV
									ļ		T I			
rosyface	Shine		+			 		T. Nach	9.00	. Haland	saraki ji			
1 .							1				-			
Notropis 1	rubellus						1							
1	The second secon							4000000	* * * * * * * * * * * * * * * * * * *		Person P	+0.09 %		
1	1									Company of the Company				LX
lorgemonth	DASS									ita est				49
Microplen	ζ]				den.			21301 1129
Salmoide							-			•	i 	i		1 10 2 7
201110122								***						
w.						 			, , , , , , , , , , , , , , , , , , ,	15 G - CON 10 10		· Constitution of the second	. 19	<u> </u>
					,			11.4	ata in Mi	\$ 18 mm 1		in and its		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
And the same of th	······································					_		- 1907 B	t in	oral The Head		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		
	erione at the things													
											- 1			
	- Marie Carlot													
							,							
Balancia de la compaño de la c	James 1987/05/grand Land										F2			
a <u></u>														
											1			
									a pa					
president i Spilander i Spiland	zazi. Liba osa al-													
													1	
								4.			<u> </u>			
i Janet er som tim skilde	alia wys sa sill													
jana Erjana Banglek,							1	erica alemania de la composición de la composición de la composición de la composición de la composición de la La composición de la br>La composición de la	and the second second		omboy, pare		2	
al de roamer de r														

ANOMALY CODES: D=deformities; E=eroded fins; F=fungus; L=lesions; M=multiple DELT anomalies; S=emaciated; Z=other



page 1 of 4

STREAM N	G-F CIL	ked Cr	eek			LOCATION		-1 (d	owns.	treas	an p	ortio	20)			
STATION#_				E		STREAM C										
LAT		ro	NG			RIVER BAS	IN									
STORET#						AGENCY										
INVESTIGA		JMR/	BJG	=		10 -										
FORM COM	PLETED BY	A Army	R/B	56		DATE 195		_		1		ON FC				
		710	F-/ 15	<u> </u>		TIME	/30	_ AM _P	<u>M</u>			UAA			-	
SAMPLE COLLECT	TION	How w	ere the f	ish captu				k	tote	barge		0	other_			
		Block	nets used	i?	J	Yes		J No								
		Sampli	ing Dura	ition	Start T	ime	-	End Time				Du	ration	_17	44 se	د.
		Stream	ı width (in meters)		Max		_	_	Mea	ın				
HABITAT	TYPES	Riff	les	_%	☐ Po	habitat type ools%	. 0								%	6
GENERAI COMMEN			ss 2 omaly	Z=	black	espot										
SPECIES	TOTAL (COUNT)				MARKET CHARLES	VEIGHT (g) SAMPLE)	D	E	F	A	NOM L	IALIE M		s	Т	z
	225												1			X
large scale stonerolle				-		-		N N		100						
Camposto	ma						33437		M		123		451	E		
U. J	82				-			T		T		T	T			TV
rainbow i							N I	N N		2 1	8) (8	Ø D	₹:			
Etheostor																
	71										-		T			IX
duskystn Shiner								3 3 9	N N	N	B	•				
Luxilus	pilsbryi															
	27											1				
Ozork n	ninnow						₩ E	Z C				=				
Notropis	nubilus	E0.20-1019-		Self-Thomas &												

SPECIES	TOTAL			H (mm)/WEIGH					T	ALIES		20	r
	(COUNT)	(25 SPEC	IMENT M	IAX SUBSAMPI	Æ)	D	E	F	L	M	S	Т	Z
	9					,							LX
rosyface	Shiner					Ø			ili. San Filip Santoning				ar part
									yolka Zantan			1 10	
. 1. 1						1							
Notropis i	rubellus					1							
41.4	<u> </u>							I	.l	I			,
blackspo	пеа					1	10 mgs - 1 M		and the state of t				
topminn	OW					1							
Fundulu						1			# 1 T A 2 T			Ę	4 (
Ollvace							T		T	T .			1
a 3 1.1	19					- Appellan - American			ļ		Ļ		<u>_X</u> _
bonded s	culpin				-	N I	4		-78 F (%)	- 1 M			
	······					-				*			
Cothis	انسنا				***								
Co. Oliva.	Fig. of property and							8 4 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	· · · · · · · · · · · · · · · · · · ·		*****	Light on the ti	X.7
Agrical Inc.	<u> </u>					2.4						<u> </u>	LX
bluntnos	e minnow					*							
						_				1		17.17.21 12.17.41	
Pinepha	les									*	con e		et it is so
notatus	Ŝ									ŕ			
	3												X
northern	hog					34.9	4.				9	ST.	
sucker		,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,											10 10 11
Hypentel	ium												
nigrical	NS										6	t with a process	en salved
	7							T					X
Ozark L												· ·	1-2-2-
vew r													
Amblopl	ites			en stadade et								erjer S	8 m ²
constell	latus					-					, /n -n		
# 12 * * ##** # 2000 **	1						T	1			T	1411	V
	<u> </u>						<u></u>	1	1	L			<u> </u>
striped	Shines					-							
1							a service of the green			1 / S			andre di
Luxilus chrysoce	ahalus				***						, vi — +-		
Chrysuce	PATE I					1	1		4 3 - 9	1	1.*	T	V
							<u> </u>		1		<u></u>		<u> </u>
black re	dhorse					•							
						-					λ,	* - 44	ş
Moxost	oma	4									k. 14		
duque	snii												

 $ANOMALY\ CODES:\ D=deformities;\ E=eroded\ fins;\ F=fungus;\ L=lesions;\ M=multiple\ DELT\ anomalies;\ S=emaciated;\ Z=other$



page <u>3</u> of <u>4</u>

				1,00	ATION			-					
STREAM NA	USO	ked Creek		- 1000	CATION	CC.	-1 (down	stream	port	on)	-	-
STATION #_			LE		EAM CLAS	55							
LAT		LONG			ER BASIN					_			
STORET#				AGE	ENCY								
INVESTIGA		IMR/BI	6	1	- 10	20 11			Lance	ON SOR			
FORM COM	PLETED BY	JMR,	BJ6		e <i>19 SEI</i> e <i>173</i>		AM &	M)		ON FOR			
SAMPLE COLLECT	TON	How were the	e fish captur	ed?	☐ bac	k pack		tote b	arge	O oth	er		
COLLECT	ION	·Block nets us	ed?	☐ Ye	s	0	No						
		Sampling Du	ration	Start Time _		E	and Time		_	Durati	on		
		Stream width	i (in meters)		Ma	ax		_	Mea	ın			
HABITAT	TYPES	Indicate the particle Riffles Submerged	%	Pools _	%		Runs Other ()_	☐ Sna	ıgs%	%	
GENERAL COMMEN		Pass .	2	black	spot								
			/										
SPECIES	TOTAL	OPTIONAL:				-			ANOM	IALIES			
	(COUNT)	(25 SPECI	MENT MAX	SUBSAME	PLE)	D	E	F	L	M	S	Т	Z
	2								<u></u>				LX.
hornyhead	chub					•							
Nocomis biguttatu	ıs												
	4												
slender n						::	Ť						
Noturas	exilis												
120	2		-										X
Smallmoun	th bass					•							
Microple	ns												
	10									1			X
banded o	latter					Ø							
Etheosto													

SPECIES	TOTAL	OPTIONAL: L	ENGTH (mn	n)/WEIGHT (g)				ANOM	ALIES	, ,	<u> 24 c</u>	
	(COUNT)	(25 SPECIM	ENT MAX S	UBSAMPLE)	D	E	F	L	M	S	Т	Z
	1								1			X
grænside	darter				3 - 4 -		l	- House of the second		I	1147.11	
יי	, , , , , , , , , , , , , , , , , , , ,				1	6						
			-		+							*
Etheosto	man				la Sila		. 1867	community to the			An a lim	ru.
blennio	RES				er, coming to 26 Mer	: 1					w	
										<u>L</u>		
					ator i	1						
					Y							
process of the second	arr diament or							A- 874				
					1			. : 1 *				
**											54 San	
			+			L	<u>.</u>	<u> </u>		<u></u>	l	J
				· · ·	-{	170,00	5.073	mattack	ngazir 1			
					-				*			
					1	· ·	atalin in	tradition was	100			
					-60 11			a reference		a a comment	de po	41.7
						1				-		
					1 "						134	1584
					1						30 km &	
					1			-	, and		06.50	
							T	1				1
277,044					2000 A 20		<u> </u>	1 1		7 70		
			_		-		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1.4	1.1.1	thirth.	3	31.7 h
t mer en de sike kossi	a saaka aa ah d					. Territoria (TPC) in	ar i sa saga	and white the		3 11 100		
	, desired				_					* L.		
							,			endings on the		vila.
												,
					1				ŕ	. ·		
	•				1			;				
Sales Sales All Sales						* m * * * * * * * * * * * * * * * * * *				a english		
					1						1.1.2	
					1.0		<u> </u>			r		T
					-		ļ					
					4							
ang nanah dagawan da							4 - 4 - 1	#				
		1 1			40.7			44 - 44 - 5 - 5 - 5 - 5 - 5 - 5 - 5 - 5			1	
					*							
,			+			23		1				ــــــــــــــــــــــــــــــــــــــ
					1							
8 - 1 - 1 - 24					4							
	٠.)		· · · · · · · · · · · · · · · · · · ·				
(*					1	f :			1			

ANOMALY CODES: D=deformities; E=eroded fins; F=fungus; L=lesions; M=multiple DELT anomalies; S=emaciated; Z=other



page 1 of 4

STREAM NAME Crooked Creek						LOCATION CC-O (reference)															
STATION #RIVERMILE						STREAM CLASS															
LATLONG						RIVER BASIN															
STORET#						AGENCY															
INVESTIGA'	TORS :	JMR.	<u> / BJ6</u>	<u></u>																	
FORM COMPLETED BY JMR/ 8JG					<u>ک ۵۵ ک</u>					REASON FOR SURVEY											
JMK/ BJG						TIME 1530 AM (M)							UAA								
SAMPLE COLLECT	How w	ere the fi									rge other										
	Block nets used?					☐ No															
	Sampling Duration Start Time					End Time					_										
	Stream width (in meters)					Max Mean							n								
HABITAT TYPES																%	_%				
GENERAL COMMENTS		Pas																			
		Ano	maly;	2 = b	lack	spot															
SPECIES															ANOMALIES						
or berns	(COUNT)		PECIME		·-	D	T	E	\neg	F	L M S T						Z				
	335	-							Appenia Appenia										X		
largescale stoneroller																			*		
Campostoma											8										
oligolepis							التسام		(C)	F_34.	- Kungt	PM	£24	Kase	Litterite	Alternation .	syriat.				
	103																		X		
duskystripe shiner							Ø	図	図	図	Ø (X)	Ø	Ø 1	<u> </u>	Ø					
Luxilus pilsbryi									<u></u>				. 4 -								
	73									\bot									X		
rainbow doctor		A.M.					Ø	Ø	(X)	Ø		X	N	1:	•						
Etheostoma		77			1.8.5.4.		100														
caerules	AM.						95011000000						managa ang ka						A. LOWER A.		
	39													20.17.00					×		
Ozark m						×	10	<u> </u>	ZI [Z						and the same of th					
Notropis nubilus														***************************************					elili il il il il il il il il il il il il		

SPECIES	TOTAL	OPTIONAL: LENGTH (mm)/WEIGHT (g)				ANOMALIES page 2 of 4									
www.	(COUNT)	(25 SP	ECIMENT	MAX SU	BSAMPLE)	D	E	F	L	M	S	T	Z		
ucesti sammari	15						<u></u>								
banded :	sculpin					Ø	1:		#	5					
Cothes						: 4 14	1						*		
carolina							er mermeres s	- g - gar		.	48 - 192				
	ᅵᅥ												\perp		
black re	edhorse								Marine and the second	ga ar ar ar					
Moxosto	ma					Maria Maria		Larger may 4.	enter graphs	· /		4			
duquesi					-		104	44) - 11	i dili di			i Tali	jaling. Tanggar		
	. 11												×		
nachor	ļ					2"73	à .				ALTONO CON	<u> </u>			
northern Sucker	"")			-		Ø	ř.		当たら後の	371					
Hypentel					**************************************]		in a second	fige for	¥ .					
nignica	ns -						nan, ka	, we start					i grande i grande i grande i grande i grande i grande i grande i grande i grande i grande i grande i grande i g		
	4												X		
smallmou	th bass							gen (d. 1.1.)	emies o Colonia (projection)		**************************************		**** 		
Micropto	· MS												Ut da		
dolomic	w											,			
***************************************	19												\perp_{X}		
Ozark b	w s s					Ø	Ø	The late	i ¥5vi Unictoro	11.11.11			- 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		
Amblopl	Tiles	1					- AL . E.S. CA		British British		jan i nasvig				
constell	latus							ro i	ar ne vi i ne vigi. L						
	8					264 4	T	T	1						
1						- Francis	1				<u> </u>	ļ	$\bot \triangle$		
longeor.	sunn's !-						\$, particular							
Lepomis	Allerdador e regis attalla agrapa de la com-					1						***	, r prvi 1		
megalo	нs					1									
	5					1		T	T				×		
bluntnose	<u> </u>					16	mater 1	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	ž Š						
Pinephi	. <u>U. 5</u> 					- 120 To - 10 - 12 - 13 - 30 - 15 - 15 - 17			The state of the s		. 5	n na úgil s val (
9,500 2,000	3		-				T	T	Ť		<u> </u>				
striped.	shiner	,					, v . ,		1 1		L	<u> </u>			
		-				-	an time da	eture i i i j							
chrysoc	s ephalus								1						

ANOMALY CODES: D=deformities; E=eroded fins; F=fungus; L=lesions; M=multiple DELT anomalies; S=emaciated; Z=other



FISH SAMPLING FIELD DATA SHEET (FRONT)

page <u>3</u> of <u>4</u>

							-					
STREAM NA	AME Cro	oked Creek		LOCATION	CC	:-0 (refer	ence)			
STATION #_			A STATE OF THE PARTY OF THE PAR	STREAM CL	ASS							
LAT		LONG		RIVER BASI	N							
STORET#				AGENCY								
INVESTIGA	TORS	JMR/BJ	rg-									
FORM COM	PLETED BY	JMR/		DATE 20 2			M	REAS	ON FOR	SURVEY		
SAMPLE COLLECT	ION	How were the f	ish captured?)XI	ack pack		tote b	arge	oth	er		
		Block nets used	1?	Yes		No						
		Sampling Dura	tion Star	t Time		End Time			Durat	ion_23	48 sec	-
		Stream width (in meters)		Max		_	Mea	an			
HABITAT	TYPES	Indicate the percentage of each habitat type present Riffles% Pools% Runs% Submerged Macrophytes% Other ()%										
GENERAL COMMEN	The second secon	Pass 1		ackspot								
		Anomaly	2 = 61	ackspot								
SPECIES	TOTAL (COUNT)	OPTIONAL: L					IALIES					
		(25 SPECIM	ENT MAX SU	BSAMPLE)	D	E	F	L	M	S	T	Z
	6					L	The state of	1		L.,,		LX
hornyhead	d chub				Γ.							
Nocomis bigutta	hus										PE WOZ	
	9		1									
rosyface	. shiner				Ø							
Notropis ru	ibellus											
	2											
mosquib	10				. •							
Gambusia	affinis											
	18											
slender n					Ø.							
Noturus	Noturus exilis											

SPECIES	TOTAL	OPTION.	AL: LEN	GTH (n	ım)/WEIG	HT (g)	ANOMALIES page 4 of 4								
	(COUNT)				SUBSAM		D	E	F	L	M	s	Т	Z	
	3													X	
greenside	date								1		L			1	
יייע		- HARREST NO. 184					*			11 P. 11			3.	- 6	
Etheoston	na						1								
blennioi			-				1						* 1	r (in),	
	2							* * * * * * * * * * * * * * * * * * * *	T	T T	I	1	1	T >-	
		nisones -					, pp	1		L	l	<u> </u>	wer i		
banded a	larter														
7	· · · · · · · · · · · · · · · · · · ·														
Etheosto		T. (1000)								eli :	. W et		ij	5 · \$ 1.5	
Lorase	, , , , , , , , , , , , , , , , , , ,						-			T		Т	<u> </u>	TV	
	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		-							<u> </u>		ļ	İ		
largemou	<i>*</i> *-			_				Table	11.47	, art gar	grianets i				
6A55											-				
Micropher	دع								A THIM I	0 E 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1					
Salmoid	45		-				A CONTRACTOR				· · · · · · · · · · · · · · · · · · ·		v		
									L						
											4			11:1	
													1.1.1.14	litti",	
*											1964				
· ×	***************************************			·····				• .				to a second	land and ag	Astronomical Control	
					12.1110000000		1			6 1 . july					
									-with war and With	/ /		ery see		Los agrees	
				·					"						
	1													T	
***************************************									<u> </u>	l		1,	<u> </u>		
	•														
os terierro.	Party is more of						*-,				6 + 74 · w	10 1 70 0			
	, i, i						1								
									 	<u> </u>	Trans.			T	
										L	<u></u>	<u> </u>		1	
							1								
	asser in the limit of														
	A company							100				: *	. 4		
·							- 100		1 1000	, ,					
							ļ				<u> </u>				
•												74.2			
general SA - Sample	ori i i i i i i i i i i i i i i i i i i													. ,4	
							1						F + 19 1F		

ANOMALY CODES: D=deformities; E=eroded fins; F=fungus; L=lesions; M=multiple DELT anomalies; S=emaciated; Z=other



FISH SAMPLING FIELD DATA SHEET (FRONT)

page <u>/</u> of <u>3</u>

STREAM NA	AME a					LOCATION			- /			_					
		oked				STREAM C			0 (ref	crenc	E.					
		KIVI	CKMILE									_					
STORET #		LON	NG		_	RIVER BAS	SIN	_		-							
INVESTIGA	TORC					AGENCY											
		JMR/	BJ	<u>G-</u>	10	DATE 20	SER IN				Tp	EAC	ON FOR	SURVEY	,		
FORM COM	PLETED BY	TIV	R/E	356	1				NA AC	50	K	EAS					
		-				TIME 18	00		TIM C	IVI		-	UAA	<u> </u>			
SAMPLE	YON.	How we	ere the fi	sh capture	d?	×	back pac	k		□ tote	barge		oth	ner			
COLLECT	ION	·Block ne	ets used:	?)	Yes		D N	o								
		Samplin	ng Durat	ion S	tart Ti	me	-	End	l Time				Durat	tion <u>18</u>	37 sec.		
	-	Stream	width (i	n meters)			Max					Mea	an				
HABITAT	TYPES					abitat type											
		Riffle				ols% %)	□ Sn	ags	%		
GENERAL COMMENTS			ss 2	acrophytes			*	<u> </u>	uici (-		
		Ano	moly	2 =	blac	kspot	-										
SPECIES	TOTAL (COUNT)	OPTIO	NAL: LI		m)/W	EIGHT (g)	D	T	E	F	AN	-	ALIES	S	Т	z	
	227	Ť				T		+			_					×	
largescale				-			Ø		IVI	M	OI K	ו ה	N KN	D D			
stonerolle				1										N N			
Campostor			-	1	-		The state of the s		AND ADDRESS OF THE PARTY OF THE	NE	N D	I P	N N	M M			
olingslepi	S							X	11								
	79							T		T	T					1	
				†	-		570			-		-				LX.	
rainbow d	astu		The state of the s			_	- Del	1X	IM	IXI .		K) I	N Z				
Etheosto	07A		an consumer.	-	-												
caerulei																	
	7		_				+	T			-	***************************************				-	
						-	+_					7.07				LX	
Ozork m	Monow						jn										
Alotropis n	ubilus																
	48												- 1			×	
duskystrip shiner	Commission of the local district of the									Ø C	ב					W-16.	
Luxilus pi																	

SPECIES	TOTAL	OPTIONAL: LENGTH (mm)/WEIGHT (g)	ANOMALIES ANOMALIES								
	(COUNT)	(25 SPECIMENT MAX SUBSAMPLE)	D	E	F	L	M	S	T	Z	
	17										
slender i	nadlom		Ø	П			1				
Noturus	exilis							9790			
	5								1	X	
greenside	date		1.3						4- 20 - 10 -	123	
Etheosto				Ar en en en en en en en en en en en en en	ang sita	oricii Nasibbo na		1444	run a lin al Swannia		
	. 1					200022200000000000000000000000000000000				X	
black rea	lhorse		**			. 1018 ()					
Moxosto. duquesr					muziyan n	9 400° 0 3					
	11						E.				
banded s	culpin		Ø)		and the second		<u></u>	l		
Cothis	ب										
	5		111111111111111111111111111111111111111								
rosyface	shiner		17							terreners Stury	
Notropis	rubellus					NATIONAL PROPERTY OF THE PROPE		en en en en en en en en en en en en en e			
	6					1			T T	V	
Ozark 1			<u> </u>				, a			L X	
Ambloplis constella	les Hus			- 1 4	. V1.1						
	1			T	İ			-	T	X	
6/untrose	minnow			1			10 P				
Pimephi notah	(<i>U.S</i> (S		out a		A CONTRACTOR STATE		67 g 79	, mwg + 15.		or gentle in the	
	2									X	
banded	dorter			4	,		1	4			
Etheost											

ANOMALY CODES: D=deformities; E=eroded fins; F=fungus; L=lesions; M=multiple DELT anomalies; S=emaciated; Z=other



FISH SAMPLING FIELD DATA SHEET (FRONT)

page <u>3</u> of <u>3</u>

STREAM NA	ME Cr	poked			LO	CATION	cc	-0 (refer	ence))		***************************************			
		RIV	ERMILE		ST	REAM CL	ASS									
LAT		LO	NG		RI	VER BASI	N									
STORET#					AC	GENCY										
INVESTIGAT	rors	JME	2/83	6												
FORM COM	PLETED BY				ı	TE 20 5				REAS	ON FOR	SURVEY	,			
		J#	nr/e	ST&	TE	ме <u> 18</u> 0	<u> </u>	AM (P	M)		MAA					
SAMPLE		How we	ere the fi	sh captured	i?	jèl b	ack pack		tote ba	rge	oth 🗗	er		-		
COLLECT	ION			_	ر فند.	T Voc.										
	•	Block n	ets used?		χŲΥ	Yes 🗆 No										
		Samoli	ng Durat	ion S	tart Time	Time End Time Duration 1887 sec										
		•				Max Mean										
		Stream	width (ii	n meters)		1	Мах			Mea	ın					
											-					
HABITAT TYPES Indicate the percentage of ea □ Riffles%						%		Runs			☐ Sna	ags	%			
				^u acrophytes .		%		Other (
GENERAL																
COMMEN	TS	Pa	55 J													
	Anomaly Z = blackspot															
SPECIES	TOTAL			ENGTH (m					-	ANON	IALIES					
SIECIES	(COUNT)			ENT MAX			D	E	F	L	M	S	Т	Z		
	2				<u></u>									×		
Hama								L			Augusta and a second	L	· · · · · · · · · · · · · · · · · · ·			
northern sucker	^°5		-	-			1									
Hypenteli	un.	277		1		1	1									
nigricar	کا					†	1									
7.1.91.1.2.3	1									1				~		
1			-	1		1	,	1	l	<u></u>	L	L	L			
longear s	untish			+		+	1									
1 48						1	1									
megalot	اخ			+		1	1			,						
1115			<u> </u>	-		<u> </u>		Γ	1	1		· · · · · · · · · · · · · · · · · · ·				
						-		<u> </u>	L	<u> </u>		· · · · · · · · · · · · · · · · · · ·	L	X		
green su	nfish		<u> </u>			_	•									
							1									
Lepomi.	. . .					-	1									
cyanelli	45								·							
	5								<u></u>	<u> </u>		<u> </u>	<u></u>	X		
hornyhead	dohuh						1:									
1 Mary nest	· Union															
Nocomis																
bigutta	hs.															
					<u> </u>	- himman			- 777							

SPECIES	TOTAL	OPTIONAL: LENGTH (mm)/WEIGHT (g)												
	(COUNT)				SUBSAN		D	E	F	L	M	S	T	Z
									<u> </u>				Att or h	
								ŧ .						* #
							15.64	1						
														5.4.3
					 	*							T	
		1656 Prihaman			1					1	All Marian and All Marian	1		<u> </u>
						5		, .						
									1		1.			
К				}	ļ				041,443,18	Authorities	., y₩ <u>`</u>		V January	
!	I.										T .	i i		
	ľ				+					1	<u>.</u>	L		ļ
						<u> </u>	-		21 1	march y so	na kipi il a			
¥							-		e Asia	la ma				
4.			ļ	<u> </u>			_			en marin i audit				
										T				
,	<u> </u>	T YOU COLOR			 			l	<u> </u>	<u> </u>		<u> </u>		
						 	- "							
							-						1.6.1	
							-							
3								1	Т	1	T	ľ		I .
		ļ			-	_	777	2000	1	7 14 15	1	<u> </u>	Mark Control of the C	
							-	Visioni Valori		in the second		1 21 11. 1 1 1/ 11.		
	a a sakto jesasan e — mil 1		1	-		-		ng web in a	4, 1, 70, 77, 5, 5	itan (
				 		-	a milja a		4					
				-					1	·	1	1	T	ı .
	and the same		-				7	<u></u>	:					
							-		* *			1		
	and the second of the second o		-											
	* *1 *			-									± .	
	T			ļ	_		1	i -	T	1		1	·1	
,			-					i	1		<u></u>		<u>. </u>	
es a comprehensive passing				-	-								ve	
					-		_							,
			-	-			:	1	· T		i i	<u> </u>		T
· · · · · · · · · · · · · · · · · · ·				_			4	<u> </u>		1,,		1		
	• *						.,			\$. F		(
e gA wicks chair 1 A A	सित वि. इ						1 1891	i i		erra i				
						-								
									í					

 $ANOMALY\ CODES:\ D=deformities;\ E=eroded\ fins;\ F=fungus;\ L=lesions;\ M=multiple\ DELT\ anomalies;\ S=emaciated;\ Z=other$

FTN Associates, LTD. Physical Characterization - Worksheet

~	\sim	•
I.	Genera	ı
	G C II C I G	L

Date/Time	20 SEP 12 1730	Stream
	JMR/ BJG	Transect No
Project No.	4315-050	Picture No

Stream _	Crooked	Creak		
Transect No.	CC-0			
Picture No.				

In-Situ Data II.

Physical Characterization III.

Dissolved Oxygen, mg/L _	9.70
Temperature, C	20.63
Conductivity, uhmos	356.
pH, su	7.1.7
ORP mv	

Stream Width, ft	25.5	
Channel Width, ft		
Pool	Length, ft	
Riffle/Run	Length, ft	
Tape Down (ft)		

36.23187 92 17815

	(ft)				-93.078	3/5	
	Tape						
	Reading		Section			Area	
Transect	from	Depth	Length	Area	Velocity	Flow	
Reading	LB/RB	(ft)	(ft)	(ft2)	(fs)	(cfs)	Comments
1.					0.00		
2	29	0.10			0.00		
3	28	0.20			-0.09		
4	27	0.20			-0.06	· ·	
5	26	0.25			0.00		
6	25	0.30			-0.01		
7	24	0.30			0.05		
8	23	0.40					
9	22	0.30			0.02		
10	21	0.50					
	20	0.60			0.23		
12	. 11	6.90	 		0.50		
13	18	0.90		ļ	0.77	-	
	17	1.10		<u> </u>	1.51		
14	16	1.20			1.74		
15	15	1.30	-	 	1.79		
16	14	1.40			1.89	-	
17	13	1.40			1.42		
18	12	1,40			1.27		
19	11	1.40	<u> </u>	_	0.72		•
20	10	1.35	 		0.35		
21	9	1.20			0.19		
22	8	0.90		ļ ⁻	0.04		
23	7	1.00		-	0.04	· ·	
24	6	0.90			-0.11		·
25	5	0.60	<u> </u>		-0.06		
26	4	0.20			-0.03		
27	3.5	0.00			0.00		LB @ 3.5 f4
Totals	0	-	0			0.000	cfs
L						Δ.	

FTN Associates, LTD. Physical Characterization - Worksheet

I.	General
A.	O 0 41 0 4 44

Date/Time	19 SEP 12 1910	Stream _	Crooked	Creek	
	JMR/ BJG	Transect No.	cc-i		
Project No.	4315-050	Picture No.			

II In-Situ Data

Physical Characterization III.

ii.		111.		
Dissolved Oxygen, mg/L	9.61	Stream Width, ft	23.5 Pt	
Temperature, C	20.51	Channel Width, ft		
Conductivity, uhmos	377.9	Pool	Length, ft	
pH, su	7.47	Riffle/Run	Length, ft	
ORP, mv		Tape Down (ft)		
		GPS —		

36.24179 -93.07558

	(f+)				-93.073.		
	Tape						
	Reading		Section			Area	
Transect	from	Depth	Length	Area	Velocity	Flow	
Reading	LBRB	(ft)	(ft)	(ft2)	(fs)	(cfs)	Comments
1	7.5	0.00	·		0.00		
2	8	0.10			0.03		
3	9	0.45			-0.09		
4	10	0.60			0.29		
5	1	0.80			0.83		
6	12	0.80			1.09		
7	13	0.70			1.73		
8	14	0.70			1.69		
9	15	0.90			1.83		
10	16	0.55			2.12		:
11	. 17	0.80			2.45		
12	18	0.80			2.52		
13	19	0.80			1.84		
14	20	0.80			1.81		
15	21	0.60			1.32		
16	22	0.70			1.52		
17	23	0.60			1.66		
18	24	0.60			0.71		
19	25	0.55			08.0		
20	26	0.40			0.51		
21	27	0.35			0.37		
22	28	0.20		-	0.47		
23	29	0.20		-	0.34		
24	30	000			0.00		
25	31	0.00			0.00		
26		1 - 16 - 2 - 3					
27							
Totals	0		Ô			0.000	cfs
41	3 e 31 F	7	·	,		0	gpm

STREAM NAME Crooked Crook	LOCATION CC-O
STATION # RIVERMILE	STREAM CLASS
LATLONG	RIVER BASIN
STORET#	AGENCY
INVESTIGATORS JMR	
FORM COMPLETED BY	DATE 205EP12 REASON FOR SURVEY
JMR	TIME 1819 AM (PM) UAA

	Habitat		Condition	Category	
	Parameter Parameter	Optimal	Suboptimal	Marginal	Poor
	Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
	SCORE 17	20 19 18 (17) 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
sampling reach	2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
ed ir	SCORE 19	20 (19) 18 17 16	15 14 13 12 11	10 9 8 7 6	$(5) \cdot (4 \cdot (3 \cdot (2 \cdot (1 \cdot (3 \cdot (2 \cdot (1 \cdot (3 \cdot (2 \cdot (2 \cdot (2 \cdot (2 \cdot (2 \cdot (2 \cdot (2$
Parameters to be evaluated in sampling reach	3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast- shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
ıram	SCORE 19	20 (19) 18 17 16	. 15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
Par	4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development, more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
	SCORE 15	20 19 18 17 16	(15) 14: 13: 12: 11:	10, 9, 8, 7, 6	15, 4, 3, 2, 1 0
Marine Process	5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
	SCORE 14	20 19 18 17 16	15 (4) 13 12 11	10, 9, 8, 7, 6	5 4 3 2 1 0

- [Habitat	Condition Category					
	Parameter	Optimal	Suboptimal	Marginal	Poor		
	6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.		
	score 20	(20) 19 18 17 16	15 14 -13 -12 -11 -	10-9-8-47-6	5 4 3 2 1 0		
oling reach	7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.		
sami	SCORE 20	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0		
Farameters to be evaluated broader than samphing reach	8. Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.		
e e	SCORE 9 (LE) RB	Left Bank 10 (9)	8 7 6	5 4 4 3	2 1 0		
2 10	SCORE 7 (BE) 48	Right Bank 10	3 - 8 - 21 (7) a 16	- 5 4 3	in-2 2 1 0		
Parameters (9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation has been removed to 5 centimeters or less in average stubble height.		
	SCORE 9 (LE) RE	Left Bank 10 9	8 7 6	5 4 3	2 1 0		
	SCORE 7 (PE) 48	Right Bank 10 9	8 (7) 6	5 4 3	2 11 0		
	10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6- 12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.		
	SCORE 10 (LB) PB	Left Bank (10) 9	8 7 6	3 4	2 1 0		
	SCORE 2 (PE)48	Right Bank 10 9	8 7 6	5 4 3	(2) 1 0		

STREAM NAME Crooked Creek	LOCATION (C.CO
STATION # RIVERMILE	STREAM CLASS
LATLONG	RIVER BASIN
STORET#	AGENCY
INVESTIGATORS JMR BJG	ALL MANAGEMENT AND AND AND AND AND AND AND AND AND AND
FORM COMPLETED BY	DATE 205ept 2012 REASON FOR SURVEY

	Habitat	Condition Category					
	Parameter Parameter	Optimal	Suboptimal	Marginal	Poor		
	1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.		
	SCORE 18	20 19 (18) 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0		
Parameters to be evaluated in sampling reach	2. Embeddedness	Gravel, cobble, and boulder particles are 0- 25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.		
ted in	SCORE 18	20 19 (18) 17 16	15 14 13 12 11	10 9 8 7 6	5:4-3-2-1-0		
eters to be evalua	3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).		
ram	SCORE 19	20 (19) 18 17 16	15 14 13 12 Jil	10, 9, 8, 7, 6	5 4 3 2 1 0		
Par	4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.		
ľ	SCORE 15	20 19 18 17 16	(\$\frac{14}{13} \] 12_[1]	10 9 8 7 6	5 4 3 2 1 0		
	5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or rifle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.		
	SCORE 14	20 19 18 17 16	15 (4) 13 12 11	10 9 8 17 7 6	5 4 3 2 1 0		

	Habitat		Condition	Category	
	Parameter	Optimal	Suboptimal	Marginal	Poor
	Alteration	Channelization or dredging absent or minimal, stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
	SCORE 20	(20) 19 18 17 16	15 14 - 13 12 112 115	109876	5 4 4 3 2 1 0
ling reach	7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
sampl	score <i>3</i> 0	(20) 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
Parameters to be evaluated broader than sampling reach	8. Bank Stability (score each bank) Note: determine left or right side by facing downstream	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
eval		Left Bank 10 (9	8 7 6	18 35 / F3 4 8 13 13 3 / 20	2 1 0
to be	SCORE 8 (BE)LB	Right Bank 10 🧼 9	(8) - √ 7∠ ∴ ≤ 6	3.5 June 4. 2.3.3	$(1+2) \cdot (1+2)
Parameters	9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
	SCORE 9 (JE) RE	Left Bank 10 0 9	8 7 6	5 4 3	2 1 0
	SCORE 7 (RE) US	Right Bank 10 9	$\left(7\right)_{\pm}$	5 = 4 (3	2 11 0
	10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6- 12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
	SCORE 10 (LE) RB		8 7 6	5 4 3	2 1 0
	SCORE 4 (BE) LB	Right Bank 10 9	8 7 6	5 (A) 3	2, 1 0

STREAM NAME Crooked Creek	LOCATION CC-O
STATION # RIVERMILE	STREAM CLASS
LATLONG	RIVER BASIN
STORET#	AGENCY
INVESTIGATORS SMR/BJG	
FORM COMPLETED BY	DATE 20 SEP 12 REASON FOR SURVEY TIME 1817 AM (FM)
JMR/ BJG Combined	TIME 1819 AM PM UAA

	Habitat		Condition	tion Category			
	Parameter	Optimal	Suboptimal	Marginal	Poor		
	1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.		
	SCORE 18	20 19 (18) 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0		
n sampling reach	2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50- 75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.		
ted i	SCORE 18	20 19 (8) 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0.		
Parameters to be evaluated in sampling reach	3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).		
ram	SCORE 19	20 (9) 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0		
Pa	4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.		
	SCORE 15	20 19 18 17 16	(15) 14 13 12 11 ·	10 9 8 7 6	5 4 3 2 1 0		
V-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1	5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.		
	SCORE 14	20 19 18 17 16	15 (14) 13 12 11	10 -9 8 14 7 6	5 4 3 2 1 0		

Habitat		Condition	Category	
Parameter	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 20	(20) · 19 · 18 · 17 · 16°.	The second secon	10 9 8 7 6	5 4 3 3 2 11 0
7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water of shallow riffles; poor habitat, distance between riffles divided by the width of the stream is a ratio of >25.
SCORE 20	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 9 (LE) RB	Left Bank 10 (9)	8 7 6	5 4 4 3 3	W. W. 2
	Right Bank (10 5 7 9)	4 18 2 (D) 116	2 5 med = 82	2 1 0
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 9 (LE) RB	Left Bank 10 (9)	8 7 6	5 4 3	,2 1 [0
SCORE 7 (RE)	Right Bank 10 9	8 (7) 16	5	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6- 12 meters; human activities have impacted zone a great deal.	Width of riparian zone < meters: little or no riparian vegetation due to human activities.
SCORE 10 (LB) RB	19 19 19 19 19 19 19 19 19 19 19 19 19 1	8 7 6	5 4 3	2 1 0
SCORE 3 (BE) 48	Right Bank 10 9	8 7 6	5 4 3	2 1 0

STREAM NAME Crooked Crock	LOCATION CC-1 (upstream portion)
STATION# RIVERMILE	STREAM CLASS
LATLONG	RIVER BASIN
STORET#	AGENCY
INVESTIGATORS JMR	
FORM COMPLETED BY	DATE 20 SEP 12 REASON FOR SURVEY
JMR	TIME 1100 M PM UAA

	Habitat		Condition	Category	
	Parameter	Optima <u>l</u>	Suboptimal	Marginal	Poor
	1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover, mix of snags, submerged logs, undercut banks, cobble or other stable babitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
	SCORE 19	20 (19) 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
n sampling reach	2. Embeddedness	Gravel, cobble, and boulder particles are 0- 25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25- 50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50- 75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
Parameters to be evaluated in sampling reach	SCORE 16	20 19 18 17 (16)	15 14 13 12 11	10 9 8 7 6	151 4 3 2 1 0
	3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by I velocity/ depth regime (usually slow-deep).
ıram	SCORE 18	20 19 (18) 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
Par	4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
	SCORE //	20 19 18 17 16	15 14 13 12 (11)	10 9 8 7 6	5 4 3 2 1 0
	5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
	SCORE 14	20 19 18 17 16	15 (14) 13 12 11	10 9 8 7 1 6	5 4 3 2 1 0

ł	Habitat -		Condition	Category	
	Parameter	Optimal	Suboptimal	Marginal	Poor
	Channel eration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabior or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SC	ORE 20	(20) 19 18 17 16	15 14 13 12 11	1098-76	5 4 3 2 1 0
Rif	Frequency of Thes (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water of shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
sc	ore 19	20 (19) 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
No or i	Bank Stability core each bank) ote: determine left right side by ing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing 60-100% of bank has erosional scars.
SC	CORE 7 (LB)	Left Bank 10 9	8 (7) 6	5 4 3	2 1 0
sc	ORE 8 (RB)	Right Bank 10 9	16 (8) sq 7 sq 6	4 7 3 3 1 1 4 1 4 3 3 1 1 1 1 1 1 1 1 1 1 1	1 2 1 0
9. Pr eac	Vegetative rotection (score ch bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambar vegetation has been removed to 5 centimeters or less in average stubble height.
sc	CORE 9 (LB)	Left Bank 10 (9)	8 7 6	5 4 3	2 1 0
SC	CORE 9 (RB)	Right Bank 10 (9)	8 7 6	5 4 3	2 1 0
Vo W ba	O. Riparian egetative Zone /idth (score each ank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6- 12 meters; human activities have impacted zone a great deal.	Width of riparian zone meters: little or no riparian vegetation due human activities.
so	CORE <u>6</u> (LB)	Left Bank 10 9	8 7 6	3 4 3	2 1 0
0.0	CORE 10 (RB)	Right Bank (10) 9	8 7 6	5 4 3	2 1 0

Total Score 166

A-8

STREAM NAME Crooked Creek	LOCATION (C) DS - usshes as the
STATION # RIVERMILE	STREAM CLASS
LATLONG	RIVER BASIN
STORET #	AGENCY
INVESTIGATORS JMR BJG	
FORM COMPLETED BY B3G	DATE 70500 2012 REASON FOR SURVEY

	Habitat	·	Condition	Category	
	Parameter	Optimal	Suboptimal	Margipal	Poor
	I. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble of other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
	SCORE 19	20 (19) 18 17 16	15 14 13 12 11	10_9 8 7 6	5 4 3 2 1 0
n sampling reach	2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
ted in	SCORE 16	20 19 18 17 (16)	15 14 13 12 11	10 9 8 7 6	51:4:3:02:1
Parameters to be evaluated in sampling reach	3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
ıram	SCORE 19	20 (19) 18 17 16	I5 14 13 12 14	10. 9 8 7 6.	5 4 3 2 1 0
Par	4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
	SCORE 14	20 19 18 17 16	15/14) 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
	SCORE (20 19 18 17 (16)	15 14 13 12 TI	10 9 8 7 6	5 4 3 2 1 0

	YT-L:4-4		Condition	Category	
	Habitat Parameter	Optimal	Suboptimal	Marginal	Poor
	6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
	SCORE 20	20) 19 18 17 16	15 14 13 12-11-	10 9 - 8 - 7 - 6	5 4 3 2 1 0
ling reach	7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
samp	score 19	20 (19) 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
Parameters to be evaluated broader than sampling reach	8. Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
e eva	SCORE 7 (LB)	Left Bank 10 9	1 8 D 6 1 C	5 4 1 3	2 0
to b	SCORE 🧏 (RB)	Right Bank 10	-(8) 7 sur6	43	dHas 2 - 2 - 2 1 2 0 1
Parameters	9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
1	SCORE 4 (LB)	Left Bank 10 (9)	8 7 6	5 4 3	2 1 0
	SCORE (RB)	Right Bank 10 (9)	7 mm 6.	5 200 minuted 4 2 2 2 2 3 2 2 3	2 1 0
	10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6- 12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
	SCORE (LB)	Left Bank 10 9	7 6	5 4 3	2 0
L	SCORE 10 (RB)	Right Bank (10)9	8 7 6	5 4 3	2 1 0

STREAM NAME Crooked Creek	LOCATION CC-1 (upstream portion)
STATION # RIVERMILE	STREAM CLASS
LATLONG	RIVER BASIN
STORET#	AGENCY
INVESTIGATORS JMR/BJG	
FORM COMPLETED BY	DATE 20 SEP 12 REASON FOR SURVEY
JMR/BJG Combined	TIME 1100 AM PM UAA

	Habitat		Condition	Category	
	Parameter	Optimal	Suboptimal	Marginal	Poor
	1. Epifaunal Substrate/ Avaifable Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable babitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
	SCORE 19	20 (19) 18 17 16	15 14 13 12 11	10. 9 8 7 6	5 4 3 2 1 0
sampling reach	2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
ted ii	SCORE 6	20_ 19, 18_ 17. (16)	15 14 13 12 11	10 9 8 7 6	$-5 \stackrel{?}{\sim} 4 + 3 + 2 \stackrel{?}{\sim} 1 \stackrel{?}{\sim} 0 \stackrel{?}{\sim}$
Parameters to be evaluated in sampling reach	3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast- shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
ram	SCORE 19	20 (19) 18 17 16	15 14 [3 12 11	10 9 8 7 6	5 4 3 2 1 0
Pa	4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
	SCORE 13	20 19 18 17 16	15 14 (13)12 11	10 9 8 7 6	5 4 3 2 1 0
	5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
	SCORE 15	20 19 18 17 16	15) 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

			Condition	Category	
	Habitat Parameter	Optimal	Suboptimal	Marginal	Poor
	6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
	SCORE 20	(20) 19 -18 - 17 - 16	15 14 -13 -12 -11-	10-9-8-7-6	5 443 2 1 0
g reach	7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
sampl	SCORE 19	20 (19) 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
Parameters to be evaluated broader than sampling reach	8. Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
e eva	SCORE 7 (LB)	Left Bank 10 9	41	5 4 3	2 [0
s to b	SCORE 8 (RB)	Right Bank 10 9	(8) 7 - 6	5 24, 3	2 1 0
Parameters	9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
	SCORE (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
	SCORE 9 (RB)	Right Bank 10 (9)	7	5. 4 \$3	2 1 0
	10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6- 12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
	SCORE 7 (LB)	Left Bank 10 9	8 (7) 6	5 4 3	2 1 0
	SCORE 10 (RB)	Right Bank 10 9	8 7 6	5 = _43	2 1 0

STREAM NAME Crooked Creek	LOCATION CC-1 (downstream partier)
STATION # RIVERMILE	STREAM CLASS
LATLONG	RIVER BASIN
STORET#	AGENCY
INVESTIGATORS JMR	
FORM COMPLETED BY	DATE 19 SEP 12 REASON FOR SURVEY TIME 7900 AM EM UAA

	Habitat		Condition	Category	
	Parameter	Optimal	Suboptimal	Marginal	Poor
	1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
	SCORE 17	20 19 18 (17) 16	15 14 13 12 11	10, 9 8 7 6	5 4 3 2 1 0
1 sampling reach	2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25- 50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50- 75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
ted ir	SCORE 19	20 (19) 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
Parameters to be evaluated in sampling reach	3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
Lam	SCORE 15	20 19 18 17 16	(15) 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
Pa	4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
	SCORE 19	20 (19) 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
1	SCORE 19	20 (19) 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Habitat			Condition	Category	
١	Parameter	Optimal	Suboptimal	Marginal	Poor
1	6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabio or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
	SCORE 20	(0) 19 18 17 16	15-14-13-12-11-	10-9-8-7-6	5 4 3 2 1 10
g reach	7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water of shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
	SCORE 19	20 (19) 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 i
	8. Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing 60-100% of bank has erosional scars.
	SCORE 6 (LB)	Left Bank 10 9	8 7	5 4 3	2 1 0
	SCORE 6 (RB)	Right Bank 10 9	- 8	14. 14. 14. 14. 14. 14. 14. 14. 14. 14.	2 1 0
rarameters to be evaluated broader than sampang recom	9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident;	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambar vegetation is very high, vegetation has been removed to 5 centimeters or less in average stubble height.
		almost all plants allowed to grow naturally.	height remaining.		
	SCORE 7 (LB)	almost all plants allowed	8 0 6	5 4 3	2 1 0
	SCORE 7 (LB) SCORE 9 (RB)	almost all plants allowed to grow naturally.		5 4 3	2 1 0
		almost all plants allowed to grow naturally. Left Bank 10, 20, 20, 20, 20, 20, 20, 20, 20, 20, 2	8 0 6	4 4 4	

STREAM NAME Crooked Creek	LOCATION (C-1 DS - Z-downstream portion
STATION#RIVERMILE	STREAM CLASS
LAT LONG	RIVER BASIN
STORET#	AGENCY
INVESTIGATORS SMR BSG	
FORM COMPLETED BY	DATE 4301 2017 REASON FOR SURVEY

	Habitat		Condition	Category	
	Parameter	Optimal	Suboptimal	Marginal	Poor
	1, Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover, mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
	SCORE 17	20 19 18 (17) 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
sampling reach	2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
ted ir	SCORE 19	18 17 16 خواکا 20	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
Parameters to be evaluated in sampling reach	3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, scote lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by I velocity/ depth regime (usually slow-deep).
ram	score /5	20 19 18 17 16	(15) 14 13 12 14	10 9 8 7 6	5 4 3 2 1 0
Para	4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
	SCORE 19	20 (19) 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riftle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
1	SCORE 17	20 19 18 (17) 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

	Habitat		Condition	Category	
	Parameter	Optimal	Suboptimal	Marginal	Poor
	6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
	SCORE 20	(20) 19 18 17 16	15 14 -13 12 11	109876	5 4 3 2 1 0
ig reach	7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent, ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat, distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
Samp	SCORE 19	20 (19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
rarameters to be evaluated broader than sampling reach	8. Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
e ev	SCORE <u>6</u> (LB)	Left Bank 10 9	8 7 7 7 66	5 4 3	2 1 0
0.00	SCORE <u>6</u> (RB)	Right Bank 10 - 1 19	3 8 3 1 7 1 6	6 = 5 - 1 = 4 - 1 = 3	2 1 0
rarameters	9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
	SCORE <u>8</u> (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
	SCORE 9 (RB)	Right Bank 10 (9)	8 7 16	5 . 4 . 3	2 1 0
	10. Riparian Vegetative Zoue Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6- 12 meters; human activities have impacted zone a great deal.	Width of riparian zone <0 meters: little or no riparian vegetation due to human activities.
	SCORE <u>\$</u> (LB)	Left Bank 10 9	8 7	(5) 4 3	2 ** 2 ** 0
	SCORE 9 (RB)	Right Bank 10 (9)	8 7 6	5 4 3	2 1 0

STREAM NAME Crooked Creek	LOCATION CC-1 (downstream perhan)
STATION # RIVERMILE	STREAM CLASS
LATLONG	RIVER BASIN
STORET#	AGENCY
INVESTIGATORS JMR/BJG	
FORM COMPLETED BY	DATE 19 SEP 12 REASON FOR SURVEY
JMR/BJG Combined	TIME 1900 AM PM UAA

	Habitat	Condition Category							
	Parameter	Optimal	Suboptimal	Marginal	Poor				
	1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.				
	SCORE 17	20 19 18 (7) 16	15 14 I3 12 11	10 9 8 7 6	5 4 3 2 1 0				
a sampling reach	2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.				
ed ii	SCORE 19	20 (19) 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0				
Parameters to be evaluated in sampling reach	3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by I velocity/ depth regime (usually slow-deep).				
ram	SCORE 15	20 19 18 17 16	(5) 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0				
Pa	4. Sediment Deposition Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.		Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.				
	SCORE 19	20 (19) 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0				
	5. Channel Flow Status Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.		Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	channel and mostly				
	SCORE 18	20 19 (8) 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0				

	** 11		Condition	Category		
	Habitat Parameter	Optimal	Suboptimal	Marginal	Poor	
Ti .	6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.	
	SCORE 20	(20) 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0	
	7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.	
amp	SCORE 19	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0	
Parameters to be evaluated broader than sampling reach	8. Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.	
e eva	SCORE 6 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0	
to b	SCORE <u>6</u> (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0	
Parameters	9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.	
	SCORE (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0	
	SCORE 9 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0	
	10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6- 12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.	
	SCORE 5 (LB)	Left Bank 10 9	8 7 6	3 4 3	2 1 0	
	SCORE 9 (RB)	Right Bank 10	8 7 6	5 4 3	2 1 0	



CHARACTERIZATION

Perennial

Stream Origin

Glacial

■ Non-glacial montane

☐ Swamp and bog

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME Croo	ked Creek	LOCATION	CC-0		Ex. ax at	
STATION #	RIVERMILE	STREAM CLAS	SS		Type France 2.	
LAT 36.23187	LONG <u>- 93. 0785</u> %	RIVER BASIN	<u> </u>	n activity	 Section 1. Annual Control of the Contr	*_ * * * * * * * * * * * * * * * * * *
STORET#	22 E28 ST #	AGENCY	*	*	4	and the state of
INVESTIGATORS	IMR/BJG	alan and a second	The significance gas to a second account when it was	175 (4)	· 17 · 10 · 10 · 10 · 10 · 10 · 10 · 10	
FORM COMPLETED BY	JMR	DATE 20 SE		1.	REASON FOR SURVEY	/
i i	JMI-	TIME 181	AM (PM)	2	UAA	
i.	્રા કાં સુપંજ ટ્રેક				A STATE OF THE STA	
WEATHER CONDITIONS	rain (ste		Past 24 Hours		here been a heavy rain in s I I No I I I I I I I I I I I I I I I I	
	clear/su	nny			्राक्ष्य कृष्याः (वे व	
SITE LOCATION/MAP	Draw a map of the site a	and indicate the	areas sampled (or	attach a	photograph)	The second of the second
	Phodos Phodos	x 1	South Market	Pro Pro	W9 \	The Way
		Photo Bio	Lie net		Flot and the same of the same	The state of the s
STREAM	Stream Subsystem	- 1	4	Stream	Type	ing Single

☐ Tidal

Mixture of origins

☐ Coldwater

☐ Intermittent



PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

				(Directly)				
WATERSHI	ED	Predominant Sur	ounding Landuse	Local Watershed				
FEATURES		Forest			☐ No evidence ☑ Some potential sources			
Field/Pasture				- to	Obvious sources			
		☐ Agricultural☐ Residential	☐ Other	· 4	Local Watershed Erosion			
		- Mariana		Lanining	None Moderate	Heavy		
RIPARIAN		Indicate the domi	nant type and record the dom	inant species of	resent			
VEGETATI	ON	Trees LB	☐ Shrubs ☐ Gr	asses I.Q	☐ Herbaceous	1		
(18 meter bu	iffer)	dominant species	nresent		•			
				Name of the second seco				
INSTREAM FEATURES		Estimated Reach	Length <u>4700</u> m		Canopy Cover Partly open Partly sh	aded Cl Shaded		
FEATURES		Estimated Stream	Width 10 m					
					High Water Mark 0.5 m			
		Sampling Reach	Aream²		D. C. SD. J. D.			
•		Area in km² (m²v	1000)km ²		Proportion of Reach Repres Morphology Types			
		,			Riffle 80 % 30 Rur	1 40 % 40		
		Estimated Stream	Depth <u>O.4</u> m		□ Riffle 2 % 30 □ Rur □ Pool 20 % 30	consulted us/ BJG		
		Surface Velocity	0.2 m/sec		Channelized			
		(at thalweg)	2 's III/sec		Channenzed C1 to			
		(at that, eg)			Dam Present	No		
LARGE WO	OODY	LWD	m² Present		· · · · · · · · · · · · · · · · · · ·	The Handrid Annual Mark		
DEBRIS		Density of LWD	2 2					
AQUATIC		· · · · · · · · · · · · · · · · · · ·	nant type and record the don	resent	,			
VEGETATI	ION	☐ Rooted emerger				☐ Free floating		
		☐ Floating Algae	Attached Alg	ae	•			
		dominant angaige	present none					
		dominant species i	nesent /10					
		Portion of the reac	h with aquatic vegetation	(%				
WATER Q	UALITY	Temperature	°C		Water Odors			
		Specific Conductance field Dissolved Oxygen 5ee field pH Turbidity			Normal/None			
		WQ Instrument	Used		Clear Slightly turbid			
				1.1 2.1	Opaque Stained	Other		
SEDIMENT		Odors			Deposits	~ ~ ~ ~ .		
SUBSTRAT	ГE		☐ Sewage ☐ Petroleu ☐ Anaerobic ☐ None	m		Paper fiber		
		Other	Li Aliacione Li Nolle		B reduct diletis	oma		
					Looking at stones which are			
		Oils		D -6	embedded, are the undersid	les black in color?		
		Absent 🗆 S	Slight	Profuse	☐ Yes No			
	INORGA	NIC SUBSTRATE	COMPONENTS		ORGANIC SUBSTRATE CO	OMPONENTS		
		(should add up to l			(does not necessarily add a	ip to 100%)		
Substrate			% Composition in	Substrate		% Composition in		
Substrate Type		Diameter	Sampling Reach	Туре	Characteristic	Sampling Area		
Bedrock			10		Sticks, wood, coarse plant			
Boulder	> 256 mm	n (10")	5	Detritus	materials (CPOM)	< 5		
Cobble		ım (2.5" – 10")	35			, , , , , , , , , , , , , , , , , , ,		
			50	Muck-Mud	Black, very fine organic (FPOM)	<1		
Gravel		(0.1"-2.5")			· · · · · · · · · · · · · · · · · · ·			
Sand	0.06 – 2n	nm (gritty)			Grey, shell fragments			

consulted w/ BJG

0.004-0.06 mm

<0.004 mm (slick)

Silt

Clay

A-6

Marl



PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

131719.

STREAM NAME Crook	ed Creek	LOCATION	con	DS-2	paperoxes.	
STATION#	RIVERMILE	STREAM CLA			क्ष्यून एक्ष्यून १ के दे	
LAT <u>36, 24380</u>	LONG 93.07640	RIVER BASIN	Karalist ayarana a	1. 5-131 8/142/133	·李昭: 明禧: 世界下十二世	, * 3 * t y 名 * 数
STORET#	n schlick f	AGENCY	· *	\$ 3. ⁴ \$		
INVESTIGATORS JM	R/856	h da commune e e chamerle companya companya communicación	encorneg espelajones ejerificación — Servicio, ou les résidigio	Adversi i	-propagasis	KTI (STANDOST TA
FORM COMPLETED BY	ren trinin t		Tr R	~ I.	ASON FOR SURVEY	\$10 Billion
12.5 million	MIR THE	TIME 190	O AM C		UAA.	. <u>1</u> 13-1 7 7 1
ł,	trac work that					
WEATHER	rd Nowi kinner	•	Past 24		iterd) quivancui re been a heavy rain in th	e last 7 days?
CONDITIONS	na,- ng P©kanati.∜		Hours		MO I was	•
*19.7		heavy rain) eady rain)	o	244. 11 3 .	Air Temperature	65° °C
	showers	s (intermittent)			,	
a 25 m²	% 🗗 %cloud		% SK		of Other som ac	
14°						
SITE LOCATION/MAP	Draw a map of the site	and indicate the الحاجاء	areas sampled	or attach a p	mediately apsker	~)
by the state of th	Ĺ				112-11-12-12-13	# 18.5 ST
, de W	(Z ₂)(/\	· · · · · · · · · · · · · · · · · · ·	/2	71.33.23 De
l l ^{wa} .		2/1	RI (-)	c)-1	REERIFFE	•
, 15°	<i>[[]</i>	RE	1256	Jan San	Por Pool	
T11	C_{2}	1 0	1/	/ (2)	CRU Z Run	
140	Sim	(25 m)			The same of the same of	. In the second
		1 8)	1 (I Island	
V				1	and the state of the	
1138			-	1	ogles () socialist de l'	
1137	(1) (or ns	/	1 Date	Les
			<i></i>			
1505	I_{\cdots}			(\bigcirc)	stole a E 1	
photos at cclusa cclusa 36.34380 93.07639			P	V .,	1	
Jusa	Samuel Sa		7 .	In	1 Plon	
04380		\ /	. (14	A 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	in the first and a second a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second and a second a second and a second and a second and a second and a second and a second and a second and a second and a second and a second
36.0 1631	((()) (2	w / 1	12 4 2		
93.0	Substitution of a substitution of			>> 1	- 1	
1 1 4 1 1 1 1 1 1 1	Marin Committee		- (/	O(1)	10	
	100	Black	Net 1	- /	10 25 1	
n ninsyn siener of	ti salah kata i	BRI	Defe	Property of the	111460 - 114900	<+ 1
1.000 1 4 1 4	1961年中,李明明 1985年1981年1981年1981年1981年1981年1981年1981年		The second second second second second second second second second second second second second second second se	- 141	the two chiefs	
STREAM	Ştream Subsystem	4.124.2	parter and	Stream	Type Type	. Assessment
CHARACTERIZATION	Perennial 🔲 I	ntermittent	☐ Tidal	☐ Coldv	vater Warmwa	
/				C-4-1		2 *******
	Stream Origin Glacial	Spring-fed		Catchm	ent Area	kin*
	☐ Non-glacial montane		of origins		ి గ్రామం	
	☐ Swamp and bog	Other_			tritus it his es	

han in the first of the momentation of a first half before the back of the first of the first half.



PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET

WATERSHED FEATURES Predominant Surrounding Landuse George Commercial Feature Field/Pasture George Commercial Feature Fea			Local Watershed No evidence Some potential sources Obvious sources Local Watershed Erosion Moderate Heavy				
☐ Residential					None Moderate	Heavy	
RIPARIAN VEGETATIO (18 meter bu	81	Indicate the domin	The state of the s		7		
INSTREAM	H	Estimated Reach l	Length <u>150</u> m		Canopy Cover	, e 1, e 1	
FEATURES		Estimated Stream	Width 10 m	ř	Partly open Partly sh		
No.		Sampling Reach A	aream²		High Water Mark 0.3 m		
•	7. ·	Area in km² (m²x1	6 4 7	,	Proportion of Reach Repres Morphology Types	3/211/18/19	
		Estimated Stream			Riffle 10 % Rur	70%_consulted we	
· .		Surface Velocity (at thalweg)	<u>0.2</u> m/sec		Channelized	• • •	
		(at thatweg)			Dam Present	s S ÉNo	
LARGE WO	OODY	LWD Consider Density of LWD	m² m²/km² (LWD /r	each area)			
AQUATIC			nant type and record the dom		resent	,	
VEGETATI	ON	☐ Rooted emergent ☐ Rooted submergent			☐ Rooted Floating ☐ Free floating		
		☐ Floating Algae					
		dominant species p	present Nine	A			
		Portion of the reac	h with aquatic vegetation(<u>/%</u>			
WATER QU	JALITY	Temperature°C Specific Conductance Dissolved Oxygen pH Turbidity WQ Instrument Used Odors Normal Sewage Petroleum Chemical Anaerobic None			Water Odors Normal/None Sewage Petroleum Chemical Fishy Other Water Surface Oils Slick Sheen Globs Flecks None Other Turbidity (if not measured) Turbid Opaque Stained Other Deposits Sludge Sawdust Paper fiber Sand Relict shells Other		
-							
	-						
SEDIMENT SUBSTRAT							
		Oils Moderate Profuse			Looking at stones which are not deeply embedded, are the undersides black in color?		
	INORGAI	NIC SUBSTRATE			ORGANIC SUBSTRATE CO		
(should add up to 100		% Composition in	Substrate		% Composition in		
Substrate Type		Diameter	Sampling Reach	Туре	Characteristic	Sampling Area	
Bedrock			10	Detritus	Sticks, wood, coarse plant materials (CPOM)	<5	
Boulder	> 256 mm		10				
Cobble		m (2.5" – 10")	25	Muck-Mud	Black, very fine organic (FPOM)	0	
Gravel		(0.1" – 2.5") nm (gritty)	3.1 2		Grey, shell fragments	, , , , , , , , , , , , , , , , , , , ,	
Sand			2	Marl	C. OJ, SHOM HUBINOMO		
Silt 0.004-0.06 mm		· ···			1		

consulted w/ BJG



PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

	the control of the co	The second secon	and the second of the second o		
	#24 \$ 2.24 . Ya		31.0 PM - 134 V	ins a decig for his despite color of	to Nathrality
m against ea	Control of the Control of the		1. 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	· *	531192
	1 (1801) (244) (27				
STREAM NAME Cro	oked Creek	LOCATION	CC-I DS	Tallfutsterne for #	
STATION#	RIVERMILE	STREAM CLASS		\$300000	
LAT 36.24158	LONG <u>-93.07609</u>	RIVER BASIN	11 12 NOVER 1 1 10 128	2 × aggargana (a.). = = = = = = = = = = = = = = = = = =	13. (12.6.4)
STORET#	ar - constrail "	AGENCY	*`*		(MARCH 1911)
INVESTIGATORS	JMR/BJG	and following and last proposition of the propositi	granden for a great of the second plan from	and the second of the second o	11511 7.3 824.67371
FORM COMPLETED BY	the second of th	DATE 20 SEP	12	REASON FOR SURVE	Y : 11.12
	THE PHOTOMETER STATE OF	TIME 1100	AM PM	LAA	7:31:14
	a kess offsprif		V shall	- The second of a second of the second of th	
WEATHER			1	part displacement	

0	telki makipun .			
WEATHER CONDITIONS	Now! I surre to "	Past 24 Hours	Has there been a heavy rain	in the last 7 days?
i eu	storm (heavy rain) rain (steady rain)		Air Temperature	65°c
50 × 310	showers (intermittent)) <u> </u>	e to Other # 2011 1 1	
	clear/sunny	9	giter black like	
SITE LOCATION/MAP	Draw a map of the site and indicate	the areas sampled (or	attach a nhotograph)	28.8
SHE LOCATION MA	braw a map of the site and indicate	the areas sampled (or	action a protography (1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
		a water	in the second of the contract	1
	plot	11/	Side Section in the section of the s	in and the second of the secon
			Company of the comment	· 伊罗亚尔约尔文克·泰斯克尔
	6	Ting 3	Ling to be the rediction of	
1		Some,	Section of the second	Vinnesyriolog
		Ky Ky	N. Shape	े कुट (विकास) है
5, a oak on, k skin stá	And the second of the second o		Color has	ol
ungs, inves	STATE OF STATE	* , 8 (1)	and the state of t	1 1 1 1 1 1
) 188 kg	the state of the s		e judicine and the brain.	
STREAM CHARACTERIZATION	Stream Subsystem Perennial Intermittent	☐ Tidat	Stream Type Coldwater Wa	िनी स्ना धिन ।दः rmwater । श्रीहरकुर्व
	Stream Origin Glacial Non-glacial montane Swamp and bog	xture of origins	en en en en en en en en en en en en en e	Mary Mary Mary Mary Mary Mary Mary Mary



PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET

(BACK) Predominant Surrounding Landuse Local Watershed WATERSHED ☐ No evidence Some potential sources **FEATURES** Forest □ Commercial ☐ Industrial ☐ Obvious sources Field/Pasture Agricultural Other_ Local Watershed Erosion ☐ Residential None Moderate RIPARIAN Indicate the dominant type and record the dominant species present VEGETATION Trees P.B ☐ Shrubs Grasses ☐ Herbaceous (18 meter buffer) dominant species present Estimated Reach Length 250m INSTREAM Canopy Cover A/Partly open □ Partly shaded □ Shaded **FEATURES** Estimated Stream Width _/5_m High Water Mark 0.5 m Sampling Reach Area Proportion of Reach Represented by Stream Morphology Types
☐ Riffle 35 % Area in km² (m²x1000) DRun 34 % _ consulted w/ ☐ Pool 33 % Estimated Stream Depth O. 3m B56 TYes No 0. 2 m/sec Channelized Surface Velocity (at thalweg) No Dam Present ☐ Yes Pre-scont LARGE WOODY LWD DEBRIS Density of LWD m²/km² (LWD/reach area) Indicate the dominant type and record the dominant species present AQUATIC VEGETATION Rooted emergent ☐ Rooted submergent ☐ Rooted Floating ☐ Free floating ☐ Attached Algae Floating Algae dominant species present Portion of the reach with aquatic vegetation Water Odors WATER QUALITY Temperature_ ☐ Sewage Mormal/None Petroleum □ Chemical Specific Conductance_ ☐ Fishy ☐ Other Dissolved Oxygen _ Water Surface Oils Slick Sheen Globs Flecks None Other Turbidity_ Turbidity (if not measured) Clear Slightly turbid □ Turbid WQ Instrument Used_ Other ☐ Opaque ☐ Stained Deposits SEDIMENT/ Odors ☐ Sludge ☐ Sawdust ☐ Sand ☐ Paper fiber ☐ Petroleum SUBSTRATE Normal ☐ Sewage Chemical ☐ Anaerobic ■ None ☐ Relict shells ☐ Other Other | Looking at stones which are not deeply

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	Diameter	% Composition in Sampling Reach	Substrate Type	Characteristic	% Composition in Sampling Area
Bedrock		10	Detritus	Sticks, wood, coarse plant	5-10
Boulder	> 256 mm (10")	10	, Dealius	materials (CPOM)	
Cobble	64-256 mm (2.5" – 10")	35	Muck-Mud	Black, very fine organic	1-
Gravel	2-64 mm (0.1" - 2.5")	. 50	[VIUCK-[VIUG	(FPOM)	
Sand	0.06 – 2mm (gritty)	<1		Grey, shell fragments	
Silt	0.004-0.06 mm	5	Marl		. 0
Clay	<0.004 mm (slick)				

Profuse

☐ Yes

☐ Slight

Absent Absent

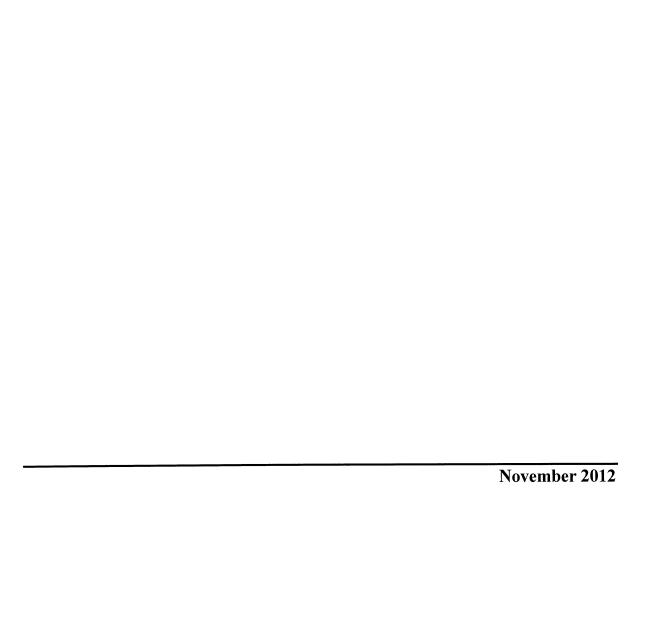
■ Moderate

embedded, are the undersides black in color?

No

consulted w/ BJG

A-6



* Minisarde #4 deployed upstream @ 15:11 Clear Gool - Only senthered light rain over tost for days - some location as september * Minisande # 5 deployed downshows @ 15:25 - same location as september sample * WRO 017:23 * WR-1 @ 16:55 28 1000 12 some bearin Temp! 8.30 ph: 7.46 ipc. LDO: Rete in the Rein

ž,

CC-1 Sample @ 1213 (Harrison DS) - Same location as flow 417 Temp 16.69 SpC pH 7.89 9.50 100 @ 14:50 Fran FTN # 38352 Just Sample (ocation WD STORM Hydrolato pulled @ 15:45 - CC-1 7 HOO! 16:00 Hovison oulfall pH 7 26 Teny 13 85 . 00 9.14 669 (a) 17:10 13.25 pH 7.67 477 SPC DO 10.98 WR-0, WR-1, + CC-O in situs collected w/ Hydrolab SN 45796 CC-1, HOOI, & YOOI in situs collected w/ Hydrolab SN 38352

FTN Associates, LTD. Physical Characterization - Worksheet

I. General

Crooked Creak Date/Time 28 Nov 12 0915 Stream Transect No. CC-O Observer IMR / BJG Project No. 4315-050 Picture No.

II. In-Situ Data

Physical Characterization III.

Dissolved Oxygen, mg/L_	9.96
Temperature, C	8.30
Conductivity, uhmos	377
pH, su	7.46
ORP, mv	

Stream Width, ft Channel Width, ft Pool Length, ft Riffle/Run Length, ft_____ Tape Down (ft) GPS

	(A-)						
	Tape						
	Reading		Section			Area	
Transect	from	Depth	Length	Area	Velocity	Flow	İ
Reading	LB/RB	(ft)	(ft)	(ft2)	(fs)	(cfs)	Comments
1	35	0.06			0,00		
2	34.1	0.1			0.00		
3	33	0.1			-0.02		
4	32	0.1			0.17		
5	31	0.2			0.24		
6	30	0.2			0.58		
7	29	0.2			0.57		
8	28	0.35			0.12		
9	27	0.4			0.31		
10	26	0.3			0.22		:
11	25	0.4			0.72		
12	રૂપ	0.5			0.89		
13	23	0.6			0.69		
14	aa	0.6			1.49		
15	21	0.9			1.40		
16	ನಿರ	0.9			1.35		
17	19	0.9			1.50		
18	18	1.0			1.07		
19	17	1,0			1.62		
20	16	0.9			0.80	ļ	
21	15	0.8			0.62		
22	14	0.8			0.50		
23	13	0.7			0.16		
24	12	0.5			-0.05		
25	11	0.4			-0.05		
26	10	0.0			0.00		
27	9	0.2			0.05		
Totals	0		Ó			0.000	cfs
	8	0.05			0.00	0	gpm
	7.5	0.00			0.00		LB @ 7.5 ft

FTN Associates, LTD. Physical Characterization - Worksheet

I. General

Date/Time	28 NOV 12 1313	Stream_	Crooked Creek
Observer _	JMR/ BJG	Transect No.	CC-1
Project No.	4315-050	Picture No.	

II. In-Situ Data

III. Physical Characterization

Dissolved Oxygen, mg/L	9.80
Temperature, C	16.69
Conductivity, uhmos	417
pH, su	7.89
ORP, mv	

Stream Width, ft	20.9	
Channel Width, ft		
Pool	Length, ft	
Riffle/Run	Length, ft	
Tape Down (ft)		
GPS		

(f+)

	(f+)						
	Tape		S4:			A was	
	Reading		Section			Area	
Transect	from	Depth	Length	Area	Velocity	Flow	
Reading	LB(RB)	(ft)	(ft)	(ft2)	(fs)	(cfs)	Comments
1	5,8	0.00	_		0.00		
2.	6	0.1			-0.18		water to the second sec
3	7	0.2			0.26		
4	8	0.4			0.14		
5	9	0.5			0.60		
6	10	0.7			0.67		
7	11	0.8			0.90		
8	12	0.9			1.41		
9	13	0.8			1.23]	
10	14	6.9			0.81		:
11	15	0.9			0.87		
12	16	0,9			1.01		
13	17	0.8			1.59		
14	18	0.8			1.22		
15	12	0.8			0.85		
16	20	0.8			0.80		
17	21	0.6			1-08		
18	22	0.6			0.80		
19	23	0.4			0.33		
20	24	0.35			0.29		
21	25	0.2			0.02		
22	26	0.1		-	0.00		
23	26.7	0.00			000		LB € 26.7 ft
24	*						
25							
26							
27							
Totals	0		Ó			0.000	cfs
<u> </u>						0	gpm

STREAM NAME Crooked Creek	LOCATION CC-O	
STATION# RIVERMILE	STREAM CLASS	
LAT LONG	RIVER BASIN	N
STORET#	AGENCY	le :
INVESTIGATORS JMR	2000	
FORM COMPLETED BY	DATE 28 NOV IX	REASON FOR SURVEY
JMR	TIME 0934 (AM) PM	UAA

27	Habitat	Condition Category			
ti kut	Parameter -	Optimal	«Suboptimal»	Marginal	Poor
	1. Epitaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifamal colonization and fish cover, mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat, well-snited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
٦					Name of the Control o
sampling reac	2. Embeddedness	Gravel, cobble, and boulder particles are 0- 25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
ıted in	score 18	20 19 (18) 17, 16	15 / 14 (13 / 12 / 11 -	10. 9 8 7 6	5 4 3 2 1 0
Parameters to be evaluated in sampling reach	3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow shallow are missing, score low).	Dominated by I velocity/ depth regime (usually slow-deep).
aram	SCORE 19	20 (19) 18 17 16	15=14 /13 12 11	10 9 8 7 6.	5 4 3 2 1 0
ď	4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
	SCORE 17	20 19 18 17 16	15 14 13 12 11	10 : 9 8 7 6	5 4 3 2 1 0
	5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
	score 15	20 19 18 17 16	(5) 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

T		-	Condition	Category	
-	Habitat Parameter	Optimal	Suboptimal	Marginal	Poor
	6. Chaunel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abuments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
	SCORE 20	(20) 19 18 17 16		10 9 8 7 6	5 4 3 2 1 0
	7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent, distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
ampl	score 20	20 19 18 17 16	15 14 13 12 1 <u>11</u>	10 9 8 7 16	5 4 3 2 1 0
Parameters to be evaluated broader than sampling reach	8. Bank Stability (score each bank) Note: determine left or right side by facing downstream. SCORE 7 (LB)	Banks stable, evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. Left Bank 10 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
to be	$\frac{1}{2}$ SCORE $\frac{7}{2}$ (RB)	Right Bank 10	8 1 0	5 4 2 3	2 10 0
Parameters to	9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	removed to 5 centimeters or less in average stubble height.
	SCORE 6 (LB) SCORE 9 (RB)	Left Bank 10 9	8 7 (6) 8 7 6	5 4 3 5 4 3	2 1 0 2 2 0 2
	10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6- 12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
	SCORE 2 (LB)	Left Bank 10 9	8 7 6	5 4 3	2) 1 - 0,
	SCORE 10 (RB)	Right Bank (10) 9	8 7 6	5 4 3	2 1 0

Total Score __170

STREAM NAME CLOCKED Creek	LOCATION (C-C
STATION#RIVERMILE	STREAM CLASS
LATLÔNG	RIVER BASIN
STORET#	AGENCY
INVESTIGATORS BSG / 5MR	
FORM COMPLETED BY	DATE 25 Lbs 2012 REASON FOR SURVEY TIME 04:34 AM PM UAA

	Habitat	Condition Category			
5543	Parameter -	Optimal	SuboptimalA	_	Poor
	1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover, mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
	SCORE	20 13 18 17 16	15 14 13 12 11	0 9 8 7 6	5 4 3 2 1 0
sampling reach	2. Embeddedness	Gravel, cobble, and boulder particles are 0- 25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25- 50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50- 75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
ed in	SCORE	20 19 17 16	15 14 13 12 11	10: 9 8 7 6	5-4-3-2-1-0
Parameters to be evaluated in sampling reach	3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by I velocity/ depth regime (usually slow-deep).
ram	SCORE	20 19 At 17 16.	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
Pa	4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment, 5-30% of the bottom affected, slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
	SCORE	20 19 🗚 17 16	15 14 13 12 11	10 9 8 7 6	-5 4 3 2 1 0
	5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water-fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
	SCORE	20 19 18 17 16	13 14 13 12 11 ·	Jo 9 8 7 6	5 4 3 2 1 0

	F 111	Condition Category				
	Habitat Parameter	Optimal	Suboptimal	Marginal	Poor	
	6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.	
	SCORE	2 19 *18 17 16		10 9 8 +7 6	5 4 3 2 1 0	
	7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream 47.1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat, distance between riffles divided by the width of the stream is a ratio of >25.	
ampl	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0	
Parameters to be evaluated broader than sampling reach	8. Bank Stability (score each bank) Note: determine left or right side by facing downstream. SCORE(LB)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. Left Bank 10	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.	
s to	SCORE (RB)	Right Bank 10 9	8 7 7	5 4 1 3 1	7 2 ⁻² 1/-10	
Parameters 1	9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent, more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.	
	SCORE(LB)	Left Bank 10 10	8 7 6	543	2 1 0	
	SCORE (RB)	Right Bank 10 9	8 A 6	5 4 f 3	: 2) 1 1 1 0 5 c	
	10. Řípariáu Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6- 12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.	
	SCORE(LB)	Left Bank 101 9	1.72		2 1 1 0	
1	SCORE (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 - 0	

Total	Score	
1 OLAI	Score	

STREAM NAME Crooked Creek	LOCATION CC -O	
STATION#RIVERMILE	STREAM CLASS	
LATLONG	RIVER BASIN	N Page
STORET#	AGENCY	U ∄ .
INVESTIGATORS JMR / BJG		\$ 1.7 m
FORM COMPLETED BY	DATE 28 NOV 12	REASON FOR SURVEY
JMR/BJG Combined	TIME 0934 (AM) PM	uAA

	The state of the s	Winds Comments Commen	Condition	Category	
Next)	Habitat Parameter	Optimal		Marginal	Poor
The state of the s	1. Epitaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifatinal colonization and fish cover, mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
70.34	SCORE 18	20 19 (18) 17 16	15 14 13 12 11	0 9 8 7 6	5 4 3 2 1 0
sampling reach	2. Embeddedness	Gravel, cobble, and boulder particles are 0- 25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25- 50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50- 75% surrounded by fine sediment	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
ed in	SCORE 18	20 19 (18) 17 16	15 d4 13 12 H.	$10.9 \cdot 8 \cdot 7 \cdot 6$	5, 4, 3-2, 1, 0
Parameters to be evaluated in sampling reach	3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow of slow-shallow are missing, score low).	Dominated by I velocity/ depth regime (usually slow-deep).
ıram	SCORE 19	20 (19) 18 17 116	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
P _i	4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
	SCORE 17	20 19 18 17 16	15 14/=13 (12/-11)	io; 9 8 7 6	5 4 3 2 1 0
	5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
	SCORE 15	20 19 18 17 16	(5) 14 13 12 11	jo 9 8 7 6	5 4 3 2 1 0

Habitat		Condition	Category	Condition Category				
Parameter	Optimal	Suboptimal	Marginal	Poor				
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabio or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.				
SCORE 20	(20) 19 18 17 16	I5 ≡14 13 12 11	10 9 8 47 6	5 4 3 2 1 0				
7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water of shallow riffles; poor habitat, distance between riffles divided by the width of the stream is a ratio of >25.				
SCORE 20	20 19 18 17 16	15 4 13 12 11	10 9 8 37 6	5 4 3 2 1 (
8. Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing 60-100% of bank has erosional scars.				
SCORE 7 (LB)	Left Bank 10 9	6 (7) e 6 (7)	5 4 3	2 1 0				
SCORE 9 (RB)	Right Bank 10 (9)	8 7 116	S 4 5 3 51	2 1 0				
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented, disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streamban vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.				
SCORE 7 (LB) SCORE 9 (RB)	Left Bank 10 - 9 Right Bank 10 9	8 (1) 6	5 4 3	2 1 0				
10. Riparian Vegetative Zone Width (score each bank riparian zone)	impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6- 12 meters; human activities have impacted zone a great deal.	Width of riparian zone meters: little or no riparian vegetation due human activities.				
SCORE 3 (LB)	Left Bank 10 9	8-17-6	4 (3)	2 1 1 1				
SCORE /O (RB)	Right Bank (10) 9	8 7 6	5 4 3	2 1 0				

Total Score 172

STREAM NAME Crooked Creek	LOCATION CC-1 (Upstream Postion)
STATION# RIVERMILE	STREAM CLASS
LAT LONG	RIVER BASIN
STORET #	AGENCY
INVESTIGATORS JMR	4.
FORM COMPLETED BY	DATE 28 NOV 12 REASON FOR SURVEY
JWB	TIME 1330 AM (M) UAA

	Habitat	Condition Category			
48.74	Parameter 1	Optimal :		Marginal	Poor
1 MMQ: A	1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover, mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat, well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat thabitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
	SCORE 19	20 (19) 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
mpling reach	2. Embeddedness	Gravel, cobble, and boulder particles are 0- 25% surrounded by fine sediment. Layering of cobble provides diversity	Gravel, cobble, and boulder particles are 25- 50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50- 75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
ก รลา		of niche space.	A CONTRACTOR	\$750 vito	drawn i
E	SCORE 6	20 19 18 17 (16)	15 14 13 12 11	10, 9, 8 7 6	5 4 3 2 1 0
Parameters to be evaluated in sampling reach	3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by I velocity/ depth regime (usually slow-deep):
ram	SCORE 20	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
Pa	4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
	SCORE 14	20 19 18 17 16	15 (14) 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riftle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
	SCORE 13	20 19 18 17 16	15 14 (13) 12 11	10 9 8 7 6	5 4 3 2 4 0.

-	Habitat -	Condition Category				
L	Parameter	Optimal	Suboptimal	Marginal	Poor	
		Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.	
Į	SCORE 20	(20) 19 18 17 16	J5 14 13 12 11	10 9 8 7 6	51.4.3.2.1.0	
	7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <1:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.	
samp	score 20	20) 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0	
Parameters to be evaluated broader than sampling reach	8. Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.	
to be eva	SCORE 7 (LB) SCORE 8 (RB)	Left Bank 10 - 9. Right Bank 10 - 9.	(8) 7 (6)	5 4 1 3 0	$=2_{11}$, 1 , 0 , 1 , 0 , 1 , 1 , 1 , 1 , 1 , 1 , 1 , 1	
Parameters	9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.	
	SCORE 7 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0	
ji	SCORE 9 (RB)	Right Bank 10 (9)	8 7 6	5 4 1 3	2 2 1 0	
	10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6- 12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.	
	SCORE 6 (LB)	Left Bank 10 9	8 7 6	5 4 3 3 ()		
	SCORE /O (RB)	Right Bank (10) 9	8 7 6	.5 4 3	210	

Total Score 171

STREAM NAME Cropped Creek	LOCATION (C) (ups home monther)
STATION#RIVERMILE	STREAM CLASS
LATLONG	RIVER BASIN
STORET#	AGENCY Leab 1
INVESTIGATORS BIG / JMR	
FORM COMPLETED BY	DATE 28 NOU 2012 REASON FOR SURVEY
B\$6-	TIME 13 RO AM (M) () A.A

	Habitat	age of the second second second	Condition	Category	
th t	Habitat Parameter	Optimal a	Suboptimal	Marginal	Poor
	1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifatmal colonization and fish cover, mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
	SCORE	20 19 18 17 16	15 14 13 12 11	(0 9 8 7 6	5 4 3 2 1 0
sampling reach	2. Embeddedness	Gravel, cobble, and boulder particles are 0- 25% surrounded by fine sediment. Layering of cobble provides diversity of niche space:	Gravel, cobble, and boulder particles are 25- 50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50- 75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
ted in	SCORE	20 19 18 17 A	15 14 13 12 11	10 9 8 7 6	25 4 3 2 i .0
Parameters to be evaluated in sampling reach	3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow) fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
ram	SCORE -	5 0 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
Pa	4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development, more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
,	SCORE	20 19 18 17 16	15 🛕 13 12 11	joi 9 8 7 6	5 4 5 2 1 0
	5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
	SCORE	20 19 18 17 16	A\$ 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

1	Habitat		Condition	Category	
	Parameter	Optimal	Suboptimal	Marginal	Poor
	6. Channel Alteration	dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
	SCORE	20 19 18 12 16		10 9 8 7 6	5 4 3 2 1 0
	7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffile or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water of shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
ampli	SCORE	19 18 17 16	15 14 13 12 111	10 9 8 7 6	5 4 3 2 1 0
to be evaluated broader than sampling reach	8. Bank Stability (score each bank) Note: determine left or right side by facing downstream. SCORE(LB) SCORE(RB)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. Left Bank 10 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in teach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
Parameters to	9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
	SCORE(LB)	Left Bank 10 A	8 7 6 8 7 26	5 4 3	2 1 0
	10. Riparian Vegetative Zone Width (score each bank riparian zone) SCORE (LB)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone. Left Bank 10 9	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6- 12 meters; human activities have impacted zone a great deal.	Width of riparian zone < meters: little or no riparian vegetation due to human activities.

Total	Score		

STREAM NAME Crooked Creek	LOCATION CC-1 (Upstream Portion)
STATION#RIVERMILE	STREAM CLASS
LATLONG	RIVER BASIN
STORET#	AGENCY
INVESTIGATORS JMR / BJG	
FORM COMPLETED BY	DATE 28 NOV 12 REASON FOR SURVEY
JMR/BJ6 Combined	TIME 1330 AM M UAA

		t to the same and the same of the	Condition	Category	
E	Habitat Parameter	Optimal	Suboptimal	. ≥ Marginal .	Poor
	1. Epitaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifatinal colonization and fish cover, mix of snags, submerged logs, undercut banks, cobble of other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat, habitat habitat, habitat availability less than desirable, substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
	score 19	20 (19) 18 19 16	15 14 13 12 11	10: 9 8 7 6	5 4 3 2 1 0
ampling reach	2. Embeddedness	Gravel, cobble, and boulder particles are 0- 25% surrounded by fine sediment. Layering of cobble provides diversity	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50- 75% surrounded by fine sediment	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
d in S	SCORE 16	of niche space.	15 014 (3 : 12 011 =	10 9 8 7 6	5 4 3 2 1 0
Parameters to be evaluated in sampling reach	3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast- shallow or slow-shallow are missing, score low).	Dominated by I velocity/ depth regime (usually slow-deep).
Lam	SCORE 20	20 19 18 17 16	715 - 14 - 13 - 12 - 11 V	⊴0: 9⊨ 8 7 6	5 4 3 2 1 0
P	4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development, more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
	SCORE 14	20 19 18 17 16	15 (4) 13 12 11	10: 9 8 7 6	5, 4, 3, 2, 1, 0
	5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or niffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
	SCORE 14	20 19 18 17 16	15 (4) 13 12 11	10. 9 8 7 6	5 4 3 2 1 0

1	Trakitat		Condition	Category	
	Habitat Parameter	Optimal	Suboptimal	Marginal	Poor
7,	6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
	SCORE 19	20 (19) 18 17 16	15 14 13 12 11	10 9 8 #7 16	514.3 2 1 0
ing reach	7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent, ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water of shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
sampi	SCORE 20	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
uated broader than	8. Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
eva	SCORE 7 (LB)	Left Bank 10 9	-8 (7) 6 · ·	5 4 1 13 10	2 1 01
to be	SCORE 8 (RB)	Right Bank 10 9	(8) ₁₁ 7 6	5 4 j 3	=2 if $=10$.
Parameters to be evaluated broader than sampling reach	9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
	SCORE 9 (LB)	Left Bank 10 (9)	8 7 6	5 4 3	2 1 0
	SCORE 9 (RB)	Right Bank 10 (9)	8 7 -6	5 4 5 3	2 1 0
	10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawus, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6- 12 meters; human activities have impacted zone a great deal.	Width of riparian zone < meters: little or no riparian vegetation due thuman activities.
	SCORE 7 (LB)	Left Bank 10 9	8 (1) 6	5 4 5 * 31	2 1
	SCORE /O(RB)	Right Bank (10) 9	8 7 6	5 .4 .3	2 1 0

Total Score 172

STREAM NAME Crooked Creek	LOCATION CC-1 (Downstream Portion)
STATION # RIVERMILE	STREAM CLASS
LATLONG	RIVER BASIN
STORET#	AGENCY
INVESTIGATORS IMP	
FORM COMPLETED BY	DATE 28 NOV 12 REASON FOR SURVEY
JWG.	TIME ISOO AM (M) UAA

	Habitat	Condition Category					
AS A	Parameter	Optinal	Suboptimal	Marginal	Poor		
	1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifainal colonization and fish cover, mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat, well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of babitat is obvious; substrate unstable or lacking.		
13.51	SCORE 18	20 19 (8) 17 16	15 14 13 12 11	0 9 8 7 6	5 4 3 2 1 0		
Parameters to be evaluated in sampling reach	2. Embeddedness	Gravel, cobble, and boulder particles are 0- 25% surrounded by fine sediment. Layering of cobble provides diversity	Gravel, cobble, and boulder particles are 25- 50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50- 75% surrounded by fine sediment	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.		
	score 19	of niche space. 20 (9) 18 17 16	15 14 - 13 12 11	10 9 8 7 6	3 4 3 2 L 0		
	3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast- shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).		
rame	SCORE 15	20 19 18 17 16	(15) 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0		
Par	4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected, slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected, sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.		
	SCORE 18	20 19 (8) 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0		
	5. Channel Flow Status	Water reaches base of both lower banks, and		Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.		
	SCORE 17	20 19 18 (17) 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0		

Т	TV-1*4-4		Condition	Category	
1	Habitat Parameter	Optimal	Suboptimal	Marginal	Poor
	6. Channel Alteration	Channelization or dredging absent or minimal, stream with normal pattern.	present, usually in areas of bridge abutments;	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
	SCORE 20	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
	7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
ampl	score 19	20 (19) 18 17 16.	(15 14 13 12 (11)	10 9 8 7 6	5 4 3 2 1 0
Parameters to be evaluated broader than sampling reach	8. Bank Stability (score each bank) Note: determine left or right side by facing downstream. SCORE (2 (LB) SCORE (2 (RB)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. Left Bank 10 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
Parameters to	9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
	SCORE 7 (LB) SCORE 9 (RB)	Left Bank 10 9	8 <u>(7)</u> 6 8 7 6	5 4 3	2 1 0
J.	10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone I2-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6- 12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
	SCORE 5 (LB)	Left Bank 10 9	8 7 6	(5) 4 3/1	2 1 - 0
	SCORE 9 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0 -

Total Score 168

STREAM NAME Crooked Creek	LOCATION CC (Downstran partin)
STATION# RIVERMILE	STREAM CLASS
LATLONG	RIVER BASIN
STORET#	AGENCY de la Company de la Com
INVESTIGATORS BJG/JMR	att. Yes attacks
FORM COMPLETED BY	DATE 28 ALAU 2013 REASON FOR SURVEY
B56-	TIME (S' OD AM END UAA

Habitat		Condition	Category	
Parameter	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover, mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient),	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50- 75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are mo than 75% surrounded by fine sediment.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 1
3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by I velocity depth regime (usually slow-deep).
SCORE	20 19 18 17 16	A 14 13 12 11	10 9 8 7 6	5 4 3 2 1
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due substantial sediment deposition.
SCORE	20 19 18 17 10	15 4 13 12 11	10 9 8 7 6	5 4 3 2 1
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing poo
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1

	Habitat		Condition	Category	
- 1	Parameter	Optimal	Suboptimal	Marginal	Poor
	6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
	SCORE	Ag 19 18 17 16	15 14 13 12 11	10 9 8 17 6	5 4 3 2 1 0
	7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural opstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some babitat, distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
samp	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
Parameters to be evaluated broader than sampling reach	8. Bank Stability (score each bank) Note: determine left or right side by facing downstream. SCORE(LB)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. Left Bank 110 9	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
rs to	SCORE(RB)	Right Bank 10 9	8 17 6	5.1 4 3 3 10	2 1 0
Parameters	9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
	SCORE(LB) SCORE(RB)	Left Bank 10 9 Right Bank 10 9	8 7 6	5 4 3 5 4 ± 3	2 1 0
	10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6- 12 meters; Iruman activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
	SCORE(LB)	Left Bank 10 9		<u></u>	2 1 1 0
l	SCORE (RB)	Right Bank 10	8 7 6	5 4 3	2 1 0

i otai ocore	Total	Score		
--------------	-------	-------	--	--

STREAM NAME Crooked Creek	LOCATION CC-1 (Downstream Portion)
STATION#RIVERMILE	STREAM CLASS	
LATLONG	RIVER BASIN	
STORET#	AGENCY	tell)
INVESTIGATORS JMR / BJG	:47.	
FORM COMPLETED BY JMR/ BJ6 Combined	DATE 28 NOV 12. TIME 1500 AM PM	REASON FOR SURVEY UAA

	Habitat	Condition Category					
1-7	Parameter	Optimal	-Suboptimal	Marginal	Poor		
	1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaimal colonization and fish cover, mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.		
1 mg. s	SCORE 8	20 19 (18) 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0		
Parameters to be evaluated in sampling reach	2. Embeddedness	Gravel, cobble, and boulder particles are 0- 25% surrounded by fine sediment. Layering of cobble provides diversity	Gravel, cobble, and boulder particles are 25- 50% surrounded by fine sediment.	Grayel, cobble, and boulder particles are 50- 75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.		
	score 19	of niche space. 20 (19) 18 17 16	15 14 13 12 11	10. 9) 8 7 6	5 4 9 2 1 0		
	3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by I velocity/ depth regime (usually slow-deep).		
L an	SCORE 15	20 19 18 17 16	(15) 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0		
Pai	4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected, sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.		
	score 17	20 19 18 (17) 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0		
	5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.		
	SCORE 17	20 19 18 (17) 16.	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0		

Habitat Parameter			Condition	Category	No. 1
-	Parameter	Optimal	Suboptimal	Marginal	Poor
	6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
	SCORE 20	20) 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
samb	SCORE 19	20 (19) 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
Parameters to be evaluated broader than sampling reach	8. Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-190% of bank has erosional scars.
e eva	SCORE 6 (LB)	Left Bank 10 9	8 7 (6)	5 4 3	2 1 0
to p	SCORE 6 (RB)	Right Bank 10 9	= 8 7 6	3 111	2 1 0
Parameters t	9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident, almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
	SCORE 8 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
	SCORE 9 (RB)	Right Bank 10 (9)	8 7 6	5 4 3	2 1 0
	10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6- 12 meters; human activities have impacted zone a great deal.	Width of riparian zone < meters: little or no riparian vegetation due to human activities.
	SCORE 5 (LB)	Left Bank 10 9	8 7 6	(5) 4 3	2 1 0
	SCORE 9 (RB)	Right Bank 10 🧿	8 7 6	5 4 3	2 1 0

Total Score 168



PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME Crook	ed Creek	LOCATION	CC-0		
STATION #	RIVERMILE	STREAM CLAS	S		
LAT	LONG	RIVER BASIN			
STORET#		AGENCY			
INVESTIGATORS JM	R1856				
FORM COMPLETED BY		DATE 28 NOV		REASON FO	R SURVEY
JA	nr_	TIME <u>0934</u>	4_ (A) PM	UA	4
WEATHER CONDITIONS	🗖 rain (ste	neavy rain) ady rain) (intermittent) cover	Past 24 Hours	🗖 Yes 🏿 No	perature 36° F 96
SITE LOCATION/MAP	Draw a map of the site of See		-	or attach a photograph	
STREAM CHARACTERIZATION		ntermittent [⊐ Tidal	Stream Type Coldwater	Warmwater
	Stream Origin Glacial Non-glacial montane	Spring-fed Mixture	of origins	Catchment Area_	km²



PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

Field/Pasture 🗆 🗈			rounding Landuse Commercial Industrial Other		Local Watershed No evidence Some po Obvious sources	tential sources	
		☐ Residential			Local Watershed Erosion None Moderate	J Heavy	
RIPARIAN VEGETAT (18 meter b	ION	Indicate the dom Trees dominant species	#	ninant species prasses			
INCOMP E A N	м	-	Length 400 m				
INSTREAM FEATURES		Estimated Reach	Length 770 m		Canopy Cover Partly open Partly sl	naded	
, Dirione		Estimated Stream	n Width <u>///</u> m				
		Sampling Reach	Aream²		High Water Mark 05 n	1	
		Area in km² (m²)	(1000)km ²	•	Proportion of Reach Repre Morphology Types	•	
			n Depthin		☐ Riffle 30 % ☐ Ru ☐ Pool 30 %	n <u>40</u> %	
						- Mari	
		(at thalweg)	m/sec		Channelized	s p kNo	
				Dam Present	s No		
LARGE W	OODY		2/12 (1 NYD)				
		Density of LWD	m²/km² (LWD/				
AQUATIC VEGETATION		Indicate the dominant type and record the dominant species p ☐ Rooted emergent ☐ Rooted submergent ☐ Hatached Algae ☐ Attached Algae				☐ Free floating	
		dominant species	dominant species present				
Portion of the reach with aquatic vegetation				<u>_</u> %			
WATER Q	UALITY		Temperature°C				
		Specific Conductance			Normal/None Sew Petroleum Che		
		Dissolved Oxygen feld pH Turbidity WQ Instrument Used			☐ Fishy ☐ Other Water Surface Oils ☐ Slick ☐ Sheen ☐ Globs ☐ Flecks ☐ None ☐ Other Turbidity (if not measured) ☐ Clear ☐ Slightly turbid ☐ Turbid		
		WQ Instrainent Osed			Opaque Stained		
SEDIMEN' SUBSTRAT		Odors Mormal Sewage Petroleum Chemical Anaerobic None			Deposits ☐ Sludge ☐ Sawdust ☐ ☐ Relict shells ☐	Paper fiber Sand Other	
					Looking at stones which are not deeply		
		Oils Absent	Slight	Profuse	embedded, are the undersidered Yes No	des black in color?	
		IIC SUBSTRATE			ORGANIC SUBSTRATE CO		
Cubatasta		(should add up to	% Composition in	Substrate	(does not necessarily add t	r '	
Substrate Type	ſ	Diameter	Sampling Reach	Type	Characteristic	% Composition in Sampling Area	
Bedrock			10	Detritus	Sticks, wood, coarse plant	1, 0.00	
Boulder	> 256 mm		<u> </u>		materials (CPOM)	15-20	
Cobble		ın (2.5" – 10")	35	Muck-Mud	Black, very fine organic (FPOM)	o l	
Gravel		(0.1"-2.5")	<u>~~</u>				
Sand	0.06 - 2m				Grey, shell fragments		
Silt	0.004-0.06 mm		•	Marl		Ó	



PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

SIREAM NAME Crooks	LUCATION CC-1 (Upstream parties)					
STATION #	RIVERMILE	STREAM CLASS				
LAT	LONG	RIVER BASIN	1			
STORET#		AGENCY				
INVESTIGATORS	ur/ BJG					
FORM COMPLETED BY		DATE 28 A		REASON FO	OR SURVEY	
	JMR-1856	TIME	O AM PM) NAA	•	
WEATHER						
CONDITIONS	Now	•	Past 24 Hours	Has there been a h	eavy rain in the last 7 days?	
•		neavy rain)		<i>f</i> *.		
		eady rain) s (intermittent)	<u> </u>	Air Tem	perature <u>SorF</u>	
	% d %cloud		<u> </u>	Other		
	clear/su	nny	<i>y</i> a	•		
SITE LOCATION/MAP	Draw a map of the site :	and indicate the	areas sampled (or	attach a photograph	<u> </u>	
	a map or moone			1/1/		
			. ,			
				dis /		
				XX		
			// //			
		ينو	_ // {/			
		in Don	(
	Res	well .	//).	/		
	V-		-//			
		\	$// \sqrt{/}$			
			// pg //			
			/ \			
) <i>(c</i>	المد			
		[=				
		(**	31084			
		1	Ku, 1			
	•	/				
		'	1 12001	Bis coches to	bies om	
			1 (N) 1	Po	of boar a	
			1 I	was all st	10 Par	
			of Me	20 10 Po 25	NJ (P	
•			end of	Big racker th	J**	
				A Biguestas h		
STREAM	Stream Subsystem			Stream Type	16.04.4	
CHARACTERIZATION	8 -	ntermittent	☐ Tidal	☐ Coldwater	Warmwater	
					<i>r</i> ·	
	Stream Origin			Catchment Area_	kın²	
	I .	pring-fed	a of origins		•	
	☐ Non-glacial montane ☐ Swamp and bog	Other	e of origins			



PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSH FEATURE		Forest Field/Pasture Agricultural	rounding Lauduse Commercial Industrial Other	Local Watershed No evidence Some potential sources Obvious sources				
		☐ Residential		Local Watershed Erosion None Moderate Heavy				
RIPARIAN VEGETAT (18 meter b	ION	Indicate the dom Trees dominant species	/ '	ninant species Grasses	present Herbaceous	,		
INSTREAM FEATURE	**		Length <u>20 </u> m n Widthm		Canopy Cover Partly open Partly sl			
		Sampling Reach	Aream²		High Water Mark 0.5 n	n		
			1000)km²	-	Proportion of Reach Repre Morphology Types	esented by Stream		
		Estimated Stream	n Depthm		☐ Riffle 33 % ☐ Ru ☐ Pool 33 %	,		
		Surface Velocity (at thalweg)	m/sec		Channelized	7.		
		3,	a ?		Dam Present	es No		
LARGE ·W DEBRIS	OODY		<u>m²</u> n²/km² (LWD /	reach area)		•		
AQUATIC VEGETAT		Indicate the dom ☐ Rooted emerge ☐ Floating Algae		nergent	present ☐ Rooted Floating ☐ Free floating			
		dominant species	present None					
		Portion of the read	th with aquatic vegetation3	<u>O_%</u>				
WATER Q	UALITY	Temperature	℃		Water Odors			
		Specifie Conduct	anee	0:0	Normal/None			
		Dissolved Oxyge	see.	held notes	☐ Fishy ☐ Other			
		Dissulved Oxyge		notes	Water Surface Oils			
		pH			☐ Slick ☐ Sheen ☐ Globs ☐ Flecks ▼ None ☐ Other			
		Turbidity			Turbidity (if not measured)			
		WQ Instrument	Used		Clear Slightly turbid Turbid Opaque Stained Other			
SEDIMEN SUBSTRA			☐ Sewage ☐ Petroleu ☐ Anaerobic ☐ None	un	Deposits ☐ Sludge ☐ Sawdust ☐ Paper fiber ☐ Sand ☐ Relict shells ☐ Other			
		Oils	Slight	Profuse	Looking at stones which ar embedded, are the undersion Yes			
	INOPCAN	IC SUBSTRATE	COMPONENTS	<u> </u>	ORGANIC SUBSTRATE CO	OMPONIENTS		
		(should add up to 1			(does not necessarily add t			
Substrate Type		Diameter	% Composition in Sampling Reach	Substrate Type	Characteristic	% Composition in Sampling Area		
Bedrock			10		Sticks, wood, coarse plant	Sampling in ou		
Boulder	> 256 mm	(10")	10	Detritus	materials (CPOM)	15		
Cobble	64-256 m	m (2.5" – 10")	30	Muck-Mud	Black, very fine organic	0		
Gravel	2-64 mm ((0.1" – 2.5")	.20	IVIUCK-IVIUU	(FPOM)	0		
Sand	0.06 – 2m	m (gritty)			Grey, shell fragments	-		
Silt	0.004-0.00			· Mari				
Class	-0.004	- (aliale)		1	l .	, !		



PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME Crook	ed Creek	LOCATION	CC-1 down	isheam reach	
STATION#	RIVERMILE	STREAM CLA			
LAT	LONG	RIVER BASIN			
STORET#		AGENCY			
INVESTIGATORS JMR	-/ BJ6-				
FORM COMPLETED BY		DATE 28 A	N 12	REASON FO	
	JMR/BJG	TIME/50	O AM PM	UA	IA
	<u> </u>				
WEATHER CONDITIONS	Now storm (h	neavy rain)	Past 24 Hours	Has there been a h	eavy rain in the last 7 days?
	🗖 rain (ste	ady rain)		Air Tem	perature <u>54°F</u>
	showers %cloud	(intermittent) cover		Other_	
	clear/su)BI	-	
SITE LOCATION/MAP	Draw a map of the site a	and indicate the	areas sampled (or	attach a photograph)
	5	ee map	on 20 Sep	12 date	sheet
				•	•
	,				
·					
					•
					•
STREAM CHARACTERIZATION	Stream Subsystem Stream Perennial	ntermittent	☐ Tidal	Stream Type Coldwater	Warmwater
	Stream Origin			Catchment Area_	kın²
		pring-fed			
	☐ Non-glacial montane ☐ Swamp and bog	Mixture Other_	ot origins		



PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSH: FEATURES		Predominant Surrounding Landuse Forest			Local Watershed No evidence Some potential sources Obvious sources			
		☐ Residential		_	Local Watershed Erosion None Moderate	Heavy		
RIPARIAN VEGETATI	1		nant type and record the dom		resent			
(18 meter bu	i i	Trees		rasses	Herbaceous			
			present					
INSTREAM FEATURES	,	Estimated Reach	Lengthm		Canopy Cover Partly open Partly sh	aded 🗖 Shaded		
Littonia		Estimated Stream	Width <u>10</u> m		High Water Mark_0,4 m			
		Sampling Reach A	Aream²					
		Area iu km² (m²x)	(1000)km²	,	Proportion of Reach Repres Morphology Types □ Riffle% □ Rur	nented by Stream		
		Estimated Stream	Depthm		Pool%			
		Surface Velocity (at thalweg)	m/sec		Channelized			
		2			Dam Present	No No		
LARGE WO	OODY		m² m²/km² (LWD /n	reach area)		,		
AQUATIC		Indicate the domi	nant type and record the don	inaut species p	resent			
VEGETAT		☐ Rooted emerger☐ Floating Algae	it 🔲 Rooted subm	ergent	☐ Rooted Floating ☐ Free floating			
			_					
		Portion of the reac	h with aquatic vegetation	D %		·		
WATER Q	UALITY	Temperature			Water Odors			
		Specific Conducts	ance	held .	Sewage Petroleum			
		Dissolved Oxygen	<u></u>	· des	Water Surface Oils Slick Sheen Globs Flecks None Other Turbidity (if not measured) Clear Slightly turbid Turbid Opaque Stained			
		рН	I	No.				
		Turbidity						
		WQ Instrument I	Used					
SEDIMEN		Odors			Deposits	n		
SUBSTRA	TE		☐ Sewage ☐ Petroleu ☐ Anaerobic ☐ None	ın		ge		
		Oils	light 🛘 Moderate 🗘	Profuse	Looking at stones which are not deeply embedded, are the undersides black in color?			
	INORGAN	VIC SUBSTRATE	COMPONENTS		ORGANIC SUBSTRATE CO	OMPONENTS		
		(should add up to I			(does not necessarily add u	ip to 100%)		
Substrate Type		Diameter	% Composition in Sampling Reach	Substrate Type	Characteristic	% Composition in Sampling Area		
Bedrock			10	Detritus	Sticks, wood, coarse plant	,		
Boulder	> 256 mm		<u> </u>		materials (CPOM)	15		
Cobble		ım (2.5" – 10")	30	Muck-Mud	Black, very fine organic	0		
Gravel		(0.1" - 2.5")	<u>১</u> ০		(FPOM)	<u> </u>		
Sand		un (gritty)	<		Grey, shell fragments			
Silt	0.004-0.0			Marl		0		
Clav	<0.004 m	um (slick)		l				

WOLMAN PEBBLE COUNT FIELD DATA SHEET

STREAM NAME Crooked Geek	LOCATION
INVESTIGATOR(S) OMR/ROTE	STREAM CLASS CC-D (Upstream Riffle)
LAT	LONG
DATE 28 NOV /2	TIME 1055 AM PM
FORM COMPLETED BY JMK / 836	REASON FOR SURVEY UAA

* *************************************	Measurement			Measurement	
Pebble ID	(mm)	Size Class	Pebble ID	(mm)	Size Class
1		128	51		90
2		128	52		16
3		128	53		64
4		128	54		64
5		180	55		128
6		64	56		180
7		64	57		128
8		11.	58		90
9		16	59		90
10		45	. 60		90
11		45	61		11
12		32	62		14
13	,	2	63		90
14		64 .	64		180
15		45	- 65		90
16		. 32	66		16
17		45	67		90
18		45	68		45
19		64	69 ·		8
20		128	70		64
21		64	71		180
22		180	72		45
23		128	73		90
24		90	74		180
25		2.8	75		128
26		90	76		90
27	•	32	77		22.6
28		32	. 78		64
29		128	79		90
30		180	80		22.6
31		129	81		16
32		11	82		11
33		11	83		32
34		64	84		45
35		90	85		90
36		128	86		11
37		90	87		90
38		64	88		90
39		128	89		22.6
40		90	90		4
41		64	91		128
42		90	92		128
43		ii	93		90
44		45	94		180
45		ii ii	95		128
46		180	96		8
47		8	97		32
48		180	98		45 45
		1)	99		
49					16
50		128	100	L	64

WOLMAN PEBBLE COUNT FIELD DATA SHEET

STREAM NAME Crooked Creok	LOCATION CC-O (OS e, Ffb)
INVESTIGATOR(S) OME 1 BJ-	STREAM CLASS
LAT	LONG
DATE 28 NOV 12	TIME 1000 (AM) PM
FORM COMPLETED BY ONE / BJG	REASON FOR SURVEY UAA

Pebble ID	Measurement (mm)	Size Class	Pebble ID	Measurement (mm)	Size Class
	(IIIII)	45	51	(IIIII)	90
$\frac{1}{2}$		5.6	52		64
3			53		128
4		64	54		90
		90	55		90
5		90 45	56		90
6	ļ		57		
7		90	58		330 ¥ 45
8	 	90.	59		
9	 	180	60		22.6
10		128	61		
11		1,28	62		90
12		16			64
13	<u> </u>	<u>64</u>	63		32
14	-	8	64		45
15		32	65		64
16		180	66		22.6
17		90	67		128
18		16	68		22.6
19		11	69		90
20		45	70		45
21	ļ	220 ₺	71		64
22			72		22.6
23		64	73		2
24		22.6	74		90
25		280 \$	75		16
26		11	76		220#
27		270	77		6-1
28		90	. 78		32
29		90	79		16
30		8	80		4
31		180	81		64
32		16	82		32
33		45	83		64
34		230 \$	84		8
35		32	85		i.
36		210	86		32
37		230 H	87		
38		240 \$	88	ļ	64
39		22.6	89		180
40	<u> </u>	32	90		32
41		64	91	ļ	90
42		29.6	92		45
43		64	93		45
44		45	94		45
45		90	95		64
46		64	96		32
47		128	97		32
48		180	98		45
49		236	99		180
50		90	100		128



Environmental Testing & Consulting, Inc.

"A Laboratory Management Partner

2790 Whitten Road

Memphis, Tennessee 38133

(901) 213-2400

4/30/2013

Harrison Wastewater Treatment Plant Ms. Kathryn Catlin PO Box 1715 Harrison, AR, 72601

Ref:

Analytical Testing

ETC Report Number: 13-114-0225

Client Project Description: Crooked Creek Sampling

Dear Ms. Kathryn Catlin:

Environmental Testing and Consulting, Inc. received sample(s) on 4/24/2013 for the analyses presented in the following report.

The above referenced project has been analyzed per your instructions. The analyses were performed in accordance with the applicable analytical method.

The analytical data has been validated using standard quality control measures performed as required by the analytical method. Quality Assurance, method validations, instrumentation maintenance and calibration for all parameters (NELAP and non-NELAP) were performed in accordance with guidelines established by the USEPA and NELAC unless otherwise indicated. Any parameter for which the laboratory is not officially NELAP accredited is indicated by a '~' symbol. These are not included in the scope because NELAP accreditation is either not available or has not been applied for. Additional certifications may be held/are available for parameters, where NELAP accreditation is not required or applicable. A full list of certifications is available upon request.

The results are shown on the attached Report of Analysis(s). Results for solid matrices are reported on an asreceived basis unless otherwise indicated. This report shall not be reproduced except in full and relates only to the samples included in this report.

Please do not hesitate to contact me or client services if you have any questions or need additional information.

Sincerely.

Randy Thomas

Rendell H. Thomas

Project Manager

Laboratory's liability in any claim relating to analyses performed shall be limited to, at laboratory's option, repeating the analysis in question at laboratory's expense, or the refund of the charges paid for performance of said analysis.

#TN00012

Kentucky UST #41



Environmental Testing & Consulting, Inc.

2790 Whitten Road

Memphis, Tennessee 38133

(901) 213-2400

Fax (901) 213-2440

"A Laboratory Management Partner"

03322

Harrison Wastewater Treatment Plant

Ms. Kathryn Catlin

PO Box 1715

Harrison , AR 72601

Project

Crooked Creek Sampling

Information:

Report Date: 4/30/2013

Report Number: 13-114-0225

REPORT OF ANALYSIS

Received: 4/24/2013

Lab No:

93982

Sample ID: Silver Valley Bridge (Downstream)

Matrix: Aqueous

Sampled: 4/23/2013 9:00

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Chloride	9.89	mg/L	0.400	1	04/30/13 04:21	ACS	EPA-300.0
Total Dissolved Solids	207	mg/L	10	1	04/25/13 14:00	NRT	2540C
Sulfate	10.9	mg/L	1.00	1	04/30/13 04:21	ACS	EPA-300.0

Lab No:

93983

Sample ID : Hwy 62/65 Bridge (Upstream)

Matrix: Aqueous

Sampled: 4/23/2013 9:10

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Chloride	6.51	mg/L	0.400	1	04/30/13 04:39	ACS	EPA-300.0
Total Dissolved Solids	196	mg/L	10	1	04/25/13 14:00	NRT	2540C
Sulfate	8.17	mg/L	1.00	1	04/30/13 04:39	ACS	EPA-300.0

Lab No:

93984

Sample ID: WWTP Discharge Point

Matrix: Aqueous

Sampled: 4/23/2013 8:50

Test	Results	Units	MQL	DF	Date / Time Analyzed	Ву	Analytical Method
Chloride	45.9	mg/L	4.00	10	04/25/13 01:20	ACS	EPA-300.0
Nitrate (NO3-N)	1.47	mg/L	0.100	1	04/24/13 14:19	ACS	EPA-300.0
Nitrite (NO2-N)	0.501	mg/L	0.100	1	04/24/13 14:19	ACS	EPA-300.0
Nitrate+Nitrite-N	1.97	mg/L	0.100	1 (04/24/13 14:19		EPA-300.0
Total Dissolved Solids	301	mg/L	10	1	04/25/13 14:00	NRT	2540C
Sulfate	55.6	mg/L	10.0	10	04/25/13 19:33	ACS	EPA-300.0

Qualifiers/ Definitions

*

Outside QC limit

MQL

Method Quantitation Limit

DF

Dilution Factor



Environmental Testing & Consulting, Inc.

2790 Whitten Road

Memphis, Tennessee 38133

(901) 213-240

Fax (901) 213-2440

"A Laboratory Management Partner"

Cooler R	eceipt Form		
Customer Number: 03322 Customer Name: Harrison Wastewater Treatm Report Number: 13-114-0225	ent Plant		
•	g Method		
○ Fed Ex ● UPS ○ US Postal○ Client	◯ Lab	Ourier	Other:
Shipping container/cooler uncompromised?	Yes	○ No	
Custody seals intact on shipping container/cooler?	O Yes	○ No	Not Required
Custody seals intact on sample bottles?	○ Yes	○ No	Not Required
Chain of Custody (COC) present?	Yes	○ No	
COC agrees with sample label(s)?	Yes	○ No	
COC properly completed	Yes	○ No	
Samples in proper containers?	Yes	○ No	
Sample containers intact?	Yes	○ No	
Sufficient sample volume for indicated test(s)?	Yes	○ No	
All samples received within holding time?	Yes	○ No	
Cooler temperature in compliance?	Yes	○ No	
Cooler/Samples arrived at the laboratory on ice. Samples were considered acceptable as cooling process had begun.	Yes	○ No	
Water - Sample containers properly preserved	Yes	○ No	○ N/A
Water - VOA vials free of headspace	O Yes	○ No	N/A

High concentration pre-weighed (methanol -14 d)

Special precautions or instructions included?

Yes

No

Comments:

() Yes

O Yes

O No

O No

Low concentration EnCore samplers (48 hr)

N/A

N/A

Any regulatory non-compliance issues will be recorded on non-compliance report.

Signature: Susan Simpson

Date & Time: 04/24/2013 10:45:55

Trip Blanks received with VOAs

Soil VOA method 5035 - compliance criteria met

High concentration container (48 hr)

WOLMAN PEBBLE COUNT FIELD DATA SHEET

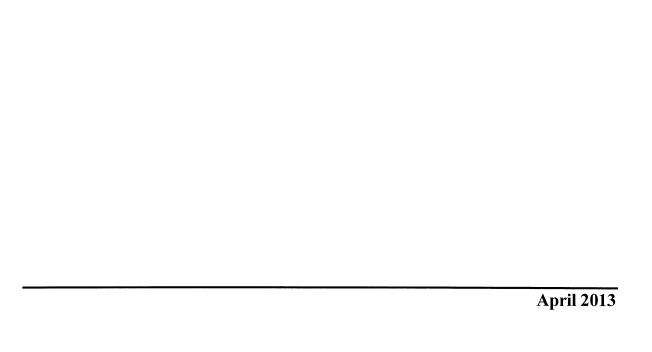
STREAM NAME Crooked Creek	LOCATION CC-1 (upstrance Reffle)
INVESTIGATOR(S) JMR/ BJG	STREAM CLASS
LAT	LONG
DATE 28 NOV 12	TIME /340 AM (PM)
FORM COMPLETED BY OME / BJG	REASON FOR SURVEY LAA

n 111	Measurement	a		Measurement	
Pebble ID	(mm)	Size Class	Pebble ID	(mm)	Size Class
1		88	51		
2		128	52		32
3		32	53		5.6
4		5.6	54		64
5		64	55		45
6		64	56		45
7		82.6	57		32
8		44	58		90
9		/18	59		2.8
10		64	60		90
11			61		90
12		45	62		
13		22.6	63		22.6
14		90 .	64		64
15		45	65		90
16		128	66		90
17		128 45	67		22.6
18		45	68		22.6
19		22	69		22.6
20 .		2	70		. 1/
21		16	71		32
22		[1]	72		. 32
23		32	73		128
24		16	74		32
25		5.6	75		32
26		64	76		64
27	·	128	77		32
28		180	. 78		45
29		90	79		16
30 .		45	80		16
31		64	81		11
32		45	82		11
33		16	83		45
34		128	84		45
35		16	85		22.6
36		32	86		16
37		16	87		I
38		1/	88		22.6
39		32	89		22 6 16 8
40		128	90		160
41		90	91		Ž
42		90	92		16
43		32	93		16 32
44	· · · · · · · · · · · · · · · · · · ·	64	94		29.6
45		6 <u>4</u> 45	95		32
46		28	96		5.6
47		11	97		7
48		22.6	98		2 32
		16	99		
49					
50		45	100		16

WOLMAN PEBBLE COUNT FIELD DATA SHEET

STREAM NAME Crooked creek	LOCATION CC-1 (Downsheam reach)
INVESTIGATOR(S) JULY 876	STREAM CLASS
LAT	LONG
DATE 28 NOV 12	TIME /5/5 AM (PM)
FORM COMPLETED BY JMR / BTG	REASON FOR SURVEY , AA

	Measurement	a,		Measurement	
Pebble ID	(mm)	Size Class	Pebble ID	(mm)	Size Class
1		22.6	51_		16
2	·	64	52		64
3		22.6	53		64
4		8	54	·	45
5		16	55		
6		32	56		45
7		20. L	57		4
8		22.6	58		16
9		16	59		22.6
. 10		20.6	60		64
11		45	61		1) .
12		1000 \$	62		8
13 -		32	63		64
14		16	64		32
15		22.6	65		16
16		- 64	66		22.6
17		45	67		32
18		45	68		8
19		Ч	69		16
20		8	70		16
21		64	71		32
22_		16	72		8
23		8	73		16
24		32	74		32
25		22.6	75		45
26		32	76		8
27		22.6	77		32
28		16	. 78		16
29		И	79		2
30		16	80		16
31		64	81		16
32		i l	82		16
33		90	83		22.6
34		22.6	84		16
35		64	85		45
36		16	86		4
37]6	87		32
38		<u>]6</u> 32	88		45
39		64	89		. 64
40		16_	90		H
41		16	91		64
42		45	92	·	20.6
43		8	93		5.6
44	•	16	94		64
45		32	95		32
46		32	96		90
47		64	97	,	22.6
48		16	98		45
49		5.6	99		
50		32	100		64



Hydrobo deployed & Wholle U. C. 0957 (CC-2) Hydrobo deployed & Wholle U. C. 0957 (CC-3) Hydrobo deployed & Vallatile DS & 1013 (CC-3) Fig. 1933 Fig. 1933 Fig. 1933 Fig. 1933 Fig. 1935 Fig. 1935 Fig. 1935 Fig. 1937 Fig. 1	Hydrolab deployed @ reliville US @ 1035 Luttal 12574 @ reliville DS @ 1035 Luttal 12574 @ 1233 Y 001 Scrp / collect o for 583 Y 001 Scrp / collect o for 583 Y 001 Scrp / collect o for 689 Hadrolab deployed @ Harrison US @ 1430 Hadrolab deployed @ Harrison US @ 1400 Frup 14.30 CC-1 Sample @ 1445 Spc SS7 Spc SS7 DO 10.31 CC-0 Sample @ 1552 temp 1895 Spc
--	---

FTN Associates, LTD. Physical Characterization - Worksheet

Y		1
I.	Genera	ı
4.	UCHULA	1

	Date/Time 02 APR 13 15 Observer JMR / JJR Project No. R04315-0003-0	Stream Transect No Picture No.	Crooked Creek	_
II.	In-Situ Data		Characterization	_
Dissolv	ved Oxygen, mg/L	Stream Width, ft		
	Temperature, C	Channel Width, ft		
Co	nductivity, uhmos	Pool	Length, ft	
	pH, su	Riffle/Run	Length, ft	
	ORP, mv	Tape Down (ft)		
		GPS		

	Tape						
	Reading		Section			Area	
Transect	from	Depth	Length	Area	Velocity	Flow	
Reading	LB/QB	(ft)	(ft)	(ft2)	(fs)	(cfs)	Comments
1	8	0-33			0.04		
2	9	0.2			0.09		
3	10	0.3			0.64		
4	U	6.2			0.26		
5	12	8. <u>2</u>			0.51		
6	13	0.3			0.40		
7	14	0.4			0.48		
8	15	0.3			0.76		
9	16	0.4			0.01		
10	17	0.2			1.27		
11	18	0.5			1.49		
12	19	0.65			1.01		
13	23	0.7			1.39		
14	21	0.6			1.62		
15	JX	1.0			1.46		
16	23	1.0			1.72		
17	રવ	1.05			2.38		
18	35	1.15			2.46		
19	36	1.3	.,		2.03		
20	27	1.3			2.82		
21	28	1.4			2.93		
22	29	1.8		-	2.94		
23	30	1.8			2.21		
24	31	1.8			1.74		
25	32	1.6			1.32		
26	33	1.5			1.07		
27	34	1.35]		-0.08		
Totals	0		0		CONTRACTOR CASE	0.000	cfs
	35	1.15			0.03	0	gpm
	36	0.9			-0.07		104
	37	0.75			-6.18		
	38	0.5			-0.12		- n 20 - 0/-
	39	0.1			0.0	, L	B @ 39.0 ft

FTN Associates, LTD. Physical Characterization - Worksheet

I.	General	~				
	Date/Time	02 APR 13	1450	Stream	Crooked Creek	
	Observer	JME JOTR		Transect No.	CC-I	
	Project No.	204315-0002-00	I	Picture No.		
II.	In-Situ Da	ıta	III.	Physical	Characterization	
Dissol	ved Oxygen, mg/L		S	Stream Width, ft		
	Temperature, C		Cl	nannel Width, ft		
Co	onductivity, uhmos			Pool_	Length, ft	
	pH, su			Riffle/Run	Length, ft	
	ORP, mv			Tape Down (ft)		
				GPS		

	Tape Reading	,	Section			Area	
Transect	from	Donth		Awag	Volonity	Flow	
		Depth	Length	Area	Velocity	1	~
Reading	LB/RB	(ft)	(ft)	(ft2)	(fs)	(cfs)	Comments
1	675	0			0.00		
2	7	0.2	0.		0.21		
3	8	0.3			1.02		
4	9	0.6			1 14		
5	10	0.7			1.66		
6	<u> </u>	0.9			1.68		
7	1)	Q,Q	-		1.75		
8	13	1.05			1,90		
9	14	1,00			259		·
10	15	0.95			2.90		
11	IL	1,1			2.79		
12	רז	1.1			2.71		
13	14,	1.0			3,17		
14	19	1.1			2.91		
15	20	1.2			3.05		
16	al	1.0			2.64		
17	22	0.9			2.15		
18	23	1.0			2,44		
19	24	0.85			1.74		
20	25	0,75			2.51		
21	26	0.7			2,00		
22	27	0.55		-	1.89		
23	FG.	0.3			1.46		
24	29	0.5			0.99		
25	3>	0.35			0.59		
26	31	0.35			0.47		
27	32	0.2			0.09		
Totals	0		Ó			0.000	cfs
	33	0:1			∞.0	0	gpm

以外

FTN Associates, LTD. Physical Characterization - Worksheet

I.	General			
	Date/Time 03 AR 13	1153 Stream	Crooked Creek	
	Observer JMK/JJK	Transect No.		
	Project No. 204315-0002	Picture No.		
II.	In-Situ Data	III. Physica	ıl Characterization	
Dissol	ved Oxygen, mg/L	Stream Width, ft		
	Temperature, C	Channel Width, ft		
C	onductivity, uhmos	Pool	Length, ft	
	pH, su	Riffle/Run	Length, ft	
	ORP, mv	Tape Down (ft)		
		GPS		

	Tape						
	Reading		Section			Area	
Transect	from	Depth	Length	Area	Velocity	Flow	
Reading	CB /RB	(ft)	(ft)	(ft2)	(fs)	(cfs)	Comments
1	<u> </u>					<u> </u>	
2	86 83	0.0		0.0	0.00	<i> </i>	
3	80	0.45	1,,(0.30	0.00		
4	77	0.45	Et lac	2.33	0.46	m15	
5	74	0.9	····	2.85	0.71		
6	71	1.05		3.22	0.98		
7	68	1.2	<u>-</u>	2.99	0.91	-	
8	65	1.4		-	3.89	E I/	s Starding hope
9	62	1.6			3,36		
10	5'9	1.75			3,51		
11	5%	1.7			3.64		
12	53	1.55			3.54		
13	50	1.4			2.91		
14	47	1.3			2.97		
15	44	1.4			2.21		
16	41	1.6			3.01		
17	38	31.5			2.39		
18	35	1,45			1.55		
19	32.	1.9			0.32		
20	29	2.0			0, 28		
21	26	2.05			0.17		
22	23	2.1			0.14		
23	20	2.1			0.30		
24	17	2.3			0.21		
25	14	2.5			0.15	-	
26	11	2.45			0.07		
27	8	2.05			0.16		
Totals	0		Ó			0.000	efs
	5	0.25			0.03	0	gpm
	RB-2	1.36			E0.0-		

rse 2.0 ft

FTN Associates, LTD. Physical Characterization - Worksheet

[.	General Date/Time 03 Apr 13 15 Observer OMF / JTF Project No. 2043/5-0000-0	Transect No.	rooked Creek 6-3
II.	In-Situ Data	III. Physical C	haracterization
Dissolv	ed Oxygen, mg/L	Stream Width, ft	
	Temperature, C	Channel Width, ft	
Coi	nductivity, uhmos	Pool	Length, ft
	pH, su	Riffle/Run	Length, ft
	ORP, mv	Tape Down (ft)	
		GPS	

				j			
	Tape Reading		Section			Area	
Transect	from	Donth		4 400	Valagita	Flow	
		Depth	Length	Area	Velocity		
Reading	LB/RB	(ft)	(ft)	(ft2)	(fs)	(cfs)	Comments
1	74	ن، ó			6.00		
2	71	0.25		/	0.25		
3	68	0.6			0.41		
4	65	0.9		/	0.48		
5	62	<i>I-</i> 1			1,13		
6	59	1.3			1.45		
7	56	1.35			1.52		
8	53	1.25			1.77		
9	50	1.4			1.56		·
10	47	1.4			2.01		:
11	44	1.5			2.00		
12	41	1.5			ચ. 33		
13	38	1.95			1.84		
14	35	2.1			2.47		
15	-32	2.3			1.98		
16	29	2.35			2.72		
17	26	2.3			2.09		
18	23	2.05			2.32		
19	ৡ৩	1.75			1.77		
20	17	1.8			0.35		
21	14	2.3			0.47		
22	11	2.5		-	0.16		
23	q	2.7		-	- 0.11		
24	5	1.55			- 0.04		
25	3.5	0.0			6.00		RB@ 3.5 ft
26							
27							
Totals	0		0			0.000	cfs
						0	gpm



PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME Crooke		LOCATION	CC-0		
STATION#	RIVERMILE	STREAM CLASS			
LAT	LONG	RIVER BASIN		5 15 1 1 X 1 X	. 11
STORET#		AGENCY			
INVESTIGATORS JVAN	4/ JJR	a sa candon y a matematica a Science de la constitución de la constitu	and the second of the second o	1 1 1 1 1 1 1 1 1 2 1 1	
FORM COMPLETED BY		DATE OF APR	3	REASON FO	R SURVEY
	JMK	TIME 1630	AM M	UA	A .
	A LOGIC BOOK		and the second		
WEATHER CONDITIONS	Now			as there been a he	eavy rain in the last 7 days?
	rain (ste	neavy rain) eady rain) s (intermittent)			perature <u>3</u> 3✓ °C
	100 %	cover		Other	× 3
SITE LOCATION/MAP	Draw a map of the site	and indicate the area	s sampled (or attac	h a photograph) .
			* a		:1
		See noks	from prev	ious visit	L
					*
				* ***	
,					
				3 4 -	
				1 .	
	,				
	, , ,				
STREAM	Stream Subsystem		Str	eam Type	
CHARACTERIZATION	Perennial 🗆 II	ntermittent 🏻 🗗 T	idal 🛅	Coldwater	Warmwater
	Stream Origin		Car	tchment Area	km²
		pring-fed	Ca	Content Area	кіп
	☐ Non-glacial montane	Mixture of o	rigins		
	Swamp and bog	Other.			



PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

				(/		COMMINION CO.	
WATERSH			rounding Landuse		Local Watershed		
FEATURE:	S	Field/Pasture	☐ Commercial ☐ Industrial		☐ No evidence Some po	otential sources	
		Agricultural	Other		- Obvious sources		
		☐ Residential			Local Watershed Erosion		
DIDADIAN	,	T		• 3	□ None Moderate □ Heavy		
RIPARIAN VEGETAT		Trees	inant type and record the don Shrubs G	ninant species p rasses	resent Herbaceous		
(18 meter b		dominant species	/ '	145565	LI Herbaceous		

INSTREAM FEATURE		Estimated Reach	Length <u>400</u> m		Canopy Cover	haded Chaded	
		Estimated Stream	a Width <u>/ Ö</u> m		Partly open Partly shaded Shaded		
		Sampling Reach	Area m²		High Water Mark 0.3	n	
				,	Proportion of Reach Repr	esented by Stream	
		Area in km (m s	1000)km ²		Morphology Types ☐ Riffle <u>30</u> % ☐ Ri	ın <u>40</u> %	
		Estimated Stream	n Depthm		☐ Pool 35 %	, v	
	Surface Velocitym/sec		Channelized	es 🔊 No			
		(at thalweg)				<i>'</i>	
LARGE W	OODV	LWD /5	m²		Dam Present Y	es No	
DEBRIS	OOD1	Density of LWD		raach araa)			
AQUATIC			inant type and record the don		reseut		
VEGETAT		□ Rooted emerge	nt 📮 Rooted subm	☐ Rooted Floating	☐ Free floating		
		☐ Floating Algae			-		
		dominant species	present				
		Portion of the read	th with aquatic vegetation	<i>20</i> %			
WATER Q	UALITY	Temperature_			Water Odors		
					Normal/None		
		Specific Conduct	ance	Cald	☐ Petroleum ☐ Chemical ☐ Fishy ☐ Other ☐		
		Dissolved Oxyge	n	125			
		Dissolved Oxygen See field notes			Water Surface Oils ☐ Slick ☐ Sheen ☐ Globs ☐ Flecks		
					None Other		
		Turbidity					
		WQ Instrument Used			Turbidity (if not measured) Clear Slightly turbid Turbid Opaque Stained Other		
SEDIMEN		Odors	5 S		Deposits 7 S	in a and a	
SUBSTRA	I E	H #'	☐ Sewage ☐ Petroleu ☐ Anaerobic ☐ None	m	2	I Paper fiber ☐ Sand I Other	
		Other					
		Oils			Looking at stones which an embedded, are the undersi		
		Absent 🗆 S	Slight	Profuse	☐ Yes Mo		
	INORGAN	IC SUBSTRATE	COMPONENTS		ORGANIC SUBSTRATE C	OMPONENTS	
		(should add up to 1			(does not necessarily add		
Substrate			% Composition in	Substrate		% Composition in	
Type	Diameter		Sampling Reach	Туре	Characteristic	Sampling Area	
Bedrock			10	Detritus	Sticks, wood, coarse plant	-	
Boulder	> 256 mm		5		materials (CPOM)	10	
Cobble		m (2.5" – 10")	40	Muck-Mud	Black, very fine organic		
Gravel		(0.1" – 2.5")	45		(FPOM)	U	
Sand	0.06 – 2m				Grey, shell fragments		
Silt	0.004-0.0	6 mm		Marl		0	
Clave	1 20 00 4	<0.004 (aliata)			į.	-	



PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME Crook	sed Creek	LOCATION	cc - 1	(Upstram Betien of Reach)
STATION#	RIVERMILE	STREAM CLASS		
LAT	LONG	RIVER BASIN		* 4
STORET#		AGENCY		
INVESTIGATORS ON	IR/OTR	The state of the s	· //	Months of the Market
FORM COMPLETED BY	OMK	DATE 03 APR 13 TIME 1450	AM (M)	REASON FOR SURVEY
	-			
WEATHER CONDITIONS	Now	Past 2 Hours		Has there been a heavy rain in the last 7 days? No
	rain (ste	neavy rain)		Air Temperature <u>36</u> ℃
	%cloud clear/sur		%	Other
SITE LOCATION/MAP	Draw a map of the site a	and indicate the areas s	sampled (or a	attach a photograph)
		e de la companya de la companya de la companya de la companya de la companya de la companya de la companya de		
		see previous	Reld	roles present
		- Beaver do	no no	
				en en en en en en en en en en en en en e
	. K. 1948			
STREAM CHARACTERIZATION	Stream Subsystem Perennial	termittent 🗖 Tida	1	Stream Type Coldwater Warmwater
ı	,	pring-fed		Catchment Areakm²
	Non-glacial montane	Mixture of origi	1115	



PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET

WATERSHE FEATURES		Predominant Surrounding Landuse ☐ Commercial ☐ Field/Pasture ☐ Industrial			Local Watershed No evidence Some potential sources Obvious sources		
		Agricultural Residential	Other				
		Residential			Local Watershed Erosion ☐ None Moderate ☐ Heavy		
RIPARIAN VEGETATION	ON		nant type and record the dom				
(18 meter bu	Į.	Trees dominant species	☐ Shrubs ☐ G	☐ Herbaceous			
INSTREAM		Estimated Reach			Canopy Cover	-	
FEATURES	li li	Estimated Stream Widthm			Partly open Partly shaded Shaded		
					High Water Mark 6 3 m		
		Sampling Reach	— — —		Proportion of Reach Repre	esented by Stream	
		Area in km² (m²x	1000)kın²		Morphology Types ☐ Riffle 33% ☐ Run 34 %		
		Estimated Stream	Depthm		□ Pool <u>33</u> %		
		Surface Velocity	m/sec		Channelized	es No	
		(at thalweg)			Dam Present	es XNo	
LARGE WO	OODY	LWD				,	
		Density of LWD					
AQUATIC VEGETATI	ON	Indicate the dominant type and record the dominant species p ☐ Rooted emergent ☐ Rooted submergent ☐ Floating Algae ☐ Attached Algae			present ☐ Rooted Floating ☐ Free floating		
dominant species present							
		Portion of the read	h with aquatic vegetation	0_%			
WATER QL	JALITY	Temperature	°℃		Water Odors ☑ Normal/None ☐ Sewage		
		Specific Conduct	ance		Petroleum		
		Dissolved Oxygen field			☐ Fishy ☐ Other		
					Water Surface Oils ☐ Slick ☐ Sheen ☐ Globs ☐ Flecks		
		Turbidity			None Other		
		-	Used		Turbidity (if not measured)		
		WQ Instrument		Clear Slightly turbid Turbid Opaque Stained Other			
SEDIMENT SUBSTRAT		Odors Normal	☐ Sewage ☐ Petroleu	ın	Deposits ☐ Sludge ☐ Sawdust ☐	Paper fiber	
	-		☐ Anaerobic ☐ None			Other	
					Looking at stones which a		
		Oils Absent 🗆 S	light	Profuse	embedded, are the undersi	des black in color?	
	INODCAN	IC SUBSTRATE	COMPONENTS		ORGANIC SUBSTRATE C	OMPONENTS	
•		(should add up to 1			(does not necessarily add		
Substrate	Substrate Diameter		% Composition in	Substrate	Characteristic	% Composition in	
Bedrock	Type Samplin		Sampling Reach	Type	Sticks, wood, coarse plant	Sampling Area	
Boulder	> 256 mm	n (10")	10	Detritus	materials (CPOM)	5	
Cobble	-,	m (2.5" – 10")	-35		Black, very fine organic		
Gravel	2-64 mm	(0.1"-2.5")	45	Muck-Mud	(FPOM)	0	
Sand	0.06 – 2m	ım (gritty)			Grey, shell fragments		
Silt	0.004-0.0	6 mm		Marl		0	



PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME COOKE	d Creek	LOCATION CC-1 (Downstream Reach)					
STATION #	RIVERMILE	STREAM CLASS					
LAT	LONG	RIVER BASIN					
STORET#		AGENCY					
INVESTIGATORS	MR / JOR						
FORM COMPLETED BY	~^^.A.4.4	DATE OF AP	R13		REASON FOR	RSURVEY	
	omr	TIME 132	<u>/ AM</u>	em	UAA		
WEATHER CONDITIONS	rain (ste	eavy rain) ady rain) (intermittent)	Past 24 Hours	Has Y	'es □ No	avy rain in the last 7 days?	
			%		Other		
		-					
SITE LOCATION/MAP	Draw a map of the site a	and indicate the					
	•						
			*.				
						•	
				-			
					,		
STREAM CHARACTERIZATION	Stream Subsystem A Perennial	ntermittent	☐ Tidal		im Type oldwater	Warmwater	
	Stream Origin Glacial Non-glacial montane Swamp and bog	pring-fed Mixture Other.	of origins	Cate	hment Area	/kın²	



PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSH FEATURES	h	Predominant Sur A Forest D Field/Pasture Agricultural Residential	rounding Landuse Commercial Industrial Other		Local Watershed No evidence Some potential sources Obvious sources Local Watershed Erosion		
RIPARIAN VEGETAT (18 meter b	ION	Trees		ninant species p rasses	None Moderate Coresent Herbaccous	J Heavy	
(20 1310101 5			present				
INSTREAM FEATURES	i i	Estimated Reach			Canopy Cover ☐ Partly open ☐ Partly sl	naded	
	ĺ				High Water Mark 0.3	ı	
			Aream ² 1000)km ²	,	Proportion of Reach Repre	Ť	
			n Deptlim		☐ Riffle 20 % ☐ Ru ☐ Pool 10 %	n <u>70</u> %	
		Surface Velocity (at thalweg)	m/sec		Channelized	<i>[</i> -	
					Dam Present	s No	
LARGE W DEBRIS	OODY	LWD Density of LWD	m² m²/km² (L WD /	reach area)			
AQUATIC VEGETAT	VEGETATION Rooted emergent Rooted submergent Attached Algae			nergent -		☐ Free floating	
		-	present	- o,			
	*** * *****		th with aquatic vegetation	Water Oder			
WATER Q	UALITY	Temperature Specific Conduct		iil		vage emical er	
		Dissolved Oxyge	see field notes				
,		pH		or	Water Surface Oils ☐ Slick ☐ Sheen ☐ Globs ☐ Flecks Man None ☐ Other		
		Turbidity			Turbidity (if not measured)		
		WQ Instrument	Used		Clear		
SEDIMEN' SUBSTRA			☐ Sewage ☐ Petroleu ☐ Anaerobic ☐ None	ım	Deposits ☐ Sludge ☐ Sawdust ☐ Paper fiber ☐ Sand ☐ Relict shells ☐ Other		
		Oils	Glight □ Moderate □	Profuse	Looking at stones which ar embedded, are the undersion Yes		
		IIC SUBSTRATE			ORGANIC SUBSTRATE CO		
0.1.44.		(should add up to		Cubatuata	(does not necessarily add t	r <u>* </u>	
Substrate Type	Г	Diameter	% Composition in Sampling Reach	Substrate Type	Characteristic	% Composition in Sampling Area	
Bedrock	. 256	(101)		Detritus	Sticks, wood, coarse plant materials (CPOM)	1	
Boulder	> 256 mm		10	-	, , , , , , , , , , , , , , , , , , , ,	<5	
Crowd		m (2.5" – 10")	<u>30</u> so	Muck-Mud	Black, very fine organic (FPOM)		
Gravel		(0.1" – 2.5") m (gritty)	30		Grey, shell fragments	- U	
Sand Silt	0.06 - 2m			Marl	Grey, shell dagments	\cap	
Clay	0.004-0.06 mm <0.004 mm (slick)			iviai i			



PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME Crook	ied Creek	LOCATION	Cc-2	-	
STATION #	RIVERMILE	STREAM CL	ASS		
LAT	LONG	RIVER BASI	N		
STORET#		AGENCY			
INVESTIGATORS JWI	~ / ゴブドー				
FORM COMPLETED BY	JMR	DATE_03 /		. REASON FOI	R SURVEY
MEVERIED	·	•			
WEATHER CONDITIONS SITE LOCATION/MAP	rain (s showe 100 % clear/s		Past 24 Hours	Air Temp Other	eavy rain in the last 7 days?
SHE LOCATION/MAP	Draw a map of the site	Shaw View	15land	Right Sh	of sample sample shies and of shier reactions
STREAM CHARACTERIZATION	Stream Subsystem Perennial	Intermittent	☐ Tidal	Stream Type Coldwater	Warmwater
	Stream Origin Glacial Non-glacial montane Swamp and bog	Spring-fed □ Mixtu □ Other	re of origins	Catchment Area	km²



PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSH FEATURE		Predominant Su Forest Field/Pasture	rrounding Landuse Commercial Industrial		Local Watershed No evidence Some potential sources Obvious sources		
	ĺ	Agricultural	Other		☐ Obvious sources		
		☐ Residential			Local Watershed Erosion None Moderate Heavy		
RIPARIAN			inant type and record the dor	- ,			
VEGETAT (18 meter b		Trees		irasses	☐ Herbaceous		
			present				
INSTREAM FEATURE		Estimated Reach	Lengthm		Canopy Cover ☑ Partly open ☐ Partly shaded ☐ Shaded		
FEATURE	3	Estimated Stream Width 25 1/m					
		Sampling Reach	Aream²		High Water Mark 1.5		
		Area in km² (ın²)	(1000)km ²		Proportion of Reach Repro	·	
		Estimated Stream	n Depthm		□ Riffle	in <u>#6</u> %	
		Surface Velocity (at thalweg)	m/sec		Channelized	es ANO	
					Dam Present DY	es S No	
LARGE W	OODY]	<u> </u>			•	
DEBRIS		Density of LWD	m²/km² (LWD/	reach area)			
AQUATIC VEGETATION Indicate the dominant type and Rooted emergent Floating Algae			inant type and record the don nt ☐ Rooted subm ☐ Attached Alş	nergent	present .□ Rooted Floating	☐ Free floating	
		dominant species	present				
		Portion of the read	ch with aquatic vegetation	<u>ン_</u> %			
WATER Q	UALITY	Temperature			Water Odors	***	
					Normal/None		
		· ·		218	☐ Fishy ☐ Ott		
1		Dissolved Oxyge	n Ser (ses	Water Surface Oils		
		pH		! (→ ,	Slick Sheen Globs Flecks None Other Turbidity (if not measured) Clear Slightly turbid Turbid Opaque Stained Other		
		Turbidity					
			Used				
SEDIMEN	T/	Odors			Deposits Stanton	D Other	
SUBSTRA		Normal	☐ Sewage ☐ Petroleu ☐ Anaerobic ☐ None	m	☐ Sludge ☐ Sawdust ☐	Paper fiber	
		Oils	Slight	Profuse	Looking at stones which ar embedded, are the undersi		
		7					
		IIC SUBSTRATE			ORGANIC SUBSTRATE C	-	
0.1.4		(should add up to		C. b44.	(does not necessarily add		
Substrate Type	Ι	Diameter ————————	% Composition in Sampling Reach	Substrate Type	Characteristic	% Composition in Sampling Area	
Bedrock			0	Detritus	Sticks, wood, coarse plant	0	
Boulder	> 256 mm		/1		materials (CPOM)		
Cobble	· · · · · · · · · · · · · · · · · · ·	m (2.5" – 10")	<u>50</u>	Muck-Mud	Black, very fine organic (FPOM)	0	
Gravel Sand	0.06 – 2m	(0.1" – 2.5") m (grifty)	30		Grey, shell fragments	_	
Silt	0.004-0.00			· Marl	Grey, such dagments		
Clay		4-0.06 mm			O		



PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME Crooke	d Creek	LOCATION	CC-3		
STATION#	RIVERMILE	STREAM CLASS		· · · · · · · · · · · · · · · · · · ·	
LAT	LONG	RIVER BASIN	The same of the sa		
STORET#		AGENCY	,		,
INVESTIGATORS TW	1R-1 JJR-				-
FORM COMPLETED BY		DATE 03 APR 13		REASON FOR	RSURVEY
	JMK	TIME 1240	AM PM	UAA	
	4.1				
WEATHER CONDITIONS	Now	Past : Hour		s there been a hea	avy rain in the last 7 days?
		neavy rain)		Λ	erature <u>40</u> °C
	□ showers	s (intermittent)		An Temp	eratureC
			%	Other	
	☐ clear/su	nny L		* 13.1	
SITE LOCATION/MAP	Draw a map of the site	and indicate the areas:	sampled (or attach	a photograph)	
		//			
		1/1 " /50	. /		<u>\$</u> .
			' /	7	* P
		Sand Strike	/ ,	. /	,
			4	and the second s	
		$\setminus \{\{\}\}_{i} = \{\}$			e e e e e e e e e e e e e e e e e e e
			5/		
				J.J.	or token of early early early
	. \	1 X /	Min		L Bernson
	\sim		1/4.	.3	ing of ale of
		\ 1		Draw	Same.
					and b
	`\	(0.4)		1	· her
		, but		3	سلامهم بماء
		lor !			hore con
		/,		e : "	ent.
	() \				
		\			
		/			
		,			
STREAM	Stream Subsystem			ат Туре	
CHARACTERIZATION	Perennial Ir	ntermittent	al 🗖 C	oldwater	Warmwater
	Stream Origin		Cate	chment Area	/ km²
	•	pring-fed	Cat	milent All Ca	nii
	☐ Non-glacial montane	Mixture of orig	ins		
	☐ Swamp and bog	Other			



PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSH	li i	Predominant Surrounding Landuse			Local Watershed		
FEATURES	8	Field/Pasture	☐ Commercial☐ Industrial☐		☐ No evidence ☐Some potential sources ☐ Obvious sources		
		Agricultural Other					
		☐ Residential			Local Watershed Erosion None Moderate	l Heavy	
RIPARIAN	i i		nant type and record the don	inant species p	resent		
VEGETATI (18 meter bu		Trees			☐ Herbaceous		
(20 0.000 0.			present				
INSTREAM FEATURES		Estimated Reach	Lengthm		Canopy Cover Partly open Partly sh	aded Shaded	
I Ditt OILD		Estimated Stream	1 Width <u> </u>				
		Sampling Reach	Aream²		High Water Mark_/.S_n		
		Area in km² (m²x	1000)km²		Proportion of Reach Repre Morphology Types	sented by Stream	
		·			☐ Riffle 15 % ☐ Rui	n_ <i>25_</i> %	
		Estimated Stream	n Depthm		□ Pool <u>60</u> %		
		Surface Velocity (at thalweg)	m/sec		Channelized	i No	
		(at thatweg)			Dam Present	s Mo	
LARGE WO	OODY	LWD	m ²	roaah aroo)			
AQUATIC			inant type and record the don		resent	:	
VEGETAT	ION	☐ Rooted emerge ☐ Floating Algae	nt 🗖 Rooted subm	ergent	☐ Rooted Floating	☐ Free floating	
		dominant species present			WARREST CO.		
		Portion of the read	h with aquatic vegetation	<u>_</u> %			
WATER Q	UALITY	V			Water Odors		
		Specific Conduct	ance	c.iJ	Normal/None Sew Petroleum Che	mical	
		Dissolved Oxyge	ı <i>9ù</i>	he.c	☐ Fishy ☐ Other		
		р Н			Water Surface Oils ☐ Slick ☐ Sheen ☐ Globs ☐ Flecks ☐ None ☐ Other		
		•					
		Turbidity			Turbidity (if not measured)		
		WQ Instrument	Used		Clear Slightly turbid Opaque Stained	☐ Turbid	
SEDIMENT		Odors			Deposits		
SUBSTRAT	ľE		☐ Sewage ☐ Petroleu ☐ Anaerobic ☐ None	ın	☐ Sludge ☐ Sawdust ☐ Relict shells ☐	Paper fiber	
		Outer			Looking at stones which are		
		Oils Absent	Slight	Profuse	embedded, are the undersid	les black in color?	
	INORGAN	IC SUBSTRATE	COMPONENTS		ORGANIC SUBSTRATE CO	OMPONENTS	
INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)				(does not necessarily add a			
Substrate Type	1	Diameter	% Composition in Sampling Reach	Substrate Type	Characteristic	% Composition in Sampling Area	
Bedrock			0	Detritus	Sticks, wood, coarse plant	~	
Boulder	> 256 mm		5	Denting	materials (CPOM)	U	
Cobble		m (2.5" – 10")	45	Muck-Mud	Black, very fine organic		
Gravel		(0.1" - 2.5")	.50		(FPOM)	<u> </u>	
Sand Silt	0.06 – 2m 0.004-0.0			Marl	Grey, shell fragments		
SHL	v.vv4-v.0	O ITUIT		IVEALL		Δ	

edEx	NEW Package
Express	US Airbill

Teaking 8022 1516 4095

From Please print and press hard. Date 4-2-13 Sender's FedEx Account Number	102\$1514-0
Sender's Jeremy Rigsby	Phone (50) 325-7779
Company FTN Associates, Ltd	λ
Address 3 Innwood Circle, S	Swife 220 Dept/Roo/Sulte/Roo
city Little Rock	State AR ZIP 72211
Your Internal Billing Reference First 24 characters w/ll appear on invoice.	of randay.
To Recipient's Name Bruce Huther	Phone (940) 387-1025
company Huther and Associa	tes, Inc.
Address 1156 North Bonnie 1	
We cannot deliver to P.O. boxes or P.O. ZIP codes. Address	Dept.Floor/Suite/Room HOLD Saturday FedExtocation edities FedExtocation edities FedExtocation edities FedExtocation edities
Use this line for the HOLD location address or for continuation of your shipping addr City Dentan	
LIN PENTON	State // ZIP /6JOI

Easy new Peel-and-Stick airbill. No pouch needed. Apply airbill directly to your package. See directions on back.

4	Express Package Service *Tomosto NOTE Service order has changed. Pleases belief carefu	
	Next Business Day	2 or 3 Susiness Days
	FedEx First Overnight Eaflest next business marning delivery to select locations. Fridey strements with be delivered on Monday unless SATURDAY Delivery is selected.	FedEx 2Day A.M. Second business morning. Saturday Dalivery NOT available.
X	FedEx Priority Overnight Next business morning." Friday chipments will be delivered on Monday unless SATURDAY Delivery is selected.	FedEx 2Day Second business afternoon.* Thursday shipments will be delivered on Monday unless SATURDAY Delivery is selected.
	FedEx Standard Overnight Next business afternoon." Saturday Delivery NDT available.	FedEx Express Saver Third business day.* Saturday Delivery NOT available.
5	Packaging *Declared value limit \$500.	
\Box	FedEx Envelope* FedEx Pak*	FedEx FedEx M Othor
6	Special Handling and Delivery Sign SATURDAY Delivery Not available Fedex Standard Overnight, Fedex 2Day A.M.,	Box Tube ature Options or FedEX Express Sever.
X	Special Handling and Delivery Sign SATURDAY Delivery Mol available of Fedex Standard Overnight, Fedex 2Day A.M. No Signature Required Pechage may be left without obtaining a signature for delivery. Our hox must be checked. No As per attached. As per attached. Yes As per attached. No As per attached. Our hox most be checked. As per attached. No As per attached. Our hox most be checked.	Tube Tube
X	Special Handling and Delivery Sign SATURDAY Delivery Held associated four Fredex Standard Overnight, Fredex 2Day A.M., No Signature Required Package may be left without obtaining a squature for delivery. Direct Si Someone at obtaining a squature for delivery. One has must be chacked. One has must be chacked. Yes Shipper's Declaration. Yes Shipper's Declaration. Yes Shipper's Declaration of the Company	Box Tube Pature Options or FedEX Express Savar. Indirect Signature If no one is evaluable at recipient's address, someone et a neighborat deficiency. Fee appliex of the same of the same of the same only. Fee appliex Dry Ice Dry Ice, 9, UN 1845 Ag
Jangur plan	Special Handling and Delivery Sign SATURDAY Delivery For a constant for Fedex Standard Overnight, Fedex 2Day A.M. No Signature Required Fedex Standard Overnight, Fedex 2Day A.M. No Signature Required Fedex Standard Overnight, Fedex 2Day A.M. No Signature Required Fedex Standard Overnight, Fedex 2Day A.M. No Signature Required Fedex Standard Overnight, Fedex 2Day A.M. No Graphon must be chacked. Yes Offen how must be chacked. Yes Shipper's Beclar Lore Shipper's Declaration. For Fedex Acct. No. Sender Enter Fedex Acct. No. Sender	Tube Tube

Rev. Date 1/12 - Part #167002 - @2012 FedEx - PRINTED IN U.S.A. SRI

TOTT BEFORE ATTIMING TO THE PACKAGE, NO POUCH NEEDED.

STREAM NAME Crooked Creek	LOCATION CC-O (UPStream Reach)		
INVESTIGATOR(S) JMR/JJR	STREAM CLASS		
LAT	LONG		
DATE OR APR 13	TIME /530 AM (PM)		
FORM COMPLETED BY JMR / TTO	REASON FOR SURVEY		

Dobble ID	Measurement	Size Class	Dobble ID	Measurement	Size Class
Pebble ID	(mm)		Pebble ID 51	(mm)	
2		16	52		90
3		64	53		128
4			54		64
		16	55	·	
5					. 22.6
6		16	56		90
7		90	57		64
8		90.	58		16
9			59		32
10		16	60		90
11		90	61		5.6
12		138	62		64
13		32	63		90
14		90 .	64		8
15		128	65		4
16		5.6	66		· 45
17		64	67		· 16
18		32	68		32
19		16.	69		64
20		180	70		11
21		45	71		64
22		90	72		HS
23			73]
24		128	74		56
25		128	75		22.6
26		45	76		32
27		32	77		16
28		32 32	. 78		128
29		64	79		16
30		45	80		90
31		90	81		90
32		45	82		90
33		180	. 83		180
34		45	84		90
35		128	85		180
36		128	86		5.6
37		128	87		90
38		32	88		8
39		32	89		280 F
40		128	90		4
41		8	91		90
42		128 8 2	92		128
43		4	93		32
44		45	94		28.6
45		128	95		64
46		32	96		5.6
47		90	97		64
48		64 64	98		5.6
49	 	90	99	 	45
50		11	100	 	90

STREAM NAME Crooked Creek	LOCATION CC-O DS liftly
INVESTIGATOR(S) JMR/ JOR	STREAM CLASS
LAT	LONG
DATE OR AFR 13	TIME 1605 AM (PM)
FORM COMPLETED BY JMP / JTR	REASON FOR SURVEY UAA

	Measurement			Measurement	
Pebble ID	(mm)	Size Class	Pebble ID	(mm)	Size Class
1		8	51		90
2		16	52		90
3		16	53		64
4		16	54		90
5		16	55		90
6		45	56		C41
7		64	57		45
8		64.	58		64
9		90	59		16
10		90	60		16
11		Ťo.	61		290 x
12		9 %	62		32
13		90	63		64
14		90	64		90
15		93	65		90
16		. 9	66		90
17		N	67		128
18		90	68		180
19		92	69		128
20		12%	70		90
21		108	71		2201
22		198	72		45
23		180	73		32
24		200 Ar	74		11
25		400 🎉	75		190
26		800 🎉	76		45
27		64	77		90
28		64	. 78		45
29		32	79		20.6
30		45	80		8
31		64	81		22.6
32		45	82		3.2
33		16	83		32
34		45	84		45
35		32	85		22.6
36		32	86		45
37		16	87		90
38		16	88		45
39		5.6	89		90
40		64	90		
41		22, 6	91		64 64
42		70	92		57.6
43		128	93		128
44	·	128	94		90
45		180	95		90
46		5.6	96		90 90
47		64	97		45
48		64	98		22.6
49		32	99		45
50		5.6	100		8

STREAM NAME Crooked Creek	LOCATION CC-1 (upstream)
INVESTIGATOR(S) JMK / JTR	STREAM CLASS
LAT	LONG
DATE 02 APR 13	TIME 1430 AM (PM)
FORM COMPLETED BY JMR / JJR	REASON FOR SURVEY LAA

	Measurement			Measurement	
Pebble ID	(mm)	Size Class	Pebble ID	(mm)	Size Class
1		138	51		
2		૧૦	52		. 90
3		11	53		64
4		45	54		5.6
5		128	55		4
6		64	56		90
7		64	57		180
8		90 .	58		8
9		45	_59		8
10		32	60		45
11		16	61		5.6
12		128	62		64
13		128	63		64
14		198	64		90
15		64	65		22.6
16		. 90	66		11
17			67		64
18		45	68		45
19		64	69		20.6
20 .		128	70		128
21		64	71		32
22		64	72		32
23		90	73		64
24		126	74		128
25		45	75		64
26		45	. 76		128
27		32	77		5.6
28		16	. 78		32
29		32	79		22.6
30		64	80		32
31		40	81		90
32		90	82 .		45
33		32	83		64
34		64	84		90
35		32	85		Ц
36		US	86		22 6
37		90	87		8
38		5.6	88		US
39		32	89		45
40	·	90	90		
41		90	91		138
42		ů,	92		90
43		- - - - - - - - - -	93		90 128
44	· -	Ц	94		64_
45		[1	95		90
		45	96		11
46			97		45
47		32	98		
48		90			32
49		Ц	99		12-
50		1	100		22.6

STREAM NAME Crooked Creek	LOCATION CC-1 (Downstream Riffle)
INVESTIGATOR(S) JMR/JTR	STREAM CLASS
LAT	LONG
DATE 62 APR 13	TIME 1345 AM (PM)
FORM COMPLETED BY TMR / JTR	REASON FOR SURVEY LAAA

Pebble ID	Measurement (mm)	Size Class	Pebble ID	Measurement (mm)	Size Class
1	· (mm)	6 4	51	(IIIII)	16
2		45	52		72
3		22.6	53		22.6
4		33	54		64
5		33	55		
6		16	56		16
7		3.9	57		45
8		45	58		90
9		16	59		64
10		7)	60		72
11		3 a	61		16
12		64	62		16
13		22.6	63		90
14		33	64		64
15		22.6	65		64
16		64	66		79.6
17		22.6	67		45
18		64	68		11
19			69		5.6
20		64	70		32
21		45	71		16
22		32	72		. 90
23		80	73		32
24		16	74		22.6
25		8	75		5.6
26		3.9	76		5.6
27		30	77		र पंडे
28		45	. 78		11
29		45	79		72
30		75	80		22.6
31		1. gov	81		11
32		30	82		73
33	-	45	83		32
34		12	84		45
35		8	85		45
36		32	86		32
37		45	87		11
38		22. <u>6</u>	88		45
39		64	89		
40	 	16	90		70
41		79	91		
42	 	90	92	· ·	1)
43		64	93		<u> </u>
44		22.6	94		64
45			95		<u> </u>
		16	96		<u>5.7</u> 24
46			97		96
7/	 	39			45
48.		16	98		45
49		16	99		45
50		70	100		64

STREAM NAME Crooked Creek	LOCATION CE-2 (Nesteam behin of Riffle)
INVESTIGATOR(S) JMR_/JM2	STREAM CLASS
LAT	LONG
DATE 03 APP 13	TIME 0815 AM PM
FORM COMPLETED BY MR/ITE	REASON FOR SURVEY TMK

Measurement	Cima Ol	Dalda D	Measurement	0! 0!
(111111)			(mm)	Size Class
				64
				16
				198
				180
				35
	64			30
				30
				45
				198
				90
				64
				90
				32
				39
	64			3.9
R. C. C. C. C. C. C. C. C. C. C. C. C. C.				64
				64
				45
	16			20.6
				8
				64
				38
				64
	45			30
	39			16
				SD . \$
	16	77		64
	22.6	. 78		22.6
		79		64
		80		45
	138	81		90
	64	82		90
	45	83		64
		84		- 8
	32	85		
	64	86		45
	64	87		33
	90	88		64
				45
	90			90
	108			64
				45
	45			72
•	90			45
	Ž			45
	<u>0</u> / 4			45
	45			4 5 4 5
	40			64
	1.2	99		90
		(mm) Size Class 16 22.6 64 45 32 64 11 11 12 22.6 16 45 17 32 45 32 46 47 47 47 47 47 48 48 48 48 48	(mm) Size Class Pebble ID 16 51 20 6 52 644 53 3 0 54 20 6 55 64 56 45 56 45 57 3 0 58 64 59 11 60 11 61 20 6 62 14 63 10 7 64 64 65 64 66 64 66 64 66 64 66 64 66 64 66 64 67 45 68 16 69 20 6 70 11 71 45 72 30 73 45 74 30 75 20 6 78 30 73 45 80 10 8 10 9 10	(mm) Size Class Pebble ID (mm) 16

STREAM NAME Cruoked Creek	LOCATION CC-2 (Courshiem Por him of Rift (c)
INVESTIGATOR(S) JMR / JJR	STREAM CLASS
LAT	LONG
DATE O3 APP_13	TIME 0845 AM PM
FORM COMPLETED BY OMP /TTR	REASON FOR SURVEY 1/4 A

	Measurement	_		Measurement	
Pebble ID	(mm)	Size Class	Pebble ID	(mm)	Size Class
1		<u>38</u>	51		45
2		22.6	52		16
3		20.6	53		45
4		90	54		72
5		45	55		16
6		ја	56		11
7		45	57		5.6
8		32	58		64
9		45	59		16
10		99.6	60		22.6
11		8	61		22,6
12		64	62		45
13		64	63		20.6
14		45	64		45
			65		
15					35
16		22.6	66		
17		45	67		64
18		45	68		336
19		90	69		30
20		64	70		64
21		23.6	71		16
22		45	72		45
23		39	73		20.6
24		64	74		45
25		45	75		3 2
26		64	76		16
27		32	77		16
28		64	. 78		45
29		45	79		45
30		180	80		72
31		45	81		128
32		90	82		16
33		90	83		45
34		79	84		25.6
35		45	85		22.6
36		64	86		33
					<u> </u>
37		45 39	87		90 45
38			88		
39		16	89		3 0
40		∂ ⊃,	90		3.3
41		33	91		33
42		45	92		40
43		64	93		45
44	1		94		64
45		11	95		22.6
46		16	96		90
47		32	97		90
48		45	98		45
49		22.6	99		45
50	-	45	100		45

STREAM NAME Crooked Creek	LOCATION CC-3 Upstram Riffle
INVESTIGATOR(S)	STREAM CLASS
LAT	LONG
DATE 03 APR 13	TIME //55 AM) PM
FORM COMPLETED BY TMR / TTR	REASON FOR SURVEY UAA

	Measurement	1		Measurement	
Pebble ID	(mm)	Size Class	Pebble ID	(mm)	Size Class
1		8	51		90
2		8	52		22.6
3		22.6	53		45
4		39	54		45
5		45	55		30
6		45	56		198
7		45	57		45
8		45	58		64
9		41	59		8
10		45	60		3.9
11		45	61		72
12		64	62		90
13		90	63		45
14		64	64		198
15		90	65		45
16		64	66		23.6
17		30	67	300	300
18		198	68		180
19		45	69		32
20		39	70		45
21		45	71		64
22		17	72		16
23		45	73		22.6
24		198	74		11
25		90	75		32
26		22.6	76		22.6
27	·	3,9	77		32
28		64	. 78		3.5
29		64	79		45
30		45	80		За
31		45	81		45
32		92.(82		64
33		DD.6	83		64
34		45	84		90
35		90	85		90
36		64	86		64
37		64	87		45
38		64	88		64
39		45	89		90
40		90	90		64
41		97.6	91		16
42		64	92		64
43		64	93		5.6 45
44	•	45	94		
45		, \$	95		23.6
46		90	96		64
47		45	97		45
48		39	98		45
49		8	99		64
50		22.6	100		45

STREAM NAME (nooked Creek	LOCATION CC-3 (Downstram By R. H.
INVESTIGATOR(S) JMR / JTR	STREAM CLASS
LAT	LONG
DATE 03 APRIS	TIME 1220 AM PM
FORM COMPLETED BY JMR/JTP	REASON FOR SURVEY LAA

Pebble ID	Measurement (mm)	Size Class	Pebble ID	Measurement (mm)	Size Class
1		180	51		11
2		198	52		32
3		90	53		45
4		90	54		64
5		90	55		198
6		198	56		32
7		90	57		180
8		64	58		90
9		64	59		45
10		43	60		3a
11		64	61		72
12		35	62		22.6
13		33	63		45
14		3245	64		22.6
15		45	65		22.6
16		45	66		16
17		64	67		16
18		90	68		16
19		45	69		45
20		64	70		45
21		3.5	71		16
22		22.6	72		90
23		22.6	73	350	70
24		45	74	220	45
25		16	75		3 2
26		16	76		64
27		92.6	77		64
		45	=0		138
28	-	45	79		90
29			80		45
30		64	81		43
31	-	22.6	82		3 2
32		45	83		
33					128
34		32	84		180
35		32 22.6	85		
36					90
37		32	87		198
38		32	88		64
39		45	89		90 90
40		16	90		70
41		32	91		33
42		90	92		64
43		90	93		90
44		90 64	94		45
45		64	95		72 16
46		64	96		16
47		45	97		16
48		45	98		45
49		64	99		45
50		45	100		32

APPENDIX E

Benthic Macroinvertebrate Assessment Methodology, Results, and Conclusions

BENTHIC MACROINVERTEBRATE ASSESSMENT METHODOLOGY, RESULTS, & CONCLUSIONS

This appendix provides the detailed evaluation of benthic macroinvertebrate communities upstream versus downstream of the Harrison wastewater treatment plant (HWWTP) and the Yellville WWTP (YWWTP) outfalls. The basic methodology follows the bioassessment III protocols outline in Pflakin et al. (1987), as modified by the Arkansas Department of Environmental Quality (ADEQ) (personal communication with Nathan Wentz, ADEQ, March 30, 2013). This modified methodology is as follows.

1.1 Modified Methodology

A multi-metric RBA score is computed based on the metrics given in Table E.1. The metric values for the reference (e.g., upstream or least-disturbed) are compared to the comparison site as indicated in the footnotes of Table E.1. A biological condition score of 0, 2, 4, or 6 is then assigned based on each comparison. The scores for the comparison site are then summed to give a composite score. The scores for the reference (i.e., upstream or least-disturbed, as appropriate) are given a value of "6" for all metrics except "% Contribution of Dominant Taxa." For this metric, the value in the table is the actual percent contribution, not a comparison to the reference. Therefore, the composite score for the reference is 5 times 6 plus the score for percent dominance¹. Finally, comparability between the reference and the comparison site is based on the composite score of the comparison site divided by the composite score of the reference site and expressed as a percent. This percentage is then compared to Table E.2 to evaluate impairment status of the comparison site relative to the reference.

Both fall and spring sampling included the collection of a duplicate riffle sample from the location downstream of the HWWTP (CC-1). Differences between the duplicate samples were within the expected range of variability.

¹ For example, if "% Contribution of Dominant Taxa" for the reference was 32%, its score would = 2 and the reference composite score for comparing to the comparison site would be 30 + 2 = 32.

Table E.1. Method for scoring selected metric values relative to a reference site.

	Biological Condition Scoring Criteria				
Metric	6	4	2	0	
Taxa Richness ^(a)	>80%	60%-80%	40%-60%	<40%	
Hilsenhoff Biotic Index (HBI) ^(b)	>85%	70%-85%	50%-70%	<50%	
Ratio of EPT to Chironomid Abundance ^(a)	>75%	50%-75%	25%-50%	<25%	
% Contribution of Dominant Taxa ^(c)	<20%	20%-30%	30%-40%	>40%	
EPT Index ^(a)	>90%	80%-90%	70%-80%	<70%	
Community Loss Index ^(d,e)	< 0.5	0.5-1.5	1.5-4.0	>4.0	

Notes:

- (a) Row entry is the metric value of the comparison site ÷ the metric value of the reference site X 100.
- (b) Row entry is the metric value of the reference site ÷ the metric value of the comparison site X 100.
- (c) Row entry is actual percent contribution, not percent comparability to reference site.
- (d) Range of values obtained. A comparison to the reference site is incorporated in these indices.
- (e) Community loss index = (x-y)/z, where x = # taxa present in reference site, y = # taxa common to both samples, and z = # taxa in comparison site. Value ranges from 0 to infinity.

Table E.2. Impairment categories based on composite scores of the comparison site expressed as a percentage of the reference site.

Impairment Status	% of Reference	Intepretation
No Significant Impairment	≥83%	Comparable to the best situation to be expected. Balanced trophic structure and optimum community structure present.
Slight Impairment	54%-79%	Community structure less than expected. Taxa richness lower than expected. Some intolerant taxa loss. Percent contribution of tolerant forms may increase.
Moderate Impairment	21%-50%	Obvious decline in taxa richness due to the loss of intolerant forms. Reduction in the EPT index.
Severe Impairment	<20%	Few taxa present and normally dominated by one or two taxa.

1.2 Analysis of Crooked Creek Data

The analysis of the Crooked Creek macroinvertebrate data involved two types of comparisons. The first type of comparison used the upstream sites as a reference (CC-0 versus CC-1 for the HWWTP reach and CC-2 versus CC-3 for the YWWTP reach). The second type involved comparisons of the Crooked Creek stations with least-disturbed waterbodies. Because

sulfate and chloride are only minor components of TDS in the Crooked Creek reaches upstream and downstream of the discharges (see Section 4.3 of the UAA report), TDS was the primary focus of the evaluation of the designated use attainment.

1.2.1 Upstream vs. Downstream Comparisons: Macrobenthos, Fall 2012

No biological sampling was conducted at CC-2 or CC-3 during the fall 2012 sampling due to absence of flow in that reach. Metric values for the HWWTP reach comparisons are provided in Table E.3. Separate comparisons were performed for CC-0 versus CC-1 and CC-0 versus CC-1 duplicate. Comparisons for each metric and the overall comparisons are provided in Table E.4. The downstream station samples for CC-1 and CC-1 duplicate were 68.8% and 93.8% comparable, respectively, to the upstream station (CC-0). These results indicate a "slight impairment" to "no significant impairment" at the downstream station due to the presence of the HWWTP discharge.

Table E.3. Summary of macroinvertebrate metrics for the fall 2012 sampling.

		Metric					
	Location	Total Taxa	HBI	Ratio of EPT to Chironomidae	Percent Contribution of Dominant Taxa	EPT Index	
	CC-0*	15	3.78	19	35%	5	
HWWTP	CC-1**	11	3.44	74	68%	3	
	CC-1 duplicate**	13	3.57	83	64%	6	

^{*} Upstream stations

1.2.1 Upstream vs. Downstream Comparisons: Macrobenthos, Spring 2013

Samples were collected at all four stations as well as at the duplicate sampling station for CC-1 during the spring 2013 sampling. Metric values for the comparisons are provided in Table E.5. As with the fall data, separate comparisons were performed for the CC-0 versus CC-1 and CC-0 versus CC-1 duplicate. Comparisons for each metric and the overall comparisons are provided in Tables E.6 and E.7 for the HWWTP and YWWTP, respectively.

^{**}Downstream stations

Upstream (CC-0) versus downstream (CC-1, CC-1 duplicate) comparison of Table E.4. macroinvertebrate metrics for the HWWTP reach during fall 2012 sampling.

Metric Comparison	Sites	Comparison with Reference	Score
Taxa Richness	CC-0 versus CC-1	73%	4
Taxa Kicilliess	CC-0 versus CC-1 duplicate	87%	6
IIDI	CC-0 versus CC-1	110%	6
HBI	CC-0 versus CC-1 duplicate	106%	6
EPT/Chironomidae	CC-0 versus CC-1	389%	6
EP1/Cnironomidae	CC-0 versus CC-1 duplicate	437%	6
	CC-0	35%	2
% Dominant	CC-1	68%	0
	CC-1 duplicate	64%	0
EDT Inday	CC-0 versus CC-1	60%	0
EPT Index	CC-0 versus CC-1 duplicate	120%	6
C	CC-0 versus CC-1	0.45	6
Community Loss	CC-0 versus CC-1 duplicate	0.23	6
		Percent of Reference	
Overa	ll Sum of Scores	(upstream)	Interpretation
CC-0	32	NA	NA
CC-1	22	68.8%	Slight impairment
CC-1 duplicate	30	93.8%	No significant impairment

Table E.5. Summary of macroinvertebrate metrics for the spring 2013 sampling.

		Metric					
	Location	Total Taxa	НВІ	Ratio of EPT to Chironomidae	Percent Contribution of Dominant Taxa	EPT Index	
	CC-0*	17	3.91	4.0	36%	6	
HWWTP	CC-1**	15	4.69	1.5	36%	5	
	CC-1 duplicate **	14	4.50	2.6	35%	5	
XXXXXX	CC-2*	17	3.94	16	43%	9	
YWWTP	CC-3**	6	4.72	1.8	34%	4	

^{*} Upstream stations **Downstream stations

Table E.6. Upstream (CC-0) versus downstream (CC-1, CC-1 duplicate) comparison of macroinvertebrate metrics for the HWWTP reach, spring 2013.

Metric Comparison	Sites	Comparison with Reference	Score
Taxa Richness	CC-0 versus CC-1	88%	6
Taxa Ricilliess	CC-0 versus CC-1 duplicate	82%	6
HBI	CC-0 versus CC-1	83%	4
ПБІ	CC-0 versus CC-1 duplicate	87%	6
EPT/Chironomidae	CC-0 versus CC-1	37%	2
Er 1/Cilifoliolilidae	CC-0 versus CC-1 duplicate	65%	4
	CC-0	36%	2
% Dominant	CC-1	36%	2
	CC-1 duplicate	35%	2
EPT Index	CC-0 versus CC-1	83%	4
EPT maex	CC-0 versus CC-1 duplicate	83%	4
Community Loss	CC-0 versus CC-1	0.27	6
Community Loss	CC-0 versus CC-1 duplicate	0.43	6
		Percent of Reference	
Overa	ll Sum of Scores	(upstream)	Interpretation
CC-0	32	NA	NA
CC-1	24	75.0%	Slight impairment
CC-1 duplicate	28	87.5%	No significant impairment

Table E.7. Upstream (CC-2) versus downstream (CC-3) comparison of macroinvertebrate metrics for the YWWTP reach, spring 2013.

Metric Comparison	Sites	Comparison with Reference	Score
Taxa Richness	CC-2 versus CC-3	35%	0
HBI	CC-2 versus CC-3	84%	4
EPT/Chironomidae	CC-2 versus CC-3	11%	0
% Dominant	CC-2	43%	0
70 Dominant	CC-3	34%	2
EPT Index	CC-2 versus CC-3	44%	0
Community Loss	CC-2 versus CC-3	1.3	4
Overall Sun	of Scores	Percent of Reference (upstream)	Interpretation
CC-2	30	NA	NA
CC-3	10	33.3%	Moderate impairment

For the HWWTP reach, downstream station samples, CC-1 and CC-1 duplicate were 75.0% and 87.5% comparable, respectively, to the upstream station (Table E.6). These results indicate a "slight impairment" to "no significant impairment" at the downstream station due to the presence of the HWWTP discharge.

For the YWWTP reach, the downstream station sample (CC-3) was 33.3% comparable to the upstream station (Table E.7). This result indicates a "moderate impairment" at the downstream station due to the presence of the YWWTP discharge.

For ease of comparison, the results presented in Tables E.5 through E.7 are summarized in Table E.8.

Table E.8. Summary of upstream versus downstream comparisons of benthic macroinvertebrate communities in Crooked Creek.

Season	Downstream Station	Percent Similarity with Reference (Upstream)	Interpretation
Fall	CC-1 (HWWTP)	68.8%	Slight impairment
ran	CC-1 duplicate (HWWTP)	93.8%	No significant impairment
	CC-1 (HWWTP)	75.0%	Slight impairment
Spring	CC-1 duplicate (HWWTP)	87.5%	No significant impairment
	CC-3 (YWWTP)	33.3%	Moderate impairment

1.2.2 Upstream vs. Downstream: TDS Concentrations

Total dissolved solids (TDS) concentrations upstream and downstream of the HWWTP and YWWTP are plotted on Figure E.1 and summarized in Tables E.9 and E.10, respectively.

Appendix E Benthic Macroinvertebrate Assessment Methodology

Table E.9. Summary of TDS concentrations from biweekly sampling of Crooked Creek upstream (US-65 bridge) and downstream (Silver Valley Road bridge) of the HWWTP (May 10, 2012, through April 23, 2013).

Summary Statistic				Downstream Change		
		Upstream (mg/L)	Downstream (mg/L)	Concentration (mg/L)	Percent	
	25 th	185	208	7	3%	
Percentile	50 th	206	223	14	7%	
Percentile	75 th	218	243	32	16%	
	95 th	249	254	41	20%	
Minin	num	147	162	-24	-9%	
Mea	an	204	220	17	9%	
Maxir	num	266	268	46	25%	

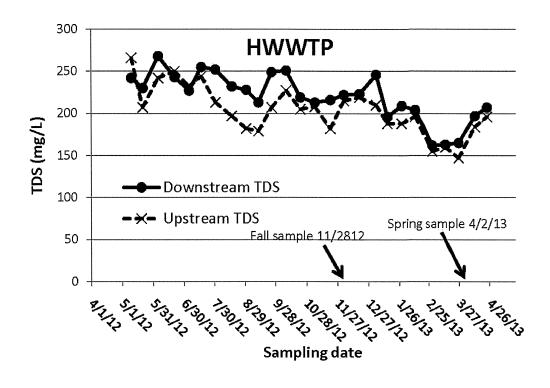
Table E.10. Summary of TDS concentrations from biweekly sampling of Crooked Creek upstream (AR-14 bridge) and downstream (Oxford property) of the YWWTP (September 24, 2012, through April 8, 2013).

Summary Statistic				Downstream Increase		
		Upstream ^(a) (mg/L)	Downstream ^(b) (mg/L)	Concentration (mg/L)	Percent	
	25 th	179	182	5	3%	
Percentile	50 th	194	204	7	4%	
	75 th	207	213	12	6%	
	95 th	210	221	16	10%	
Minin	num	157	174	-2	-1%	
Mea	ın	194	199	8	4%	
Maxin	num	210	223	17	11%	

Notes:

⁽a) Consistent flows were not observed in this reach of Crooked Creek until January 2, 2013.

⁽b) Consistent flows were not observed in this reach of Crooked Creek until February 11, 2013.



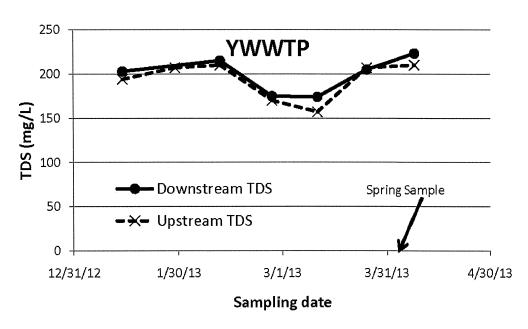


Figure E.1. Time-series plots of TDS in Crooked Creek upstream and downstream of HWWTP and YWWTP outfalls.

Visual examination of the TDS summaries and plots indicates that the outfalls have a minor influence on downstream TDS concentrations at both locations. TDS concentrations increased by an average of 9% and 4% in Crooked Creek below the HWWTP and YWWTP outfalls, respectively (Tables E.9 and E.10.) This corresponded to a minimal change in the macroinvertebrate community downstream as represented by duplicate samples (no significant impairment to slight impairment; Table E.8). Upstream to downstream differences in both reaches are typically less than monthly or biweekly differences (Figure E.1). It is not clear whether a cause and effect relationship would be expected to exist between small changes such as these. The YWWTP reaches showed the largest upstream to downstream assemblage differences (Table E.8) but showed the smallest upstream to downstream mineral differences in both absolute and relative terms, where the average TDS concentration increased by 8 mg/L downstream of the YWWTP outfall (Table E.10). This result shows that the magnitude of the minerals increase downstream of the discharge is not commensurate with the downstream change in the benthic macroinvertebrate communities. If the macroinvertebrate assemblages are responding to the modest upstream to downstream increases in mineral concentrations (i.e., a less than 10% difference in upstream versus downstream 95th percentile TDS values), then the greatest upstream to downstream mineral differences (observed at the HWWTP) should cause the greatest upstream to downstream assemblage differences. The opposite was observed. Accordingly, there must be other underlying mechanisms affecting assemblage structure. These underlying factors do not appear to be related to physical habitat or substrate because those factors do not vary appreciably between upstream and downstream locations.

1.3 Comparisons with Least-Disturbed Waterbodies

TDS concentrations at both the upstream and downstream sites in both reaches exceed the Crooked Creek TDS criterion of 200 mg/L. Therefore, upstream versus downstream comparisons of macrobenthos communities do not address potential effects on aquatic life due to the fact that TDS concentrations also exceed criteria upstream of the outfall. Evaluation of potential effects due to TDS concentrations that exceed criteria must be based on comparisons with reference locations that do not exceed TDS criteria. Therefore, the second type of

comparison evaluated macroinvertebrate and water quality data of the Crooked Creek locations versus available data from ADEQ's routine biological monitoring of least-disturbed waterbodies. An advantage of this type of comparison is that it can account for variability among sites with information from several reference sites and comparison sites. A disadvantage of this approach is that the comparison is somewhat biased, because Crooked Creek is not a least-disturbed system in the reaches upstream and downstream of the HWWTP and YWWTP discharges. Therefore, a certain level of impairment due to factors other than minerals (e.g., urbanization and other land uses) should be expected in those reaches.

Based on conversations with ADEQ staff, this approach used biological and water quality collections from Yocum Creek (YC) and Long Creek (LC) at two locations on each stream (YC-1, YC-2, LC-1 and LC-2). Basic information on these sites is provided in Table E.11. Both spring and fall macrobenthos collections were available from one or two sites on both reference streams. Field sampling methods used for the ADEQ routine biological monitoring (timed single-habitat collections from riffles) as well as sample sorting and taxonomic identification protocols were comparable to those used for this study.

The approach to incorporating multiple reference and comparison sites was to compute the overall percent similarity as described in Section 1.1 for each pair-wise combination of reference and Crooked Creek site within each reach the pair-wise combinations for each season are provided in Table E.12. The metric values for the least-disturbed reference streams (Table E.13) were used along with data provided in Tables E.3 and E.4 to compute percent similarity values for all pair-wise combinations of reference versus Crooked Creek sites for each metric (Tables E.14 and E.15).

Benthic Macroinvertebrate Assessment Methodology

Table E.11. Basic information for least-disturbed reference sites used in the analysis of benthic macroinvertebrate communities.

Stream Name	Drainage Area (mi²)	Latitude	Longitude	Sample Date	ADEQ Sample Reference Number
Yocum Creek 1	55	36.41444	-93.3829	06/07/2001	ADEQ4k-50
Yocum Creek 1	55	30.41444	-93.3829	11/01/2000	ADEQ4k-3
Yocum Creek 2	55	36.41439	-93.3862	N/A	N/A
1 ocum Creek 2				11/01/2000	ADEQ4k-4
Lang Charle 1	1.1 100 26 20000 02 2116		-93.3116	06/07/2001	ADEQ4k-48
Long Creek 1	190	36.38808	-93.3116	10/31/2000	ADEQ4k-1
r C 12	190	36.38793	02.2116	06/07/2001	ADEQ4k-49
Long Creek 2			-93.3116	10/31/2000	ADEQ4k-2

Table E.12. Matrix of possible pair-wise comparisons of least-disturbed reference sites versus Crooked Creek sites for fall and spring macrobenthos samples.

	YC-1	YC-2	LC-1	LC-2
CC-0	Fall and spring	Fall only	Fall and spring	Fall and spring
CC-1	Fall and spring	Fall only	Fall and spring	Fall and spring
CC-1 duplicate	Fall and spring	Fall only	Fall and spring	Fall and spring
CC-2	Spring only	No comparison	Spring only	Spring only
CC-3	Spring only	No comparison	Spring only	Spring only

NC = no comparison

Table E.13. Metric values for least-disturbed reference streams.

		Metric					
Season	Location	Total Taxa	нві	Ratio of EPT to Chironomidae	Percent Contribution of Dominant Taxa	EPT Index	
	YC-1	16	3.71	379	20.1%	9	
Fall	YC-2	14	3.31	79	50.0%	8	
Fall	LC-1	27	3.87	87	45.6%	11	
	LC-2	20	3.32	65	46.7%	8	
	YC-1	26	4.55	21	21.7%	13	
Spring	LC-1	25	4.51	19	13.7%	11	
	LC-2	22	4.58	15	15.8%	11	

Table E.14. Comparison matrices of percent similarity/IBI scores for each metric for all pair-wise combinations of least-disturbed reference streams with Crooked Creek sites sampled during fall 2012.

Metric	Crooked Creek (Comparison)	Least-Disturbed Reference Site (percent similarity / IBI score)				
Comparison	Site	YC-1	YC-2	LC-1	LC-2	
	CC-0	94% / 6	107% / 6	56% / 2	75% / 4	
Taxa Richness	CC-1	69% / 4	79% / 4	41% / 2	55%/2	
	CC-1 duplicate	81% / 6	93% / 6	48% / 2	65% / 4	
	CC-0	98% / 6	88% / 6	102% / 6	88% / 6	
HBI	CC-1	108% / 6	96% / 6	112% / 6	97% / 6	
	CC-1 duplicate	104% / 6	93% / 6	108% / 6	93% / 6	
EDT/	CC-0	5% / 0	24% / 0	22% / 0	29% / 2	
EPT/	CC-1	20% / 0	94% / 6	86% / 6	114% / 6	
Chironomidae	CC-1 duplicate	22% / 0	106% / 6	96% / 6	129% / 6	
	CC-0	35% / 2				
8- 	CC-1	68% / 0				
% Contribution	CC-1 duplicate	64% / 0				
of Dominant	YC-1	20% / 4				
Taxa	YC-2	50% / 0				
	LC-1	46% / 0				
	LC-2	47% / 0				
	CC-0	56% / 0	63% / 0	45% / 0	63% / 0	
EPT Index	CC-1	33% / 0	38% / 0	27% / 0	38% / 0	
	CC-1 duplicate	67% / 0	75% / 2	55% / 0	75% / 2	
Community I	CC-0	0.53 / 4	0.33 / 6	1.20 / 4	0.67 / 4	
Community Loss	CC-1	0.91 / 4	0.73 / 4	1.73 / 2	1.09 / 4	
Index	CC-1 duplicate	0.62 / 4	0.46 / 6	1.38 / 4	0.77 / 4	

Table E.15. Comparison matrices of percent similarity/IBI scores for each metric for all pair-wise combinations of least-disturbed reference streams versus Crooked Creek sites sampled during spring 2013.

	Crooked Creek	Least-Disturbed Reference Site (percent similarity/IBI score)			
Metric Comparison	(Comparison) Site	YC-1	LC-1	LC-2	
	CC-0	65% / 4	68% / 4	77% / 4	
	CC-1	58% / 2	60% / 4	68% / 4	
Taxa Richness	CC-1 duplicate	54% / 2	56% / 2	64% / 4	
Γaxa Richness HBI EPT/Chironomidae	CC-2	65% / 4	68% / 4	77% / 4	
	CC-3	(percent similarity YC-1	24%/0	27% / 0	
	CC-0	116% / 6	115% / 6	117% / 6	
	CC-1	97% / 6	96% / 6	98% / 6	
HBI	CC-1 duplicate	101% / 6	100% / 6	102% / 6	
	CC-2	115% / 6	114% / 6	116% / 6	
	CC-3	96% / 6	96% / 6	97% / 6	
	CC-0	19% / 0	21%/0	27% / 2	
	CC-1	7% / 0	8% / 0	10% / 0	
EPT/Chironomidae	CC-1 duplicate	12% / 0	14% / 0	17% / 0	
	CC-2	78% / 6	87% / 6	108% / 6	
	CC-3	8%/0	9% / 0	12% / 0	
	CC-0	36% / 2			
	CC-1	36% / 2			
	CC-1 duplicate	35% / 2			
% Contribution of	CC-2	YC-1 LC-1 65% / 4 68% / 4 58% / 2 60% / 4 54% / 2 56% / 2 65% / 4 68% / 4 23% / 0 24% / 0 116% / 6 115% / 6 97% / 6 96% / 6 101% / 6 100% / 6 115% / 6 114% / 6 96% / 6 96% / 6 19% / 0 21% / 0 7% / 0 8% / 0 12% / 0 14% / 0 78% / 6 87% / 6 8% / 0 9% / 0 36% / 2 35% / 2 43% / 0 34% / 2 22% / 4 14% / 6 16% / 6 46% / 0 38% / 0 45% / 0 38% / 0 45% / 0 69% / 0 82% / 4 31% / 0 36% / 0 0.88 / 4 0.71 / 4 1.07 / 4 0.80 / 4			
Dominant Taxa	CC-3	34% / 2			
	YC-1	22% / 4			
	LC-1	14% / 6			
	LC-2	16% / 6			
	CC-0	46% / 0	55% / 0	55% / 0	
	CC-1	38% / 0	45% / 0	45% / 0	
EPT Index	CC-1 duplicate	38% / 0	45% / 0	45% / 0	
	CC-2	69% / 0	82% / 4	82% / 4	
	CC-3	31% / 0	36% / 0	36% / 0	
	CC-0	0.88 / 4	0.71 / 4	0.59 / 4	
G	CC-1	1.07 / 4	0.80 / 4	0.73 / 4	
Community Loss	CC-1 duplicate	1.07 / 4	0.86 / 4	0.79 / 4	
Index	CC-2	1.00 / 4	0.94 / 4	0.82 / 4	
	CC-3	3.17 / 2	3.00 / 2	2.50 / 2	

Overall similarity values for each pair-wise comparison are provided in Table E.16 and summarized in Table E.17. The summary presented in Table E.17 indicates that depending on the season and the particular sites that are compared, sites upstream or downstream of the HWWTP or YWWTP were slightly to moderately impaired relative to least-disturbed reference sites. A summary of TDS, chloride and sulfate concentrations from ten sampling events on Yocum Creek and Long Creek during the same general time period as the biological sampling (2001 through 2004 for the water quality sampling versus 2000 and 2001 for the biological sampling) and during multiple seasons shows an average TDS concentration of 228 mg/L, with all measurements in excess of the Crooked Creek TDS criterion of 200 mg/L (Table E.18). This result demonstrates that TDS concentrations that exceed 200 mg/L will support a least-disturbed benthic macroinvertebrate community.

Table E.16. Comparison matrix of overall percent similarity between least-disturbed reference and Crooked Creek sites.

Season	Crooked Creek (Comparison) Site	Least-Disturbed Reference Site			
		YC-1	YC-2	LC-1	LC-2
Fall	CC-0	52.9%	66.7%	46.7%	60.0%
	CC-1	41.2%	66.7%	53.3%	60.0%
	CC-1 duplicate	47.1%	86.7%	60.0%	73.3%
	CC-0	47.1%	No data	44.4%	50.0%
Spring	CC-1	41.2%	No data	44.4%	44.4%
	CC-1 duplicate	41.2%	No data	38.9%	44.4%
	CC-2	58.8%	No data	66.7%	66.7%
	CC-3	29.4%	No data	27.8%	27.8%

Table E.17. Summary of overall percent similarity between least-disturbed reference and Crooked Creek sites.

Season	Summary Statistic	Percent Similarity	Interpretation
	Minimum	41.2%	Moderate Impairment
Fall	Mean	59.5%	Slight Impairment
	Maximum	86.7%	No Significant Impairment
	Minimum	27.8%	Moderate Impairment
Spring	Mean	44.9%	Moderate Impairment
	Maximum	66.7%	Slight Impairment

Table E.18. Summary of mineral concentrations from ADEQ sampling of Long Creek and Yocum Creek least-disturbed streams.

Location	Sampling Date	TDS (mg/L)	Sulfate (mg/L)	Chloride (mg/L)
	10/10/2000	238	7.8	15.6
	11/07/2000	226	7.9	14.5
Long Creek (ADEQ WHI0071)	09/12/2000	227	6.9	14.0
	05/29/2001	229	9.7	17.0
	06/26/2001	226	9.2	17.0
	10/27/2003	235	5.9	12.2
Yocum Creek (ADEQ WHI0137)	01/12/2004	236	7.5	12.6
	03/22/2004	233	6.9	12.8
	05/17/2004	207	5.7	9.9
Minimum		207	5.7	9.9
Mean		228	7.5	14.0
Maximum		238	9.7	17.0

1.4 Findings and Conclusions

The benthic macroinvertebrate communities downstream of the HWWTP and YWWTP showed discernible effects relative to the upstream locations, ranging from moderate impairment to no significant impairment depending on the season and location. Biweekly monitoring of TDS revealed only minor increases (9% and 4% downstream of HWWTP and YWWTP, respectively) in TDS in Crooked Creek due to the wastewater discharges. These comparisons suggest that downstream TDS increases are not of sufficient magnitude and timing to be considered as a likely cause of downstream changes in the macrobenthos community.

The benthic macroinvertebrate communities in Crooked Creek showed discernible differences relative to the least-disturbed streams, ranging from moderate to no significant impairment depending on season and location. TDS concentrations in the least-disturbed reference streams averaged 228 mg/L, with all measurements in excess of the Crooked Creek TDS criterion of 200 mg/L. This result demonstrates that TDS concentrations that exceed 200 mg/L will support a least-disturbed benthic macroinvertebrate community.

This analysis shows that variability in benthic macroinvertebrate communities of Crooked Creek is not attributable to variability in TDS concentrations and that current TDS

concentrations in Crooked Creek upstream and downstream of HWWTP and YWWTP will support Ozark Highland ecoregion least-disturbed aquatic life.

1.5 Literature Cited

Plafkin, J.L., M.T. Barbour, K.D. Porter, S.K. Gross, and R.M. Hughes. 1989. *Rapid bioassessment protocols for use in streams and rivers: Benthic macroinvertebrates and fish* [EPA 440-4-89-001]. Washington, DC: US Environmental Protection Agency, Office of Water Regulations and Standards.

APPENDIX	X	H
----------	---	---

Benthic Macroinvertebrate Taxa and Abundance for Crooked Creek Stations and Least-Disturbed Streams

C-5 226 53 LC-1 33 29 4 YC-1 4 9 92 YC-2 -|2|4 CC-1 Dup 2 s 32 25 ဗ္က CC-1 256 18 4 65 4 0-00 126 9 8 186 17 6.4 Tricorythodes
Paraleptophlebia
Ephoron
Microvelia
Rhagavelia
Petrophila Hemerodromia Leurocuta Maccaffertium Genus Macronychus Optioservus Stenelmis Dineutus Gyretes Lutrochus Ectopria Stenacron Stenonema Isonychia Choroterpes Simulium Silvius Hexatoma Tipula Ameletus Baetis Caenis Ferrissia Leptohyphiidae | Leptohyphiidae | Leptohyphiidae | Leptohyphiidae | Polymitarcyidae | Veliidae | Veliidae | Pyadiidae | Pyadiidae | Pyadiidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae | Conydalidae Heptageniidae
Heptageniidae
Heptageniidae
Heptageniidae
Heptageniidae
Sonychiidae
Isonychiidae
Isonychiidae Decepoda Cambaridae
Architaenioglossa Viviparidae
Basommatophora Ancylidae
Basommatophora Planorbidae
Neotanenioglossa Pleuroceridae
Coleoptera Elmidae
Coleoptera Elmidae Elmidae
Elmidae
Gyrinidae
Gyrinidae
Gyrinidae
Lutrochus
Psephenidae
Psephenidae
Chironomidae
Empididae
Simulidae
Tabanidae
Tipulidae
Tipulidae
Tipulidae
Ameletidae
Baetidae
Baetidae Family Ephemeroptera H
Ephemeroptera H
Ephemeroptera H
Ephemeroptera H
Ephemeroptera H
Ephemeroptera H
Ephemeroptera Ephemeroptera Is
Ephemeroptera Is
Ephemeroptera II
Ephemeroptera II
Ephemeroptera II Diptera
Diptera
Diptera
Diptera
Diptera
Ephemeroptera
Ephemeroptera
Ephemeroptera
Ephemeroptera
Ephemeroptera
Ephemeroptera Ephemeroptera [
Ephemeroptera [
Hemiptera |
Hemiptera |
Lepidoptera |
Lepidoptera |
Megaloptera | Order Coleoptera
Coleoptera
Coleoptera
Coleoptera
Coleoptera
Coleoptera
Coleoptera Diptera Diptera Bivalvia (Crustacea | Crustacea | Gastropoda | Gastropoda | Gastropoda | Gastropoda | Gastropoda | Insecta (Castropoda | Castropoda | C **Class** irudinea Insect Insecta Insecta Insecta Insecta Insecta Insecta Insecta Insecta Insecta

Table F.1. Benthic macroinvertebrate counts from fall 2012 sampling

Corydalus

Table F.1. Benthic macroinvertebrate counts from fall 2012 sampling.

1860	_	_	_												
LC-2		3				3	2	6				1		2	1
LC-1		2			1	2		3	1	3	1			7	1
YC-1								09	4	9		45	1	31	
YC-2								4				1		3	
CC-1 Dup								61				2			
CC-1	2							23							
0-33								95				4			
FFG	PR	PR	PR	PR	PR	SH	SH	FC	sc	FC		FC	29	SH	29
7	5.1	6	6.3	4.9	6.2	2.5	6.3	9.9	3	4		2.8	6.9	7.7	10
Genus	Argia	Enallagma	Dromogomphus	Gomphus	Ophiogomphus	Strophopteryx	Taniopteryx	Cheumatopsyche	Heliopsyche	Hydropchyche	Manophylax	Chimarra	Gammarus	Lirceus	
Family	Coenagrionidae /	Coenagrionidae	Gomphidae	Gomphidae	Gomphidae	Taeniopterygidae Strophopteryx	Taeniopterygidae T	Hydropsychidae (Hydropsychidae	Hydropsychidae H	Limnephilidae N	Philopotamoidae Chimarra	Gammaridae	Asellidae L	
Order	Odonata	Odonata	Odonata	Odonata	Odonata	Plecoptera	Plecoptera	Trichoptera	Frichoptera	Trichoptera	Trichoptera	Frichoptera F	Amphipoda	/ soboda	
Class	Insecta	Insecta	Insecta	Insecta	Insecta	Insecta	Insecta	Insecta	Insecta	Insecta	Insecta	Insecta	Malacostraca /	Malacostraca	Oligochaeta

Note: All of the individuals in FTN's 2012 and 2013 Crooked Creek collection identified the taxa marked in red as Maccaffertium. In the latest edition of Merrit, Cummins and Berg, the genus Stenonema was split into Stenonema and Maccaffertium. This edition postdates the collection of the ADEQ samples. Therefore the ADEQ samples probably contained what would now be identified as Maccaffertium. Accordingly, for purposes of comparability we have classified the Maccaffertium individuals in the FTN collection as Stenonema.

Table F.2. Benthic macroinvertebrate counts from spring 2013 sampling.

CONTROL 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	AND AND ADDRESS OF THE PARTY OF												
Hirudinea				3	PA								
Bivalvia				8	5 S	6	7	16	-				
Bivalvia			Corbicula	9	5								
Crustacea	Decapoda	Cambaridae		9	၁ဗ			-			_	-	-
Gastropoda	Architaenioglossa	Viviparidae		4	SC							-	2
Gastropoda	Basommatophora	Ancylidae	Ferrissia	6.9	SC							1	
Gastropoda	Basommatophora	Physidae		80	SC				3		1		
Gastropoda	Basommatophora	Planorbidae		7	SC								1
Gastropoda	Neotanenioglossa	Pleuroceridae		7	SC				1				
nsecta	Coleoptera	Dryopidae	Helichus	5.4									
nsecta	Coleoptera	Elmidae	Dubiraphia	9	SC								
nsecta	Coleoptera	Elmidae	Macronychus	4.7	29		1	9					
nsecta	Coleoptera	Elmidae	Optioservus	2.7	၁၄	49	24	38			30	1	1
nsecta	Coleoptera	Elmidae	Stenelmis	5.4	SC	16	91	91			2	9	74
nsecta	Coleoptera	Gyrinidae	Dineutus	5.5	PR								
nsecta	Coleoptera	Gyrinidae	Gyretes	2	PR						-	2	-
nsecta	Coleoptera	Hydrophilinae	Berosus	8.6									
nsecta	Coleoptera	Lutrochus	Lutrochus	2.9									
nsecta	Coleoptera	Psephenidae	Ectopria	4	SC								
nsecta	Coleoptera	Psephenidae	Psephenus	2	၁၄	14	2				8	4	4
nsecta	Diptera					2*	10*	*9	*9	13*		*	
Insecta	Diptera	Athericidae	Atherix	2	PR	2			-	8			
Insecta	Diptera	Chironomidae		9	၁၅	59	137	99	14	117	7	5	11
nsecta	Diptera	Empididae	Hemerodromia	9	PR						1		1
nsecta	Diptera	Simulidae	Simulium	4.4	FC	3	2		52			1	7
nsecta	Diptera	Tabanidae	Silvius	8	PR								
Insecta	Diptera	Tipulidae	Hexatoma	4.7	PR								
Insecta	Diptera	Tipulidae	Tipula	7.7									
Insecta	Ephemeroptera	Ameletidae	Ameletus	2.1	39						3		
Insecta	Ephemeroptera	Baetidae	Baetis	3.1	39				134	106	56	5	6
Insecta	Ephemeroptera	Baetidae	Procloeon	4	29						2		
nsecta	Ephemeroptera	Caenidae	Caenis	7.6	29	24	11	4			14	4	18
nsecta	Ephemeroptera	Ephemerellidae	Ephemerella	2.9	OC				2	9			
nsecta	Ephemeroptera	Heptageniidae	Heptagenia	2.8									
nsecta	Ephemeroptera	Heptageniidae	Leurocuta	1	SC							1	
nsecta	Ephemeroptera	Heptageniidae	Maccaffertium	4	SC								
nsecta	Ephemeroptera	Heptageniidae	Stenacron	3.1	SC						8	-	
nsecta	Ephemeroptera	Heptageniidae	Stenonema	3.3	SC	143	174	143	20	4	16	16	56
Insecta	Ephemeroptera	Isonychiidae	Isonychia	2	SC	44	9	7	-		9	12	31
nsecta	Ephemeroptera	Leptophlebiidae	Choroterpes	4	၁၅								-
nsecta	Ephemeroptera	Leptohyphiidae	Leptophlebia	6.4	၁၅								
nsecta	Ephemeroptera	Leptohyphiidae	Triconythodes	5.4	၁၅						8	16	34
Insecta	Ephemeroptera	Polymitarcyidae	Ephoron	2	၁ဗ								2
Insecta	Hemiptera	Veliidae	Microvelia	9	PR						8		
poopto											,	•	

Table F.2. Benthic macroinvertebrate counts from spring 2013 sampling.

						2000	* ***		7.7	The second second	*	the state of the s	Self-residence and the self-residence
Class	Order	Family	Genus		FFG	CC-0	CC-1	CC-1 Dup	CC-2	CC-3	YC-1	[C-1	TC-7
Insecta	Lepidoptera	Crambidae		9	HS		1	1	1				
Insecta		Pyralidae	Petrophila	2.5	sc								
Insecta		Schoenobiinae	Cambrinae	9	SH	2							
Insecta	Megaloptera	Corydalidae	Corydalus	5.6	PR	2					2	2	-
		Coenagrionidae	Argia	5.1	PR	1	1	-				-	
		Coenagrionidae	Enallagma	6									
	Odonata	Gomphidae	Dromogomphus	6.3	PR								
		Gomphidae	Somphus	4.9	PR						2	-	
Insecta	Plecoptera	Capniidae		1	SH				1				
Insecta		Perlidae	Acroneuria	0									
		Perlidae	Agnetina	2	PR						5		
Insecta		Perlidae	Neoperla	1.6	PR				6				
Insecta	Plecoptera	Perlidae	Isoperla	2	PR				1				
Insecta		Perlidae	Perlesta	4.9					09	92			
Insecta		Taeniopterygidae	Strophopteryx	2.5	SH						2	-	
Insecta	Trichoptera					2*							
Insecta		Hydropsychidae	Cheumatopsyche	9.9	FC						46	17	21
Insecta	Trichoptera	Hydropsychidae	Heliopsyche	3	SC	23	11	18				7	5
Insecta	Trichoptera	Hydropsychidae	Hydropchyche	4	FC	1	2	1			11	14	17
Insecta	Trichoptera	Philopotamoidae	Chimarra	2.8	FC	1					5		2
Insecta	Trichoptera	Psychomyiidae	Lype	4.3	SC				1				
Malacostraca	Isopoda	Asellidae	Lirceus	7.7	SH	1	3	5	2		9	2	
Oligochaeta				10	29						1		
	***************************************			*********************************			***************************************						

Note: All of the individuals in FTN's 2012 and 2013 Crooked Creek collection identified the taxa marked in red as Maccaffertium. In the latest edition of Merrit, Cummins and Berg, the genus Stenonema was split into Stenonema and Maccaffertium. This edition postdates the collection of the ADEQ samples. Therefore the ADEQ samples probably contained what would now be identified as Maccaffertium individuals in the FTN collection as Stenonema.



ADEQ Historical Monitoring Data

ADEQ Historical Monitoring Data for TDS at **Station WHI0200** (Crooked Creek at Hudson Road).

	ADEQ Lab			Concentration
Station ID	Number	Date Sampled	Parameter	(mg/L)
WHI0200	2013-2679	7/30/2013	TDS	202
WHI0200	2013-2275	6/25/2013	TDS	209
WHI0200	2013-1905	5/28/2013	TDS	189
WHI0200	2013-1314	4/22/2013	TDS	141
WHI0200	2013-0892	3/25/2013	TDS	127
WHI0200	2013-0347	2/5/2013	TDS	168
WHI0200	2013-0126	1/15/2013	TDS	217
WHI0200	2012-3818	12/10/2012	TDS	225
WHI0200	2012-3579	11/13/2012	TDS	226
WHI0200	2012-3373	10/23/2012	TDS	233
WHI0200	2012-3019	9/25/2012	TDS	197
WHI0200	2012-2650	8/28/2012	TDS	195
WHI0200	2012-2232	7/24/2012	TDS	188
WHI0200	2012-1912	6/26/2012	TDS	196
WHI0200	2012-1335	5/1/2012	TDS	187
WHI0200	2012-1271	4/24/2012	TDS	193
WHI0200	2012-0927	3/27/2012	TDS	164
WHI0200	2012-0574	2/28/2012	TDS	159
WHI0200	2012-0273	1/30/2012	TDS	139
WHI0200	2011-3643	11/28/2011	TDS	142

ADEQ Historical Monitoring Data for TDS at **Station WHI0067** (Crooked Creek above Harrison, Arkansas).

	ADEQ Lab			Concentration
Station ID	Number	Date Sampled	Parameter	(mg/L)
WHI0067	2013-2677	7/30/2013	TDS	193
WHI0067	2013-2273	6/25/2013	TDS	209
WHI0067	2013-1903	5/28/2013	TDS	207
WHI0067	2013-1312	4/22/2013	TDS	177
WHI0067	2013-0890	3/26/2013	TDS	159
WHI0067	2013-0345	2/5/2013	TDS	190
WHI0067	2013-0124	1/15/2013	TDS	194
WHI0067	2012-3816	12/10/2012	TDS	243
WHI0067	2012-3577	11/13/2012	TDS	204
WHI0067	2012-3371	10/23/2012	TDS	223
WHI0067	2012-3017	9/25/2012	TDS	208
WHI0067	2012-2648	8/28/2012	TDS	207
WHI0067	2012-2230	7/24/2012	TDS	210
WHI0067	2012-1910	6/26/2012	TDS	209
WHI0067	2012-1333	5/1/2012	TDS	200
WHI0067	2012-1269	4/24/2012	TDS	210
WHI0067	2012-0925	3/27/2012	TDS	180
WHI0067	2012-0572	2/28/2012	TDS	192
WHI0067	2012-0271	1/30/2012	TDS	174
WHI0067	2011-3934	12/12/2011	TDS	206
WHI0067	2011-3540	11/15/2011	TDS	217
WHI0067	2011-3270	10/18/2011	TDS	188
WHI0067	2011-2909	8/20/2011	TDS	215
WHI0067	2011-2525	8/16/2011	TDS	219
WHI0067	2011-2145	7/18/2011	TDS	212
WHI0067	2011-1784	6/14/2011	TDS	185
WHI0067	2011-1419	5/17/2011	TDS	183
WHI0067	2011-1151	4/26/2011	TDS	137
WHI0067	2011-0823	3/29/2011	TDS	198
WHI0067	2011-0482	2/22/2011	TDS	219
WHI0067	2011-0250	1/25/2011	TDS	226
WHI0067	2010-3936	12/28/2010	TDS	216
WHI0067	2010-3647	11/21/2010	TDS	230
WHI0067	2010-3407	10/26/2010	TDS	218
WHI0067	2010-3047	9/21/2010	TDS	223
WHI0067	2010-2356	8/10/2010	TDS	200
WHI0067	2010-1972	7/20/2010	TDS	205
WHI0067	2010-1540	6/16/2010	TDS	214
WHI0067	2010-1106	5/4/2010	TDS	210
WHI0067	2010-0909	4/13/2010	TDS	204
WHI0067	2010-0673	3/16/2010	TDS	205

ADEQ Historical Monitoring Data for TDS at **Station WHI0067** (Crooked Creek above Harrison, Arkansas).

	ADEQ Lab			Concentration
Station ID	Number	Date Sampled	Parameter	(mg/L)
WHI0067	2010-0485	2/23/2010	TDS	167
WHI0067	2010-0095	1/12/2010	TDS	212
WHI0067	2009-3178	12/1/2009	TDS	212
WHI0067	2009-2974	11/3/2009	TDS	187
WHI0067	2009-2730	10/13/2009	TDS	162
WHI0067	2009-2420	9/15/2009	TDS	166
WHI0067	2009-2078	8/10/2009	TDS	250
WHI0067	2009-1833	7/21/2009	TDS	166
WHI0067	2009-1567	6/23/2009	TDS	205
WHI0067	2009-0908	4/7/2009	TDS	195
WHI0067	2009-0433	2/17/2009	TDS	194
WHI0067	2009-0102	1/13/2009	TDS	217
WHI0067	2008-3497	12/9/2008	TDS	205
WHI0067	2008-3352	11/24/2008	TDS	225
WHI0067	2008-3070	10/21/2008	TDS	227
WHI0067	2008-2762	9/16/2008	TDS	196
WHI0067	2008-2514	8/19/2008	TDS	215
WHI0067	2008-2171	7/15/2008	TDS	190
WHI0067	2008-1936	6/17/2008	TDS	217
WHI0067	2008-1515	5/13/2008	TDS	169
WHI0067	2008-1197	4/1/2008	TDS	124
WHI0067	2009-0674	3/17/2008	TDS	206
WHI0067	2008-0949	3/3/2008	TDS	108
WHI0067	2008-0803	2/19/2008	TDS	168
WHI0067	2008-0126	1/15/2008	TDS	222
WHI0067	2007-3030	12/4/2007	TDS	217
WHI0067	2007-2853	11/13/2007	TDS	226
WHI0067	2007-2529	10/2/2007	TDS	203
WHI0067	2007-2342	9/5/2007	TDS	216
WHI0067	2007-2085	7/17/2007	TDS	199
WHI0067	2007-1853	6/19/2007	TDS	203
WHI0067	2007-1545	5/15/2007	TDS	186
WHI0067	2007-1135	4/10/2007	TDS	206
WHI0067	2007-1014	3/27/2007	TDS	211
WHI0067	2007-0753	2/27/2007	TDS	189
WHI0067	2007-0378	1/16/2007	TDS	161
WHI0067	2006-3203	12/12/2006	TDS	216
WHI0067	2006-2870	10/31/2006	TDS	234
WHI0067	2006-2690	10/10/2006	TDS	233
WHI0067	2006-2483	9/12/2006	TDS	224
WHI0067	2006-2296	8/15/2006	TDS	226

ADEQ Historical Monitoring Data for TDS at **Station WHI0067** (Crooked Creek above Harrison, Arkansas).

	ADEQ Lab			Concentration
Station ID	Number	Date Sampled	Parameter	(mg/L)
WHI0067	2006-2081	7/18/2006	TDS	222
WHI0067	2006-1839	6/20/2006	TDS	216
WHI0067	2006-1088	5/16/2006	TDS	199
WHI0067	2006-0877	4/18/2006	TDS	207
WHI0067	2006-0572	3/7/2006	TDS	208
WHI0067	2006-0236	1/31/2006	TDS	213
WHI0067	2006-0010	1/3/2006	TDS	218
WHI0067	2005-3489	12/13/2005	TDS	225
WHI0067	2005-3334	11/15/2005	TDS	194
WHI0067	2005-3098	10/18/2005	TDS	219
WHI0067	2005-2617	9/13/2005	TDS	228
WHI0067	2005-2263	8/16/2005	TDS	211
WHI0067	2005-2031	7/26/2005	TDS	215
WHI0067	2005-1481	6/14/2005	TDS	215
WHI0067	2005-1249	5/17/2005	TDS	209
WHI0067	2005-0919	4/12/2005	TDS	158
WHI0067	2005-0581	3/15/2005	TDS	215
WHI0067	2005-0310	2/8/2005	TDS	194
WHI0067	2005-0105	1/11/2005	TDS	192
WHI0067	2004-3175	12/14/2004	TDS	206
WHI0067	2004-3031	11/16/2004	TDS	205
WHI0067	2004-2782	10/19/2004	TDS	223
WHI0067	2004-2584	9/28/2004	TDS	230
WHI0067	2004-2324	8/24/2004	TDS	217
WHI0067	2004-1942	7/27/2004	TDS	224
WHI0067	2004-1563	6/22/2004	TDS	235
WHI0067	2004-1409	5/25/2004	TDS	217
WHI0067	2004-1168	4/27/2004	TDS	194
WHI0067	2004-0802	3/30/2004	TDS	213
WHI0067	2004-0536	2/24/2004	TDS	200
WHI0067	2004-0287	1/27/2004	TDS	206
WHI0067	2003-3086	12/16/2003	TDS	215
WHI0067	2003-2917	11/18/2003	TDS	206
WHI0067	2003-2653	10/21/2003	TDS	246
WHI0067	2003-2354	9/9/2003	TDS	237
WHI0067	2003-2067	8/5/2003	TDS	222

ADEQ Historical Monitoring Data for TDS at **Station WHI0066** (Crooked Creek below Harrison, Arkansas).

	ADEQ Lab			Concentration
Station ID	Number	Date Sampled	Parameter	(mg/L)
WHI0066	2013-2678	7/30/2013	TDS	217
WHI0066	2013-2274	6/25/2013	TDS	222
WHI0066	2013-1904	5/28/2013	TDS	217
WHI0066	2013-1313	4/22/2013	TDS	185
WHI0066	2013-0891	3/26/2013	TDS	168
WHI0066	2013-0346	2/5/2013	TDS	195
WHI0066	2013-0125	1/15/2013	TDS	205
WHI0066	2012-3817	12/10/2012	TDS	224
WHI0066	2012-3578	11/13/2012	TDS	231
WHI0066	2012-3372	10/23/2012	TDS	251
WHI0066	2012-3018	9/25/2012	TDS	250
WHI0066	2012-2649	8/28/2012	TDS	244
WHI0066	2012-2231	7/24/2012	TDS	246
WHI0066	2012-1911	6/26/2012	TDS	240
WHI0066	2012-1334	5/1/2012	TDS	217
WHI0066	2012-1270	4/24/2012	TDS	220
WHI0066	2012-0926	3/27/2012	TDS	193
WHI0066	2012-0573	2/28/2012	TDS	206
WHI0066	2012-0272	1/30/2012	TDS	177
WHI0066	2011-3935	12/12/2011	TDS	217
WHI0066	2011-3541	11/15/2011	TDS	222
WHI0066	2011-3271	10/18/2011	TDS	229
WHI0066	2011-2910	8/20/2011	TDS	215
WHI0066	2011-2526	8/16/2011	TDS	210
WHI0066	2011-2146	7/18/2011	TDS	228
WHI0066	2011-1785	6/14/2011	TDS	181
WHI0066	2011-1420	5/17/2011	TDS	183
WHI0066	2011-1152	4/26/2011	TDS	145
WHI0066	2011-0824	3/29/2011	TDS	203
WHI0066	2011-0483	2/22/2011	TDS	241
WHI0066	2011-0251	1/25/2011	TDS	252
WHI0066	2010-3937	12/28/2010	TDS	211
WHI0066	2010-3648	11/21/2010	TDS	250
WHI0066	2010-3408	10/26/2010	TDS	228
WHI0066	2010-3048	9/21/2010	TDS	225
WHI0066	2010-2357	8/10/2010	TDS	227
WHI0066	2010-1973	7/20/2010	TDS	208
WHI0066	2010-1541	6/16/2010	TDS	222
WHI0066	2010-1107	5/4/2010	TDS	198
WHI0066	2010-0910	4/13/2010	TDS	206
WHI0066	2010-0674	3/16/2010	TDS	205

ADEQ Historical Monitoring Data for TDS at **Station WHI0066** (Crooked Creek below Harrison, Arkansas).

	ADEQ Lab			Concentration
Station ID	Number	Date Sampled	Parameter	(mg/L)
WHI0066	2010-0486	2/23/2010	TDS	170
WHI0066	2010-0096	1/12/2010	TDS	220
WHI0066	2009-3179	12/1/2009	TDS	213
WHI0066	2009-2975	11/3/2009	TDS	192
WHI0066	2009-2731	10/13/2009	TDS	165
WHI0066	2009-2419	9/15/2009	TDS	199
WHI0066	2009-2077	8/10/2009	TDS	232
WHI0066	2009-1834	7/21/2009	TDS	151
WHI0066	2009-1568	6/23/2009	TDS	204
WHI0066	2009-1281	5/19/2009	TDS	197
WHI0066	2009-0909	4/7/2009	TDS	194
WHI0066	2009-0434	2/17/2009	TDS	196
WHI0066	2009-0103	1/13/2009	TDS	209
WHI0066	2008-3498	12/9/2008	TDS	202
WHI0066	2008-3353	11/24/2008	TDS	240
WHI0066	2008-3071	10/21/2008	TDS	242
WHI0066	2008-3068	10/21/2008	TDS	189
WHI0066	2008-2763	9/16/2008	TDS	204
WHI0066	2008-2515	8/19/2008	TDS	226
WHI0066	2008-2172	7/15/2008	TDS	199
WHI0066	2008-1935	6/17/2008	TDS	208
WHI0066	2008-1516	5/13/2008	TDS	176
WHI0066	2008-1198	4/1/2008	TDS	138
WHI0066	2009-0675	3/17/2008	TDS	221
WHI0066	2008-0950	3/3/2008	TDS	112
WHI0066	2008-0804	2/19/2008	TDS	178
WHI0066	2008-0127	1/15/2008	TDS	244
WHI0066	2007-3031	12/4/2007	TDS	266
WHI0066	2007-2854	11/13/2007	TDS	261
WHI0066	2007-2530	10/2/2007	TDS	257
WHI0066	2007-2343	9/5/2007	TDS	258
WHI0066	2007-2086	7/17/2007	TDS	213
WHI0066	2007-1854	6/19/2007	TDS	235
WHI0066	2007-1546	5/15/2007	TDS	210
WHI0066	2007-1136	4/10/2007	TDS	227
WHI0066	2007-1015	3/27/2007	TDS	218
WHI0066	2007-0754	2/27/2007	TDS	194
WHI0066	2007-0379	1/16/2007	TDS	168
WHI0066	2006-3204	12/12/2006	TDS	213
WHI0066	2006-2871	10/31/2006	TDS	250
WHI0066	2006-2691	10/10/2006	TDS	287

ADEQ Historical Monitoring Data for TDS at **Station WHI0066** (Crooked Creek below Harrison, Arkansas).

	ADEQ Lab			Concentration
Station ID	Number	Date Sampled	Parameter	(mg/L)
WHI0066	2006-2484	9/12/2006	TDS	219
WHI0066	2006-2297	8/15/2006	TDS	288
WHI0066	2006-2082	7/18/2006	TDS	272
WHI0066	2006-1840	6/20/2006	TDS	261
WHI0066	2006-1089	5/16/2006	TDS	213
WHI0066	2006-0878	4/18/2006	TDS	228
WHI0066	2006-0573	3/7/2006	TDS	256
WHI0066	2006-0237	1/31/2006	TDS	230
WHI0066	2006-0011	1/3/2006	TDS	274
WHI0066	2005-3490	12/13/2005	TDS	257
WHI0066	2005-3335	11/15/2005	TDS	204
WHI0066	2005-3099	10/18/2005	TDS	269
WHI0066	2005-2618	9/13/2005	TDS	267
WHI0066	2005-2264	8/16/2005	TDS	260
WHI0066	2005-2032	7/26/2005	TDS	265
WHI0066	2005-1482	6/14/2005	TDS	239
WHI0066	2005-1250	5/17/2005	TDS	225
WHI0066	2005-0920	4/12/2005	TDS	164
WHI0066	2005-0582	3/15/2005	TDS	228
WHI0066	2005-0311	2/8/2005	TDS	210
WHI0066	2005-0106	1/11/2005	TDS	200
WHI0066	2004-3176	12/14/2004	TDS	219
WHI0066	2004-3032	11/16/2004	TDS	213
WHI0066	2004-2783	10/19/2004	TDS	244
WHI0066	2004-2585	9/28/2004	TDS	274
WHI0066	2004-2325	8/24/2004	TDS	247
WHI0066	2004-1943	7/27/2004	TDS	234
WHI0066	2004-1564	6/22/2004	TDS	229
WHI0066	2004-1410	5/25/2004	TDS	226
WHI0066	2004-1169	4/27/2004	TDS	204
WHI0066	2004-0803	3/30/2004	TDS	230
WHI0066	2004-0537	2/24/2004	TDS	216
WHI0066	2004-0288	1/27/2004	TDS	217
WHI0066	2003-3087	12/16/2003	TDS	234
WHI0066	2003-2918	11/18/2003	TDS	212
WHI0066	2003-2654	10/21/2003	TDS	270
WHI0066	2003-2355	9/9/2003	TDS	265
WHI0066	2003-2068	8/5/2003	TDS	239

ADEQ Historical Monitoring Data for TDS at **Stations WHI0048A/WHI0193** (Crooked Creek west of Yellville at Kelly's Slab).

	ADEQ Lab			Concentration
Station ID	Number	Date Sampled	Parameter	(mg/L)
WHI0193	2013-2444	7/9/2013	TDS	158
WHI0193	2013-2054	6/4/2013	TDS	200
WHI0193	2013-1552	5/7/2013	TDS	194
WHI0193	2013-0971	4/2/2013	TDS	195
WHI0193	2013-0640	3/5/2013	TDS	190
WHI0193	2013-0470	2/19/2013	TDS	200
WHI0193	2013-0068	1/8/2013	TDS	200
WHI0193	2012-3781	12/4/2012	TDS	173
WHI0193	2012-3485	11/5/2012	TDS	165
WHI0193	2012-3199	10/9/2012	TDS	160
WHI0193	2012-2836	9/11/2012	TDS	141
WHI0193	2012-2390	8/7/2012	TDS	141
WHI0193	2012-2038	7/10/2012	TDS	147
WHI0193	2012-1786	6/12/2012	TDS	152
WHI0193	2012-1558	5/22/2012	TDS	144
WHI0193	2012-1086	4/10/2012	TDS	189
WHI0193	2012-0795	3/13/2012	TDS	196
WHI0193	2012-0439	2/14/2012	TDS	200
WHI0193	2012-0097	1/10/2012	TDS	192
WHI0193	2011-3732	12/5/2011	TDS	207
WHI0193	2011-3434	11/1/2011	TDS	166
WHI0193	2011-3116	10/4/2011	TDS	139
WHI0193	2011-2785	9/6/2011	TDS	145
WHI0193	2011-2749	8/30/2011	TDS	136
WHI0193	2011-2020	7/5/2011	TDS	160
WHI0193	2011-1625	6/7/2011	TDS	176
WHI0193	2011-1236	5/3/2011	TDS	168
WHI0193	2011-0951	4/5/2011	TDS	201
WHI0193	2011-0512	3/1/2011	TDS	184
WHI0193	2011-0333	2/7/2011	TDS	203
WHI0193	2011-0099	1/18/2011	TDS	197
WHI0193	2010-3792	12/7/2010	TDS	199
WHI0193	2010-3615	11/16/2010	TDS	191
WHI0193	2010-3320	10/19/2010	TDS	177
WHI0193	2010-3117	9/28/2010	TDS	176
WHI0193	2010-2556	8/17/2010	TDS	167
WHI0193	2010-1781	7/6/2010	TDS	234
WHI0193	2010-1462	6/8/2010	TDS	191
WHI0193	2010-1184	5/11/2010	TDS	174
WHI0193	2010-0816	4/6/2010	TDS	192
WHI0193	2010-0525	3/2/2010	TDS	196

ADEQ Historical Monitoring Data for TDS at **Stations WHI0048A/WHI0193** (Crooked Creek west of Yellville at Kelly's Slab).

	ADEQ Lab			Concentration
Station ID	Number	Date Sampled	Parameter	(mg/L)
WHI0193	2010-0385	2/16/2010	TDS	207
WHI0193	2010-0147	1/19/2010	TDS	216
WHI0193	2009-3279	12/8/2009	TDS	204
WHI0193	2009-3043	11/17/2009	TDS	206
WHI0193	2009-2786	10/20/2009	TDS	236
WHI0193	2009-2303	9/1/2009	TDS	184
WHI0193	2009-2148	8/19/2009	TDS	205
WHI0193	2009-1879	7/28/2009	TDS	201
WHI0193	2009-1445	6/9/2009	TDS	208
WHI0193	2009-1126	5/5/2009	TDS	197
WHI0193	2009-1054	4/28/2009	TDS	209
WHI0193	2009-0602	3/10/2009	TDS	202
WHI0193	2009-0408	2/10/2009	TDS	209
WHI0193	2009-0220	1/20/2009	TDS	193
WHI0193	2008-3517	12/9/2008	TDS	204
WHI0193	2008-3273	11/18/2008	TDS	201
WHI0193	2008-2934	10/7/2008	TDS	215
WHI0193	2008-2700	9/9/2008	TDS	226
WHI0193	2008-2436	8/12/2008	TDS	188
WHI0193	2008-2115	7/8/2008	TDS	189
WHI0193	2008-1858	6/10/2008	TDS	203
WHI0193	2008-1595	5/20/2008	TDS	182
WHI0193	2008-1314	4/15/2008	TDS	192
WHI0193	2008-1008	3/11/2008	TDS.	217
WHI0193	2008-0298	2/4/2008	TDS	200
WHI0193	2008-0033	1/8/2008	TDS	207
WHI0193	2007-3131	12/11/2007	TDS	211
WHI0193	2007-2933	11/27/2007	TDS	210
WHI0193	2007-2618	10/16/2007	TDS	178
WHI0193	2007-2409	9/18/2007	TDS	179
WHI0193	2007-2260	8/7/2007	TDS	184
WHI0193	2007-1998	7/10/2007	TDS	183
WHI0193	2007-1699	6/5/2007	TDS	197
WHI0193	2007-1387	5/1/2007	TDS	189
WHI0193	2007-1074	4/3/2007	TDS	196
WHI0193	2007-0821	3/13/2007	TDS	195
WHI0193	2007-0547	2/6/2007	TDS	210
WHI0193	2007-0421	1/23/2007	TDS	204
WHI0193	2006-3281	12/19/2006	TDS	228
WHI0193	2006-3064	11/28/2006	TDS	221
WHI0193	2006-2752	10/17/2006	TDS	145

ADEQ Historical Monitoring Data for TDS at **Stations WHI0048A/WHI0193** (Crooked Creek west of Yellville at Kelly's Slab).

	ADEQ Lab			Concentration
Station ID	Number	Date Sampled	Parameter	(mg/L)
WHI0193	2006-2549	9/19/2006	TDS	186
WHI0193	2006-2237	8/8/2006	TDS	173
WHI0048A	2006-1993	7/11/2006	TDS	166
WHI0048A	2006-1737	6/6/2006	TDS	205
WHI0048A	2006-1000	5/2/2006	TDS	198
WHI0048A	2006-0759	4/4/2006	TDS	192
WHI0048A	2006-0516	2/28/2006	TDS	209
WHI0048A	2006-0328	2/7/2006	TDS	204
WHI0048A	2006-0077	1/10/2006	TDS	198
WHI0048A	2005-3398	12/6/2005	TDS	210
WHI0048A	2005-3270	11/8/2005	TDS	190
WHI0048A	2005-2911	10/4/2005	TDS	185
WHI0048A	2005-1702	7/5/2005	TDS	175
WHI0048A	2005-1431	6/7/2005	TDS	206
WHI0048A	2005-1206	5/10/2005	TDS	212
WHI0048A	2005-0809	4/5/2005	TDS	199
WHI0048A	2005-0485	3/1/2005	TDS	213
WHI0048A	2005-0264	2/1/2005	TDS	226
WHI0048A	2005-0027	1/4/2005	TDS	169
WHI0048A	2004-3088	12/7/2004	TDS	218
WHI0048A	2004-2884	11/2/2004	TDS	201
WHI0048A	2004-2077	8/10/2004	TDS	164
WHI0048A	2004-1661	7/6/2004	TDS	188
WHI0048A	2004-1468	6/8/2004	TDS	205
WHI0048A	2004-1259	5/11/2004	TDS	343
WHI0048A	2004-0872	4/6/2004	TDS	210
WHI0048A	2004-0634	3/9/2004	TDS	212
WHI0048A	2004-0332	2/3/2004	TDS	221
WHI0048A	2004-0130	1/13/2004	TDS	226
WHI0048A	2003-3030	12/9/2003	TDS	190
WHI0048A	2003-2750	11/4/2003	TDS	201
WHI0048A	2003-2559	10/14/2003	TDS	189
WHI0048A	2003-2374	9/16/2003	TDS	184
WHI0048A	2003-2165	8/19/2003	TDS	163

ADEQ Historical Monitoring Data for TDS at **Station WHI0048B** (Crooked Creek 2 miles south of Flippin, Arkansas).

	ADEQ Lab			Concentration
Station ID	Number	Date Sampled	Parameter	(mg/L)
WHI0048B	2013-2050	6/4/2013	TDS	198
WHI0048B	2013-1548	5/7/2013	TDS	199
WHI0048B	2013-0967	4/2/2013	TDS	194
WHI0048B	2013-0636	3/5/2013	TDS	190
WHI0048B	2013-0466	2/19/2013	TDS	196
WHI0048B	2012-1082	4/10/2012	TDS	187
WHI0048B	2012-0791	3/13/2012	TDS	186
WHI0048B	2012-0435	2/14/2012	TDS	198
WHI0048B	2012-0093	1/10/2012	TDS	192
WHI0048B	2011-3728	12/5/2011	TDS	208
WHI0048B	2011-1621	6/7/2011	TDS	176
WHI0048B	2011-1232	5/3/2011	TDS	164
WHI0048B	2011-0947	4/5/2011	TDS	188
WHI0048B	2011-0508	3/1/2011	TDS	191
WHI0048B	2010-1457	6/8/2010	TDS	186
WHI0048B	2010-1179	5/11/2010	TDS	175
WHI0048B	2010-0811	4/6/2010	TDS	187
WHI0048B	2010-0520	3/2/2010	TDS	199
WHI0048B	2010-0380	2/16/2010	TDS	208
WHI0048B	2010-0142	1/19/2010	TDS	215
WHI0048B	2009-3274	12/8/2009	TDS	206
WHI0048B	2009-3038	11/17/2009	TDS	209
WHI0048B	2009-2781	10/20/2009	TDS	231
WHI0048B	2009-2143	8/19/2009	TDS	167
WHI0048B	2009-1874	7/28/2009	TDS	194
WHI0048B	2009-1440	6/9/2009	TDS	212
WHI0048B	2009-1121	5/5/2009	TDS	200
WHI0048B	2009-1049	4/28/2009	TDS	208
WHI0048B	2009-0597	3/10/2009	TDS	192
WHI0048B	2009-0403	2/10/2009	TDS	201
WHI0048B	2008-2929	10/7/2008	TDS	208
WHI0048B	2008-2695	9/9/2008	TDS	227
WHI0048B	2008-2431	8/12/2008	TDS	185
WHI0048B	2008-2110	7/8/2008	TDS	188
WHI0048B	2008-1853	6/10/2008	TDS	197
WHI0048B	2008-1590	5/20/2008	TDS	176
WHI0048B	2008-1309	4/15/2008	TDS	193
WHI0048B	2008-1003	3/11/2008	TDS	212
WHI0048B	2007-1993	7/10/2007	TDS	176
WHI0048B	2007-1382	5/1/2007	TDS	186
WHI0048B	2007-1069	4/3/2007	TDS	171

ADEQ Historical Monitoring Data for TDS at **Station WHI0048B** (Crooked Creek 2 miles south of Flippin, Arkansas).

	ADEQ Lab			Concentration
Station ID	Number	Date Sampled	Parameter	(mg/L)
WHI0048B	2007-0816	3/13/2007	TDS	195
WHI0048B	2007-0542	2/6/2007	TDS	207
WHI0048B	2007-0416	1/23/2007	TDS	211
WHI0048B	2006-1001	5/2/2006	TDS	199
WHI0048B	2005-1207	5/10/2005	TDS	197
WHI0048B	2005-0810	4/5/2005	TDS	200
WHI0048B	2005-0486	3/1/2005	TDS	212
WHI0048B	2005-0265	2/1/2005	TDS	221
WHI0048B	2005-0028	1/4/2005	TDS	194
WHI0048B	2004-3089	12/7/2004	TDS	218
WHI0048B	2004-2885	11/2/2004	TDS	183
WHI0048B	2004-1662	7/6/2004	TDS	168
WHI0048B	2004-1469	6/8/2004	TDS	180
WHI0048B	2004-1260	5/11/2004	TDS	225
WHI0048B	2004-0873	4/6/2004	TDS	200
WHI0048B	2004-0635	3/9/2004	TDS	220
WHI0048B	2004-0333	2/3/2004	TDS	221
WHI0048B	2003-3031	12/9/2003	TDS	196

ADEQ Historical Monitoring Data for TDS at **Station WHI0048C** (Crooked Creek at Hwy 101, 2 miles north of Rea Valley, AR).

	ADEQ Lab	· / · · · · · · · · · · · · · · · · · ·		Concentration
Station ID	Number	Date Sampled	Parameter	(mg/L)
WHI0048C	2013-2051	6/4/2013	TDS	193
WHI0048C	2013-1549	5/7/2013	TDS	193
WHI0048C	2013-0968	4/2/2013	TDS	180
WHI0048C	2013-0637	3/5/2013	TDS	193
WHI0048C	2013-0467	2/19/2013	TDS	214
WHI0048C	2012-1083	4/10/2012	TDS	180
WHI0048C	2012-0792	3/13/2012	TDS	185
WHI0048C	2012-0436	2/14/2012	TDS	216
WHI0048C	2012-0094	1/10/2012	TDS	189
WHI0048C	2011-3729	12/5/2011	TDS	190
WHI0048C	2011-1622	6/7/2011	TDS	174
WHI0048C	2011-1233	5/3/2011	TDS	157
WHI0048C	2011-0948	4/5/2011	TDS	218
WHI0048C	2011-0509	3/1/2011	TDS	195
WHI0048C	2010-3113	9/28/2010	TDS	159
WHI0048C	2010-1777	7/6/2010	TDS	159
WHI0048C	2010-1458	6/8/2010	TDS	178
WHI0048C	2010-1180	5/11/2010	TDS	179
WHI0048C	2010-0812	4/6/2010	TDS	186
WHI0048C	2010-0521	3/2/2010	TDS	191
WHI0048C	2010-0381	2/16/2010	TDS	206
WHI0048C	2010-0143	1/19/2010	TDS	212
WHI0048C	2009-3275	12/8/2009	TDS	195
WHI0048C	2009-3039	11/17/2009	TDS	201
WHI0048C	2009-2782	10/20/2009	TDS	238
WHI0048C	2009-2299	9/1/2009	TDS	166
WHI0048C	2009-2144	8/19/2009	TDS	174
WHI0048C	2009-1875	7/28/2009	TDS	162
WHI0048C	2009-1441	6/9/2009	TDS	197
WHI0048C	2009-1122	5/5/2009	TDS	197
WHI0048C	2009-1050	4/28/2009	TDS	198
WHI0048C	2009-0598	3/10/2009	TDS	180
WHI0048C	2009-0404	2/10/2009	TDS	193
WHI0048C	2008-2930	10/7/2008	TDS	194
WHI0048C	2008-2696	9/9/2008	TDS	230
WHI0048C	2008-2432	8/12/2008	TDS	176
WHI0048C	2008-2111	7/8/2008	TDS	176
WHI0048C	2008-1854	6/10/2008	TDS	186
WHI0048C	2008-1591	5/20/2008	TDS	177
WHI0048C	2008-1310	4/15/2008	TDS	198
WHI0048C	2008-1004	3/11/2008	TDS	215

ADEQ Historical Monitoring Data for TDS at **Station WHI0048C** (Crooked Creek at Hwy 101, 2 miles north of Rea Valley, AR).

	ADEQ Lab			Concentration
Station ID	Number	Date Sampled	Parameter	(mg/L)
WHI0048C	2007-1994	7/10/2007	TDS	192
WHI0048C	2007-1383	5/1/2007	TDS	178
WHI0048C	2007-1070	4/3/2007	TDS	189
WHI0048C	2007-0817	3/13/2007	TDS	196
WHI0048C	2007-0543	2/6/2007	TDS	207
WHI0048C	2007-0417	1/23/2007	TDS	213
WHI0048C	2006-1738	6/6/2006	TDS	202
WHI0048C	2006-1002	5/2/2006	TDS	197
WHI0048C	2006-0760	4/4/2006	TDS	221
WHI0048C	2006-0329	2/7/2006	TDS	245
WHI0048C	2005-1432	6/7/2005	TDS	189
WHI0048C	2005-1208	5/10/2005	TDS	192
WHI0048C	2005-0811	4/5/2005	TDS	194
WHI0048C	2005-0487	3/1/2005	TDS	198
WHI0048C	2005-0266	2/1/2005	TDS	229
WHI0048C	2005-0029	1/4/2005	TDS	219
WHI0048C	2004-3090	12/7/2004	TDS	225
WHI0048C	2004-2886	11/2/2004	TDS	178
WHI0048C	2004-1663	7/6/2004	TDS	145
WHI0048C	2004-1470	6/8/2004	TDS	169
WHI0048C	2004-1261	5/11/2004	TDS	233
WHI0048C	2004-0874	4/6/2004	TDS	237
WHI0048C	2004-0636	3/9/2004	TDS	208
WHI0048C	2004-0334	2/3/2004	TDS	244
WHI0048C	2004-0131	1/13/2004	TDS	169
WHI0048C	2003-3032	12/9/2003	TDS	281

ADEQ Historical Monitoring Data for Sulfate at **Station WHI0200** (Crooked Creek at Hudson Road).

	ADEQ Lab			Concentration
Station ID	Number	Date Sampled	Parameter	(mg/L)
WHI0200	2013-2679	7/30/2013	Sulfate	3.64
WHI0200	2013-2275	6/25/2013	Sulfate	4.61
WHI0200	2013-1905	5/28/2013	Sulfate	7.52
WHI0200	2013-1314	4/22/2013	Sulfate	11.3
WHI0200	2013-0892	3/25/2013	Sulfate	11.4
WHI0200	2013-0347	2/5/2013	Sulfate	10.6
WHI0200	2013-0126	1/15/2013	Sulfate	14.6
WHI0200	2012-3818	12/10/2012	Sulfate	5.25
WHI0200	2012-3579	11/13/2012	Sulfate	4.44
WHI0200	2012-3373	10/23/2012	Sulfate	6.54
WHI0200	2012-3019	9/25/2012	Sulfate	3.38
WHI0200	2012-2650	8/28/2012	Sulfate	3.12
WHI0200	2012-2232	7/24/2012	Sulfate	2.86
WHI0200	2012-1912	6/26/2012	Sulfate	3.4
WHI0200	2012-1335	5/1/2012	Sulfate	4.55
WHI0200	2012-1271	4/24/2012	Sulfate	5
WHI0200	2012-0927	3/27/2012	Sulfate	5.61
WHI0200	2012-0574	2/28/2012	Sulfate	7.02
WHI0200	2012-0273	1/30/2012	Sulfate	6.59
WHI0200	2011-3643	11/28/2011	Sulfate	6.85

ADEQ Historical Monitoring Data for Sulfate at **Station WHI0067** (Crooked Creek above Harrison, Arkansas).

	ADEQ Lab			Concentration
Station ID	Number	Date Sampled	Parameter	(mg/L)
WHI0067	2013-2677	7/30/2013	Sulfate	4.55
WHI0067	2013-2273	6/25/2013	Sulfate	4.41
WHI0067	2013-1903	5/28/2013	Sulfate	5.71
WHI0067	2013-1312	4/22/2013	Sulfate	8.98
WHI0067	2013-0890	3/26/2013	Sulfate	9.57
WHI0067	2013-0345	2/5/2013	Sulfate	8
WHI0067	2013-0124	1/15/2013	Sulfate	5.3
WHI0067	2012-3816	12/10/2012	Sulfate	19.1
WHI0067	2012-3577	11/13/2012	Sulfate	4.82
WHI0067	2012-3371	10/23/2012	Sulfate	5.27
WHI0067	2012-3017	9/25/2012	Sulfate	5.84
WHI0067	2012-2648	8/28/2012	Sulfate	4.65
WHI0067	2012-2230	7/24/2012	Sulfate	4.36
WHI0067	2012-1910	6/26/2012	Sulfate	4.4
WHI0067	2012-1333	5/1/2012	Sulfate	4.23
WHI0067	2012-1269	4/24/2012	Sulfate	4.17
WHI0067	2012-0925	3/27/2012	Sulfate	5.11
WHI0067	2012-0572	2/28/2012	Sulfate	5.54
WHI0067	2012-0271	1/30/2012	Sulfate	5.66
WHI0067	2011-3934	12/12/2011	Sulfate	7.14
WHI0067	2011-3540	11/15/2011	Sulfate	6.89
WHI0067	2011-3270	10/18/2011	Sulfate	5.09
WHI0067	2011-2909	8/20/2011	Sulfate	5.06
WHI0067	2011-2525	8/16/2011	Sulfate	4.42
WHI0067	2011-2145	7/18/2011	Sulfate	3.94
WHI0067	2011-1784	6/14/2011	Sulfate	4.3
WHI0067	2011-1419	5/17/2011	Sulfate	4.96
WHI0067	2011-1151	4/26/2011	Sulfate	5.9
WHI0067	2011-0823	3/29/2011	Sulfate	6.3
WHI0067	2011-0482	2/22/2011	Sulfate	10.7
WHI0067	2011-0250	1/25/2011	Sulfate	4.95
WHI0067	2010-3936	12/28/2010	Sulfate	19.5
WHI0067	2010-3647	11/21/2010	Sulfate	4.1
WHI0067	2010-3407	10/26/2010	Sulfate	4.23
WHI0067	2010-3047	9/21/2010	Sulfate	5.22
WHI0067	2010-2356	8/10/2010	Sulfate	3.79
WHI0067	2010-1972	7/20/2010	Sulfate	5.13
WHI0067	2010-1540	6/16/2010	Sulfate	4.33
WHI0067	2010-1106	5/4/2010	Sulfate	9.22
WHI0067	2010-0909	4/13/2010	Sulfate	U
WHI0067	2010-0673	3/16/2010	Sulfate	5.78

ADEQ Historical Monitoring Data for Sulfate at **Station WHI0067** (Crooked Creek above Harrison, Arkansas).

	ADEQ Lab		-	Concentration
Station ID	Number	Date Sampled	Parameter	(mg/L)
WHI0067	2010-0485	2/23/2010	Sulfate	6.79
WHI0067	2010-0095	1/12/2010	Sulfate	5.66
WHI0067	2009-3178	12/1/2009	Sulfate	5.05
WHI0067	2009-2974	11/3/2009	Sulfate	5.09
WHI0067	2009-2730	10/13/2009	Sulfate	4.44
WHI0067	2009-2420	9/15/2009	Sulfate	3.58
WHI0067	2009-2078	8/10/2009	Sulfate	14
WHI0067	2009-1833	7/21/2009	Sulfate	3.57
WHI0067	2009-1567	6/23/2009	Sulfate	4.92
WHI0067	2009-0908	4/7/2009	Sulfate	6.27
WHI0067	2009-0433	2/17/2009	Sulfate	6.02
WHI0067	2009-0102	1/13/2009	Sulfate	9.37
WHI0067	2008-3497	12/9/2008	Sulfate	4.13
WHI0067	2008-3352	11/24/2008	Sulfate	4.34
WHI0067	2008-3070	10/21/2008	Sulfate	3.8
WHI0067	2008-2762	9/16/2008	Sulfate	4.57
WHI0067	2008-2514	8/19/2008	Sulfate	5.13
WHI0067	2008-2171	7/15/2008	Sulfate	4.78
WHI0067	2008-1936	6/17/2008	Sulfate	9.43
WHI0067	2008-1515	5/13/2008	Sulfate	5.6
WHI0067	2008-1197	4/1/2008	Sulfate	5.42
WHI0067	2009-0674	3/17/2008	Sulfate	5.51
WHI0067	2008-0949	3/3/2008	Sulfate	6.46
WHI0067	2008-0803	2/19/2008	Sulfate	7.81
WHI0067	2008-0126	1/15/2008	Sulfate	6.87
WHI0067	2007-3030	12/4/2007	Sulfate	5.07
WHI0067	2007-2853	11/13/2007	Sulfate	5.23
WHI0067	2007-2529	10/2/2007	Sulfate	4.7
WHI0067	2007-2342	9/5/2007	Sulfate	4.7
WHI0067	2007-2085	7/17/2007	Sulfate	5.77
WHI0067	2007-1853	6/19/2007	Sulfate	4.85
WHI0067	2007-1545	5/15/2007	Sulfate	6.48
WHI0067	2007-1135	4/10/2007	Sulfate	5.19
WHI0067	2007-1014	3/27/2007	Sulfate	5.3
WHI0067	2007-0753	2/27/2007	Sulfate	6.06
WHI0067	2007-0378	1/16/2007	Sulfate	5.81
WHI0067	2006-3203	12/12/2006	Sulfate	7.85
WHI0067	2006-2870	10/31/2006	Sulfate	6.02
WHI0067	2006-2690	10/10/2006	Sulfate	6.08
WHI0067	2006-2483	9/12/2006	Sulfate	5.85
WHI0067	2006-2296	8/15/2006	Sulfate	5.22

ADEQ Historical Monitoring Data for Sulfate at **Station WHI0067** (Crooked Creek above Harrison, Arkansas).

	ADEQ Lab			Concentration
Station ID	Number	Date Sampled	Parameter	(mg/L)
WHI0067	2006-2081	7/18/2006	Sulfate	5.02
WHI0067	2006-1839	6/20/2006	Sulfate	4.65
WHI0067	2006-1088	5/16/2006	Sulfate	5.52
WHI0067	2006-0877	4/18/2006	Sulfate	8.29
WHI0067	2006-0572	3/7/2006	Sulfate	7.06
WHI0067	2006-0236	1/31/2006	Sulfate	5.49
WHI0067	2006-0010	1/3/2006	Sulfate	5.52
WHI0067	2005-3489	12/13/2005	Sulfate	5.73
WHI0067	2005-3334	11/15/2005	Sulfate	3.84
WHI0067	2005-3098	10/18/2005	Sulfate	5.4
WHI0067	2005-2617	9/13/2005	Sulfate	4.72
WHI0067	2005-2263	8/16/2005	Sulfate	4.51
WHI0067	2005-2031	7/26/2005	Sulfate	4.44
WHI0067	2005-1481	6/14/2005	Sulfate	4.62
WHI0067	2005-1249	5/17/2005	Sulfate	4.84
WHI0067	2005-0919	4/12/2005	Sulfate	6.28
WHI0067	2005-0581	3/15/2005	Sulfate	6.03
WHI0067	2005-0310	2/8/2005	Sulfate	6.74
WHI0067	2005-0105	1/11/2005	Sulfate	5.7
WHI0067	2004-3175	12/14/2004	Sulfate	5.62
WHI0067	2004-3031	11/16/2004	Sulfate	6.91
WHI0067	2004-2782	10/19/2004	Sulfate	7.33
WHI0067	2004-2584	9/28/2004	Sulfate	4.93
WHI0067	2004-2324	8/24/2004	Sulfate	4.8
WHI0067	2004-1942	7/27/2004	Sulfate	5.13
WHI0067	2004-1563	6/22/2004	Sulfate	8.27
WHI0067	2004-1409	5/25/2004	Sulfate	4.5
WHI0067	2004-1168	4/27/2004	Sulfate	6.07
WHI0067	2004-0802	3/30/2004	Sulfate	8.79
WHI0067	2004-0536	2/24/2004	Sulfate	7.08
WHI0067	2004-0287	1/27/2004	Sulfate	8.57
WHI0067	2003-3086	12/16/2003	Sulfate	7.92
WHI0067	2003-2917	11/18/2003	Sulfate	4.38
WHI0067	2003-2653	10/21/2003	Sulfate	6.15
WHI0067	2003-2354	9/9/2003	Sulfate	5.43
WHI0067	2003-2067	8/5/2003	Sulfate	5.29

ADEQ Historical Monitoring Data for Sulfate at **Station WHI0066** (Crooked Creek below Harrison, Arkansas).

	ADEQ Lab			Concentration
Station ID	Number	Date Sampled	Parameter	(mg/L)
WHI0066	2013-2678	7/30/2013	Sulfate	10.3
WHI0066	2013-2274	6/25/2013	Sulfate	10.8
WHI0066	2013-1904	5/28/2013	Sulfate	8.5
WHI0066	2013-1313	4/22/2013	Sulfate	10.4
WHI0066	2013-0891	3/26/2013	Sulfate	10.4
WHI0066	2013-0346	2/5/2013	Sulfate	9.06
WHI0066	2013-0125	1/15/2013	Sulfate	10.7
WHI0066	2012-3817	12/10/2012	Sulfate	21.2
WHI0066	2012-3578	11/13/2012	Sulfate	13.1
WHI0066	2012-3372	10/23/2012	Sulfate	12.9
WHI0066	2012-3018	9/25/2012	Sulfate	16.6
WHI0066	2012-2649	8/28/2012	Sulfate	15.2
WHI0066	2012-2231	7/24/2012	Sulfate	22.2
WHI0066	2012-1911	6/26/2012	Sulfate	11.6
WHI0066	2012-1334	5/1/2012	Sulfate	6.99
WHI0066	2012-1270	4/24/2012	Sulfate	6.83
WHI0066	2012-0926	3/27/2012	Sulfate	5.79
WHI0066	2012-0573	2/28/2012	Sulfate	8.01
WHI0066	2012-0272	1/30/2012	Sulfate	6.24
WHI0066	2011-3935	12/12/2011	Sulfate	11.1
WHI0066	2011-3541	11/15/2011	Sulfate	10.5
WHI0066	2011-3271	10/18/2011	Sulfate	12.6
WHI0066	2011-2910	8/20/2011	Sulfate	9.61
WHI0066	2011-2526	8/16/2011	Sulfate	9
WHI0066	2011-2146	7/18/2011	Sulfate	8.5
WHI0066	2011-1785	6/14/2011	Sulfate	7.12
WHI0066	2011-1420	5/17/2011	Sulfate	6.98
WHI0066	2011-1152	4/26/2011	Sulfate	5.93
WHI0066	2011-0824	3/29/2011	Sulfate	8.89
WHI0066	2011-0483	2/22/2011	Sulfate	17.8
WHI0066	2011-0251	1/25/2011	Sulfate	12.9
WHI0066	2010-3937	12/28/2010	Sulfate	11.7
WHI0066	2010-3648	11/21/2010	Sulfate	13.3
WHI0066	2010-3408	10/26/2010	Sulfate	9
WHI0066	2010-3048	9/21/2010	Sulfate	7.27
WHI0066	2010-2357	8/10/2010	Sulfate	8.37
WHI0066	2010-1973	7/20/2010	Sulfate	10.4
WHI0066	2010-1541	6/16/2010	Sulfate	10.1
WHI0066	2010-1107	5/4/2010	Sulfate	5.98
WHI0066	2010-0910	4/13/2010	Sulfate	8.12
WHI0066	2010-0674	3/16/2010	Sulfate	7.34

ADEQ Historical Monitoring Data for Sulfate at **Station WHI0066** (Crooked Creek below Harrison, Arkansas).

	ADEQ Lab			Concentration
Station ID	Number	Date Sampled	Parameter	(mg/L)
WHI0066	2010-0486	2/23/2010	Sulfate	7.85
WHI0066	2010-0096	1/12/2010	Sulfate	7.1
WHI0066	2009-3179	12/1/2009	Sulfate	6.24
WHI0066	2009-2975	11/3/2009	Sulfate	6.08
WHI0066	2009-2731	10/13/2009	Sulfate	4.76
WHI0066	2009-2419	9/15/2009	Sulfate	6.77
WHI0066	2009-2077	8/10/2009	Sulfate	4.34
WHI0066	2009-1834	7/21/2009	Sulfate	4.67
WHI0066	2009-1568	6/23/2009	Sulfate	7.86
WHI0066	2009-1281	5/19/2009	Sulfate	6.23
WHI0066	2009-0909	4/7/2009	Sulfate	7.31
WHI0066	2009-0434	2/17/2009	Sulfate	8.5
WHI0066	2009-0103	1/13/2009	Sulfate	5.86
WHI0066	2008-3498	12/9/2008	Sulfate	11.4
WHI0066	2008-3353	11/24/2008	Sulfate	9.97
WHI0066	2008-3068	10/21/2008	Sulfate	7.6
WHI0066	2008-3071	10/21/2008	Sulfate	8.93
WHI0066	2008-2763	9/16/2008	Sulfate	5.57
WHI0066	2008-2515	8/19/2008	Sulfate	8.62
WHI0066	2008-2172	7/15/2008	Sulfate	7.85
WHI0066	2008-1935	6/17/2008	Sulfate	5.04
WHI0066	2008-1516	5/13/2008	Sulfate	7.57
WHI0066	2008-1198	4/1/2008	Sulfate	6.06
WHI0066	2009-0675	3/17/2008	Sulfate	11
WHI0066	2008-0950	3/3/2008	Sulfate	8.29
WHI0066	2008-0804	2/19/2008	Sulfate	10
WHI0066	2008-0127	1/15/2008	Sulfate	13.7
WHI0066	2007-3031	12/4/2007	Sulfate	19.5
WHI0066	2007-2854	11/13/2007	Sulfate	15.3
WHI0066	2007-2530	10/2/2007	Sulfate	17.2
WHI0066	2007-2343	9/5/2007	Sulfate	20.9
WHI0066	2007-2086	7/17/2007	Sulfate	11.2
WHI0066	2007-1854	6/19/2007	Sulfate	21.3
WHI0066	2007-1546	5/15/2007	Sulfate	15.3
WHI0066	2007-1136	4/10/2007	Sulfate	16.6
WHI0066	2007-1015	3/27/2007	Sulfate	9.58
WHI0066	2007-0754	2/27/2007	Sulfate	9.48
WHI0066	2007-0379	1/16/2007	Sulfate	6.28
WHI0066	2006-3204	12/12/2006	Sulfate	5.79
WHI0066	2006-2871	10/31/2006	Sulfate	11.7
WHI0066	2006-2691	10/10/2006	Sulfate	23.9

ADEQ Historical Monitoring Data for Sulfate at **Station WHI0066** (Crooked Creek below Harrison, Arkansas).

	ADEQ Lab			Concentration
Station ID	Number	Date Sampled	Parameter	(mg/L)
WHI0066	2006-2484	9/12/2006	Sulfate	14.8
WHI0066	2006-2297	8/15/2006	Sulfate	37.7
WHI0066	2006-2082	7/18/2006	Sulfate	27.7
WHI0066	2006-1840	6/20/2006	Sulfate	29.6
WHI0066	2006-1089	5/16/2006	Sulfate	7.23
WHI0066	2006-0878	4/18/2006	Sulfate	20.7
WHI0066	2006-0573	3/7/2006	Sulfate	24.2
WHI0066	2006-0237	1/31/2006	Sulfate	13.3
WHI0066	2006-0011	1/3/2006	Sulfate	31.1
WHI0066	2005-3490	12/13/2005	Sulfate	17.1
WHI0066	2005-3335	11/15/2005	Sulfate	9.96
WHI0066	2005-3099	10/18/2005	Sulfate	19.8
WHI0066	2005-2618	9/13/2005	Sulfate	18.2
WHI0066	2005-2264	8/16/2005	Sulfate	28.8
WHI0066	2005-2032	7/26/2005	Sulfate	29.1
WHI0066	2005-1482	6/14/2005	Sulfate	15.2
WHI0066	2005-1250	5/17/2005	Sulfate	10.2
WHI0066	2005-0920	4/12/2005	Sulfate	7.06
WHI0066	2005-0582	3/15/2005	Sulfate	10.1
WHI0066	2005-0311	2/8/2005	Sulfate	8.59
WHI0066	2005-0106	1/11/2005	Sulfate	6.68
WHI0066	2004-3176	12/14/2004	Sulfate	8.23
WHI0066	2004-3032	11/16/2004	Sulfate	10
WHI0066	2004-2783	10/19/2004	Sulfate	13.3
WHI0066	2004-2585	9/28/2004	Sulfate	21.9
WHI0066	2004-2325	8/24/2004	Sulfate	14.5
WHI0066	2004-1943	7/27/2004	Sulfate	13.5
WHI0066	2004-1564	6/22/2004	Sulfate	4.34
WHI0066	2004-1410	5/25/2004	Sulfate	5.92
WHI0066	2004-1169	4/27/2004	Sulfate	6.62
WHI0066	2004-0803	3/30/2004	Sulfate	9.6
WHI0066	2004-0537	2/24/2004	Sulfate	11.3
WHI0066	2004-0288	1/27/2004	Sulfate	9.95
WHI0066	2003-3087	12/16/2003	Sulfate	10.4
WHI0066	2003-2918	11/18/2003	Sulfate	6.79
WHI0066	2003-2654	10/21/2003	Sulfate	13.3
WHI0066	2003-2355	9/9/2003	Sulfate	14.5
WHI0066	2003-2068	8/5/2003	Sulfate	9.99

ADEQ Historical Monitoring Data for Sulfate at **Stations WHI0048A/WHI0193** (Crooked Creek west of Yellville at Kelly's Slab).

	ADEQ Lab			Concentration
Station ID	Number	Date Sampled	Parameter	(mg/L)
WHI0193	2013-2444	7/9/2013	Sulfate	5.03
WHI0193	2013-2054	6/4/2013	Sulfate	5.81
WHI0193	2013-1552	5/7/2013	Sulfate	6.62
WHI0193	2013-0971	4/2/2013	Sulfate	7.29
WHI0193	2013-0640	3/5/2013	Sulfate	7.11
WHI0193	2013-0470	2/19/2013	Sulfate	8.06
WHI0193	2013-0068	1/8/2013	Sulfate	8.69
WHI0193	2012-3781	12/4/2012	Sulfate	8.12
WHI0193	2012-3485	11/5/2012	Sulfate	7.6
WHI0193	2012-3199	10/9/2012	Sulfate	7.16
WHI0193	2012-2836	9/11/2012	Sulfate	6.14
WHI0193	2012-2390	8/7/2012	Sulfate	5.76
WHI0193	2012-2038	7/10/2012	Sulfate	5.01
WHI0193	2012-1786	6/12/2012	Sulfate	5.26
WHI0193	2012-1558	5/22/2012	Sulfate	5.1
WHI0193	2012-1086	4/10/2012	Sulfate	4.75
WHI0193	2012-0795	3/13/2012	Sulfate	5.29
WHI0193	2012-0439	2/14/2012	Sulfate	5.49
WHI0193	2012-0097	1/10/2012	Sulfate	6.64
WHI0193	2011-3732	12/5/2011	Sulfate	6.8
WHI0193	2011-3434	11/1/2011	Sulfate	6.59
WHI0193	2011-3116	10/4/2011	Sulfate	6.32
WHI0193	2011-2785	9/6/2011	Sulfate	5.52
WHI0193	2011-2749	8/30/2011	Sulfate	5.33
WHI0193	2011-2020	7/5/2011	Sulfate	5.62
WHI0193	2011-1625	6/7/2011	Sulfate	5.01
WHI0193	2011-1236	5/3/2011	Sulfate	4.76
WHI0193	2011-0951	4/5/2011	Sulfate	6.99
WHI0193	2011-0512	3/1/2011	Sulfate	8.38
WHI0193	2011-0333	2/7/2011	Sulfate	8.32
WHI0193	2011-0099	1/18/2011	Sulfate	9.14
WHI0193	2010-3792	12/7/2010	Sulfate	7.19
WHI0193	2010-3615	11/16/2010	Sulfate	6.03
WHI0193	2010-3320	10/19/2010	Sulfate	6.04
WHI0193	2010-3117	9/28/2010	Sulfate	5.4
WHI0193	2010-2556	8/17/2010	Sulfate	5.13
WHI0193	2010-1781	7/6/2010	Sulfate	5.44
WHI0193	2010-1462	6/8/2010	Sulfate	5.1
WHI0193	2010-1184	5/11/2010	Sulfate	4.33
WHI0193	2010-0816	4/6/2010	Sulfate	4.73
WHI0193	2010-0525	3/2/2010	Sulfate	5.26

ADEQ Historical Monitoring Data for Sulfate at **Stations WHI0048A/WHI0193** (Crooked Creek west of Yellville at Kelly's Slab).

	ADEQ Lab			Concentration
Station ID	Number	Date Sampled	Parameter	(mg/L)
WHI0193	2010-0385	2/16/2010	Sulfate	5.21
WHI0193	2010-0147	1/19/2010	Sulfate	6.1
WHI0193	2009-3279	12/8/2009	Sulfate	5.16
WHI0193	2009-3043	11/17/2009	Sulfate	4.85
WHI0193	2009-2786	10/20/2009	Sulfate	5.35
WHI0193	2009-2303	9/1/2009	Sulfate	5.79
WHI0193	2009-2148	8/19/2009	Sulfate	6.76
WHI0193	2009-1879	7/28/2009	Sulfate	5.72
WHI0193	2009-1445	6/9/2009	Sulfate	5.24
WHI0193	2009-1126	5/5/2009	Sulfate	5.2
WHI0193	2009-1054	4/28/2009	Sulfate	5.51
WHI0193	2009-0602	3/10/2009	Sulfate	6.57
WHI0193	2009-0408	2/10/2009	Sulfate	5.65
WHI0193	2009-0220	1/20/2009	Sulfate	7.24
WHI0193	2008-3517	12/9/2008	Sulfate	6.13
WHI0193	2008-3273	11/18/2008	Sulfate	5.29
WHI0193	2008-2934	10/7/2008	Sulfate	5.17
WHI0193	2008-2700	9/9/2008	Sulfate	4.45
WHI0193	2008-2436	8/12/2008	Sulfate	4.65
WHI0193	2008-2115	7/8/2008	Sulfate	4.9
WHI0193	2008-1858	6/10/2008	Sulfate	5.96
WHI0193	2008-1595	5/20/2008	Sulfate	4.87
WHI0193	2008-1314	4/15/2008	Sulfate	5.23
WHI0193	2008-1008	3/11/2008	Sulfate	6.63
WHI0193	2008-0298	2/4/2008	Sulfate	10.9
WHI0193	2008-0033	1/8/2008	Sulfate	9.3
WHI0193	2007-3131	12/11/2007	Sulfate	9.42
WHI0193	2007-2933	11/27/2007	Sulfate	9.33
WHI0193	2007-2618	10/16/2007	Sulfate	8.17
WHI0193	2007-2409	9/18/2007	Sulfate	8.92
WHI0193	2007-2260	8/7/2007	Sulfate	6.67
WHI0193	2007-1998	7/10/2007	Sulfate	5.38
WHI0193	2007-1699	6/5/2007	Sulfate	6.63
WHI0193	2007-1387	5/1/2007	Sulfate	6.15
WHI0193	2007-1074	4/3/2007	Sulfate	6.33
WHI0193	2007-0821	3/13/2007	Sulfate	6.43
WHI0193	2007-0547	2/6/2007	Sulfate	6.04
WHI0193	2007-0421	1/23/2007	Sulfate	5.83
WHI0193	2006-3281	12/19/2006	Sulfate	6.56
WHI0193	2006-3064	11/28/2006	Sulfate	6.26
WHI0193	2006-2752	10/17/2006	Sulfate	5.22

ADEQ Historical Monitoring Data for Sulfate at **Stations WHI0048A/WHI0193** (Crooked Creek west of Yellville at Kelly's Slab).

	ADEQ Lab			Concentration
Station ID	Number	Date Sampled	Parameter	(mg/L)
WHI0193	2006-2549	9/19/2006	Sulfate	9.74
WHI0193	2006-2237	8/8/2006	Sulfate	6.46
WHI0048A	2006-1993	7/11/2006	Sulfate	6.51
WHI0048A	2006-1737	6/6/2006	Sulfate	5.77
WHI0048A	2006-1000	5/2/2006	Sulfate	5.67
WHI0048A	2006-0759	4/4/2006	Sulfate	7.19
WHI0048A	2006-0516	2/28/2006	Sulfate	10
WHI0048A	2006-0328	2/7/2006	Sulfate	9.4
WHI0048A	2006-0077	1/10/2006	Sulfate	9.75
WHI0048A	2005-3398	12/6/2005	Sulfate	8.39
WHI0048A	2005-3270	11/8/2005	Sulfate	8.19
WHI0048A	2005-2911	10/4/2005	Sulfate	7.65
WHI0048A	2005-1702	7/5/2005	Sulfate	7.07
WHI0048A	2005-1431	6/7/2005	Sulfate	5.57
WHI0048A	2005-1206	5/10/2005	Sulfate	5.52
WHI0048A	2005-0809	4/5/2005	Sulfate	5.34
WHI0048A	2005-0485	3/1/2005	Sulfate	5.85
WHI0048A	2005-0264	2/1/2005	Sulfate	5.89
WHI0048A	2005-0027	1/4/2005	Sulfate	4.69
WHI0048A	2004-3088	12/7/2004	Sulfate	5.56
WHI0048A	2004-2884	11/2/2004	Sulfate	5.95
WHI0048A	2004-2077	8/10/2004	Sulfate	6.69
WHI0048A	2004-1661	7/6/2004	Sulfate	5.79
WHI0048A	2004-1468	6/8/2004	Sulfate	5.01
WHI0048A	2004-1259	5/11/2004	Sulfate	19.3
WHI0048A	2004-0872	4/6/2004	Sulfate	6.45
WHI0048A	2004-0634	3/9/2004	Sulfate	6.85
WHI0048A	2004-0332	2/3/2004	Sulfate	7.59
WHI0048A	2004-0130	1/13/2004	Sulfate	8.74
WHI0048A	2003-3030	12/9/2003	Sulfate	7.35
WHI0048A	2003-2750	11/4/2003	Sulfate	8.08
WHI0048A	2003-2559	10/14/2003	Sulfate	7.73
WHI0048A	2003-2374	9/16/2003	Sulfate	6.43
WHI0048A	2003-2165	8/19/2003	Sulfate	6.13

ADEQ Historical Monitoring Data for Sulfate at **Station WHI0048B** (Crooked Creek 2 miles south of Flippin, Arkansas).

	ADEQ Lab			Concentration
Station ID	Number	Date Sampled	Parameter	(mg/L)
WHI0048B	2013-2050	6/4/2013	Sulfate	5.93
WHI0048B	2013-1548	5/7/2013	Sulfate	6.88
WHI0048B	2013-0967	4/2/2013	Sulfate	7.54
WHI0048B	2013-0636	3/5/2013	Sulfate	7.49
WHI0048B	2013-0466	2/19/2013	Sulfate	8.5
WHI0048B	2012-1082	4/10/2012	Sulfate	4.85
WHI0048B	2012-0791	3/13/2012	Sulfate	5.36
WHI0048B	2012-0435	2/14/2012	Sulfate	5.58
WHI0048B	2012-0093	1/10/2012	Sulfate	6.88
WHI0048B	2011-3728	12/5/2011	Sulfate	7.51
WHI0048B	2011-1621	6/7/2011	Sulfate	4.84
WHI0048B	2011-1232	5/3/2011	Sulfate	4.74
WHI0048B	2011-0947	4/5/2011	Sulfate	7.14
WHI0048B	2011-0508	3/1/2011	Sulfate	8.77
WHI0048B	2010-1457	6/8/2010	Sulfate	4.99
WHI0048B	2010-1179	5/11/2010	Sulfate	4.54
WHI0048B	2010-0811	4/6/2010	Sulfate	4.81
WHI0048B	2010-0520	3/2/2010	Sulfate	5.37
WHI0048B	2010-0380	2/16/2010	Sulfate	5.32
WHI0048B	2010-0142	1/19/2010	Sulfate	5.92
WHI0048B	2009-3274	12/8/2009	Sulfate	5.16
WHI0048B	2009-3038	11/17/2009	Sulfate	4.85
WHI0048B	2009-2781	10/20/2009	Sulfate	5
WHI0048B	2009-2143	8/19/2009	Sulfate	5.32
WHI0048B	2009-1874	7/28/2009	Sulfate	5.46
WHI0048B	2009-1440	6/9/2009	Sulfate	5.25
WHI0048B	2009-1121	5/5/2009	Sulfate	5.19
WHI0048B	2009-1049	4/28/2009	Sulfate	5.62
WHI0048B	2009-0597	3/10/2009	Sulfate	6.63
WHI0048B	2009-0403	2/10/2009	Sulfate	5.82
WHI0048B	2008-2929	10/7/2008	Sulfate	5.14
WHI0048B	2008-2695	9/9/2008	Sulfate	4.47
WHI0048B	2008-2431	8/12/2008	Sulfate	4.42
WHI0048B	2008-2110	7/8/2008	Sulfate	4.96
WHI0048B	2008-1853	6/10/2008	Sulfate	5.54
WHI0048B	2008-1590	5/20/2008	Sulfate	4.96
WHI0048B	2008-1309	4/15/2008	Sulfate	5.26
WHI0048B	2008-1003	3/11/2008	Sulfate	6.7
WHI0048B	2007-1993	7/10/2007	Sulfate	5.63
WHI0048B	2007-1382	5/1/2007	Sulfate	6.12
WHI0048B	2007-1069	4/3/2007	Sulfate	6.39

ADEQ Historical Monitoring Data for Sulfate at **Station WHI0048B** (Crooked Creek 2 miles south of Flippin, Arkansas).

	ADEQ Lab			Concentration
Station ID	Number	Date Sampled	Parameter	(mg/L)
WHI0048B	2007-0816	3/13/2007	Sulfate	6.51
WHI0048B	2007-0542	2/6/2007	Sulfate	6.16
WHI0048B	2007-0416	1/23/2007	Sulfate	5.89
WHI0048B	2006-1001	5/2/2006	Sulfate	5.88
WHI0048B	2005-1207	5/10/2005	Sulfate	5.43
WHI0048B	2005-0810	4/5/2005	Sulfate	5.42
WHI0048B	2005-0486	3/1/2005	Sulfate	5.96
WHI0048B	2005-0265	2/1/2005	Sulfate	5.88
WHI0048B	2005-0028	1/4/2005	Sulfate	5.49
WHI0048B	2004-3089	12/7/2004	Sulfate	5.73
WHI0048B	2004-2885	11/2/2004	Sulfate	5.83
WHI0048B	2004-1662	7/6/2004	Sulfate	5.71
WHI0048B	2004-1469	6/8/2004	Sulfate	5
WHI0048B	2004-1260	5/11/2004	Sulfate	5.27
WHI0048B	2004-0873	4/6/2004	Sulfate	6.55
WHI0048B	2004-0635	3/9/2004	Sulfate	7.1
WHI0048B	2004-0333	2/3/2004	Sulfate	7.47
WHI0048B	2003-3031	12/9/2003	Sulfate	7.81

ADEQ Historical Monitoring Data for Sulfate at **Station WHI0048C** (Crooked Creek at Hwy 101, 2 miles north of Rea Valley, AR).

	ADEQ Lab			Concentration
Station ID	Number	Date Sampled	Parameter	(mg/L)
WHI0048C	2013-2051	6/4/2013	Sulfate	5.24
WHI0048C	2013-1549	5/7/2013	Sulfate	6.76
WHI0048C	2013-0968	4/2/2013	Sulfate	7.62
WHI0048C	2013-0637	3/5/2013	Sulfate	7.57
WHI0048C	2013-0467	2/19/2013	Sulfate	10.7
WHI0048C	2012-1083	4/10/2012	Sulfate	4.83
WHI0048C	2012-0792	3/13/2012	Sulfate	5.42
WHI0048C	2012-0436	2/14/2012	Sulfate	5.56
WHI0048C	2012-0094	1/10/2012	Sulfate	7.11
WHI0048C	2011-3729	12/5/2011	Sulfate	6.62
WHI0048C	2011-1622	6/7/2011	Sulfate	5.02
WHI0048C	2011-1233	5/3/2011	Sulfate	4.69
WHI0048C	2011-0948	4/5/2011	Sulfate	10.3
WHI0048C	2011-0509	3/1/2011	Sulfate	9.4
WHI0048C	2010-3113	9/28/2010	Sulfate	7
WHI0048C	2010-1777	7/6/2010	Sulfate	3.59
WHI0048C	2010-1458	6/8/2010	Sulfate	4.78
WHI0048C	2010-1180	5/11/2010	Sulfate	4.43
WHI0048C	2010-0812	4/6/2010	Sulfate	4.8
WHI0048C	2010-0521	3/2/2010	Sulfate	5.35
WHI0048C	2010-0381	2/16/2010	Sulfate	5.3
WHI0048C	2010-0143	1/19/2010	Sulfate	5.5
WHI0048C	2009-3275	12/8/2009	Sulfate	5.01
WHI0048C	2009-3039	11/17/2009	Sulfate	4.9
WHI0048C	2009-2782	10/20/2009	Sulfate	4.98
WHI0048C	2009-2299	9/1/2009	Sulfate	4.56
WHI0048C	2009-2144	8/19/2009	Sulfate	4.07
WHI0048C	2009-1875	7/28/2009	Sulfate	5.03
WHI0048C	2009-1441	6/9/2009	Sulfate	5.13
WHI0048C	2009-1122	5/5/2009	Sulfate	5.18
WHI0048C	2009-1050	4/28/2009	Sulfate	5.5
WHI0048C	2009-0598	3/10/2009	Sulfate	6.19
WHI0048C	2009-0404	2/10/2009	Sulfate	5.72
WHI0048C	2008-2930	10/7/2008	Sulfate	4.69
WHI0048C	2008-2696	9/9/2008	Sulfate	4.47
WHI0048C	2008-2432	8/12/2008	Sulfate	4.37
WHI0048C	2008-2111	7/8/2008	Sulfate	4.59
WHI0048C	2008-1854	6/10/2008	Sulfate	4.24
WHI0048C	2008-1591	5/20/2008	Sulfate	5.04
WHI0048C	2008-1310	4/15/2008	Sulfate	5.32
WHI0048C	2008-1004	3/11/2008	Sulfate	6.78

ADEQ Historical Monitoring Data for Sulfate at **Station WHI0048C** (Crooked Creek at Hwy 101, 2 miles north of Rea Valley, AR).

	ADEQ Lab			Concentration
Station ID	Number	Date Sampled	Parameter	(mg/L)
WHI0048C	2007-1994	7/10/2007	Sulfate	5.43
WHI0048C	2007-1383	5/1/2007	Sulfate	6.22
WHI0048C	2007-1070	4/3/2007	Sulfate	5.93
WHI0048C	2007-0817	3/13/2007	Sulfate	5.92
WHI0048C	2007-0543	2/6/2007	Sulfate	5.95
WHI0048C	2007-0417	1/23/2007	Sulfate	5.89
WHI0048C	2006-1738	6/6/2006	Sulfate	3.86
WHI0048C	2006-1002	5/2/2006	Sulfate	5.75
WHI0048C	2006-0760	4/4/2006	Sulfate	9.52
WHI0048C	2006-0329	2/7/2006	Sulfate	18.4
WHI0048C	2005-1432	6/7/2005	Sulfate	3.88
WHI0048C	2005-1208	5/10/2005	Sulfate	5.23
WHI0048C	2005-0811	4/5/2005	Sulfate	5.45
WHI0048C	2005-0487	3/1/2005	Sulfate	6.18
WHI0048C	2005-0266	2/1/2005	Sulfate	6.2
WHI0048C	2005-0029	1/4/2005	Sulfate	10.1
WHI0048C	2004-3090	12/7/2004	Sulfate	6.61
WHI0048C	2004-2886	11/2/2004	Sulfate	5.33
WHI0048C	2004-1663	7/6/2004	Sulfate	5.92
WHI0048C	2004-1470	6/8/2004	Sulfate	5.1
WHI0048C	2004-1261	5/11/2004	Sulfate	5.33
WHI0048C	2004-0874	4/6/2004	Sulfate	7.12
WHI0048C	2004-0636	3/9/2004	Sulfate	7.15
WHI0048C	2004-0334	2/3/2004	Sulfate	9.9
WHI0048C	2004-0131	1/13/2004	Sulfate	9.02
WHI0048C	2003-3032	12/9/2003	Sulfate	36.5

ADEQ Historical Monitoring Data for Chloride at **Station WHI0200** (Crooked Creek at Hudson Road).

	ADEQ Lab			Concentration
Station ID	Number	Date Sampled	Parameter	(mg/L)
WHI0200	2013-2679	7/30/2013	Chloride	6.3
WHI0200	2013-2275	6/25/2013	Chloride	6.99
WHI0200	2013-1905	5/28/2013	Chloride	6.52
WHI0200	2013-1314	4/22/2013	Chloride	5.82
WHI0200	2013-0892	3/25/2013	Chloride	5.67
WHI0200	2013-0347	2/5/2013	Chloride	6.78
WHI0200	2013-0126	1/15/2013	Chloride	8.09
WHI0200	2012-3818	12/10/2012	Chloride	8.09
WHI0200	2012-3579	11/13/2012	Chloride	8.26
WHI0200	2012-3373	10/23/2012	Chloride	8.1
WHI0200	2012-3019	9/25/2012	Chloride	8.03
WHI0200	2012-2650	8/28/2012	Chloride	7.92
WHI0200	2012-2232	7/24/2012	Chloride	7.92
WHI0200	2012-1912	6/26/2012	Chloride	8.66
WHI0200	2012-1335	5/1/2012	Chloride	6.74
WHI0200	2012-1271	4/24/2012	Chloride	6.75
WHI0200	2012-0927	3/27/2012	Chloride	5.18
WHI0200	2012-0574	2/28/2012	Chloride	6.42
WHI0200	2012-0273	1/30/2012	Chloride	5.65
WHI0200	2011-3643	11/28/2011	Chloride	6.14

ADEQ Historical Monitoring Data for Chloride at **Station WHI0067** (Crooked Creek above Harrison, Arkansas).

	ADEQ Lab			Concentration
Station ID	Number	Date Sampled	Parameter	(mg/L)
WHI0067	2013-2677	7/30/2013	Chloride	6.72
WHI0067	2013-2273	6/25/2013	Chloride	7.87
WHI0067	2013-1903	5/28/2013	Chloride	8.11
WHI0067	2013-1312	4/22/2013	Chloride	7.34
WHI0067	2013-0890	3/26/2013	Chloride	7.28
WHI0067	2013-0345	2/5/2013	Chloride	8.12
WHI0067	2013-0124	1/15/2013	Chloride	8.11
WHI0067	2012-3816	12/10/2012	Chloride	19.1
WHI0067	2012-3577	11/13/2012	Chloride	7.71
WHI0067	2012-3371	10/23/2012	Chloride	8.54
WHI0067	2012-3017	9/25/2012	Chloride	9.01
WHI0067	2012-2648	8/28/2012	Chloride	8.29
WHI0067	2012-2230	7/24/2012	Chloride	7.91
WHI0067	2012-1910	6/26/2012	Chloride	8.46
WHI0067	2012-1333	5/1/2012	Chloride	6.84
WHI0067	2012-1269	4/24/2012	Chloride	6.77
WHI0067	2012-0925	3/27/2012	Chloride	5.6
WHI0067	2012-0572	2/28/2012	Chloride	6.96
WHI0067	2012-0271	1/30/2012	Chloride	6.08
WHI0067	2011-3934	12/12/2011	Chloride	7.59
WHI0067	2011-3540	11/15/2011	Chloride	9.84
WHI0067	2011-3270	10/18/2011	Chloride	8.94
WHI0067	2011-2909	8/20/2011	Chloride	8.43
WHI0067	2011-2525	8/16/2011	Chloride	8.64
WHI0067	2011-2145	7/18/2011	Chloride	7.77
WHI0067	2011-1784	6/14/2011	Chloride	7.73
WHI0067	2011-1419	5/17/2011	Chloride	7.26
WHI0067	2011-1151	4/26/2011	Chloride	5.19
WHI0067	2011-0823	3/29/2011	Chloride	9.18
WHI0067	2011-0482	2/22/2011	Chloride	15.9
WHI0067	2011-0250	1/25/2011	Chloride	10.3
WHI0067	2010-3936	12/28/2010	Chloride	16.9
WHI0067	2010-3647	11/21/2010	Chloride	7.21
WHI0067	2010-3407	10/26/2010	Chloride	7.69
WHI0067	2010-3047	9/21/2010	Chloride	8.1
WHI0067	2010-2356	8/10/2010	Chloride	7.32
WHI0067	2010-1972	7/20/2010	Chloride	7.71
WHI0067	2010-1540	6/16/2010	Chloride	7.34
WHI0067	2010-1106	5/4/2010	Chloride	9.17
WHI0067	2010-0909	4/13/2010	Chloride	6.89
WHI0067	2010-0673	3/16/2010	Chloride	7.28

ADEQ Historical Monitoring Data for Chloride at **Station WHI0067** (Crooked Creek above Harrison, Arkansas).

	ADEQ Lab			Concentration
Station ID	Number	Date Sampled	Parameter	(mg/L)
WHI0067	2010-0485	2/23/2010	Chloride	7.22
WHI0067	2010-0095	1/12/2010	Chloride	7.11
WHI0067	2009-3178	12/1/2009	Chloride	6.42
WHI0067	2009-2974	11/3/2009	Chloride	6.75
WHI0067	2009-2730	10/13/2009	Chloride	4.58
WHI0067	2009-2420	9/15/2009	Chloride	4.25
WHI0067	2009-2078	8/10/2009	Chloride	11.6
WHI0067	2009-1833	7/21/2009	Chloride	4.8
WHI0067	2009-1567	6/23/2009	Chloride	6.83
WHI0067	2009-0908	4/7/2009	Chloride	6.51
WHI0067	2009-0433	2/17/2009	Chloride	7.55
WHI0067	2009-0102	1/13/2009	Chloride	10.3
WHI0067	2008-3497	12/9/2008	Chloride	6.55
WHI0067	2008-3352	11/24/2008	Chloride	6.96
WHI0067	2008-3070	10/21/2008	Chloride	6.46
WHI0067	2008-2762	9/16/2008	Chloride	5.69
WHI0067	2008-2514	8/19/2008	Chloride	7
WHI0067	2008-2171	7/15/2008	Chloride	6.6
WHI0067	2008-1936	6/17/2008	Chloride	11.8
WHI0067	2008-1515	5/13/2008	Chloride	5.99
WHI0067	2008-1197	4/1/2008	Chloride	3.9
WHI0067	2009-0674	3/17/2008	Chloride	7.68
WHI0067	2008-0949	3/3/2008	Chloride	2.85
WHI0067	2008-0803	2/19/2008	Chloride	7.95
WHI0067	2008-0126	1/15/2008	Chloride	8.92
WHI0067	2007-3030	12/4/2007	Chloride	8.25
WHI0067	2007-2853	11/13/2007	Chloride	8.7
WHI0067	2007-2529	10/2/2007	Chloride	7.67
WHI0067	2007-2342	9/5/2007	Chloride	8.56
WHI0067	2007-2085	7/17/2007	Chloride	7.7
WHI0067	2007-1853	6/19/2007	Chloride	7.56
WHI0067	2007-1545	5/15/2007	Chloride	7.23
WHI0067	2007-1135	4/10/2007	Chloride	7.84
WHI0067	2007-1014	3/27/2007	Chloride	7.86
WHI0067	2007-0753	2/27/2007	Chloride	8.22
WHI0067	2007-0378	1/16/2007	Chloride	6.56
WHI0067	2006-3203	12/12/2006	Chloride	10.2
WHI0067	2006-2870	10/31/2006	Chloride	8.7
WHI0067	2006-2690	10/10/2006	Chloride	8.95
WHI0067	2006-2483	9/12/2006	Chloride	7.89
WHI0067	2006-2296	8/15/2006	Chloride	9.33

ADEQ Historical Monitoring Data for Chloride at **Station WHI0067** (Crooked Creek above Harrison, Arkansas).

	ADEQ Lab			Concentration
Station ID	Number	Date Sampled	Parameter	(mg/L)
WHI0067	2006-2081	7/18/2006	Chloride	8.57
WHI0067	2006-1839	6/20/2006	Chloride	7.89
WHI0067	2006-1088	5/16/2006	Chloride	7.22
WHI0067	2006-0877	4/18/2006	Chloride	9.07
WHI0067	2006-0572	3/7/2006	Chloride	11.3
WHI0067	2006-0236	1/31/2006	Chloride	8.87
WHI0067	2006-0010	1/3/2006	Chloride	8.79
WHI0067	2005-3489	12/13/2005	Chloride	8.33
WHI0067	2005-3334	11/15/2005	Chloride	6.58
WHI0067	2005-3098	10/18/2005	Chloride	8.76
WHI0067	2005-2617	9/13/2005	Chloride	8.45
WHI0067	2005-2263	8/16/2005	Chloride	7.52
WHI0067	2005-2031	7/26/2005	Chloride	8.34
WHI0067	2005-1481	6/14/2005	Chloride	7.73
WHI0067	2005-1249	5/17/2005	Chloride	7.78
WHI0067	2005-0919	4/12/2005	Chloride	5.55
WHI0067	2005-0581	3/15/2005	Chloride	8.07
WHI0067	2005-0310	2/8/2005	Chloride	8.04
WHI0067	2005-0105	1/11/2005	Chloride	8.2
WHI0067	2004-3175	12/14/2004	Chloride	7.65
WHI0067	2004-3031	11/16/2004	Chloride	8.19
WHI0067	2004-2782	10/19/2004	Chloride	9.14
WHI0067	2004-2584	9/28/2004	Chloride	8.34
WHI0067	2004-2324	8/24/2004	Chloride	8.36
WHI0067	2004-1942	7/27/2004	Chloride	8.05
WHI0067	2004-1563	6/22/2004	Chloride	11.4
WHI0067	2004-1409	5/25/2004	Chloride	7.29
WHI0067	2004-1168	4/27/2004	Chloride	7.42
WHI0067	2004-0802	3/30/2004	Chloride	7.39
WHI0067	2004-0536	2/24/2004	Chloride	8.91
WHI0067	2004-0287	1/27/2004	Chloride	9.18
WHI0067	2003-3086	12/16/2003	Chloride	10.1
WHI0067	2003-2917	11/18/2003	Chloride	7.19
WHI0067	2003-2653	10/21/2003	Chloride	10.1
WHI0067	2003-2354	9/9/2003	Chloride	9.5
WHI0067	2003-2067	8/5/2003	Chloride	8.26

ADEQ Historical Monitoring Data for Chloride at **Station WHI0066** (Crooked Creek below Harrison, Arkansas).

	ADEQ Lab			Concentration
Station ID	Number	Date Sampled	Parameter	(mg/L)
WHI0066	2013-2678	7/30/2013	Chloride	12.7
WHI0066	2013-2274	6/25/2013	Chloride	13.9
WHI0066	2013-1904	5/28/2013	Chloride	12.9
WHI0066	2013-1313	4/22/2013	Chloride	10.1
WHI0066	2013-0891	3/26/2013	Chloride	9.14
WHI0066	2013-0346	2/5/2013	Chloride	10.7
WHI0066	2013-0125	1/15/2013	Chloride	14.4
WHI0066	2012-3817	12/10/2012	Chloride	21.3
WHI0066	2012-3578	11/13/2012	Chloride	18.4
WHI0066	2012-3372	10/23/2012	Chloride	19.4
WHI0066	2012-3018	9/25/2012	Chloride	20.2
WHI0066	2012-2649	8/28/2012	Chloride	20.6
WHI0066	2012-2231	7/24/2012	Chloride	18.6
WHI0066	2012-1911	6/26/2012	Chloride	16.5
WHI0066	2012-1334	5/1/2012	Chloride	10.5
WHI0066	2012-1270	4/24/2012	Chloride	10
WHI0066	2012-0926	3/27/2012	Chloride	6.26
WHI0066	2012-0573	2/28/2012	Chloride	9.73
WHI0066	2012-0272	1/30/2012	Chloride	7.64
WHI0066	2011-3935	12/12/2011	Chloride	11.9
WHI0066	2011-3541	11/15/2011	Chloride	14.1
WHI0066	2011-3271	10/18/2011	Chloride	16.5
WHI0066	2011-2910	8/20/2011	Chloride	11.5
WHI0066	2011-2526	8/16/2011	Chloride	13
WHI0066	2011-2146	7/18/2011	Chloride	10.9
WHI0066	2011-1785	6/14/2011	Chloride	9.49
WHI0066	2011-1420	5/17/2011	Chloride	8.45
WHI0066	2011-1152	4/26/2011	Chloride	5.24
WHI0066	2011-0824	3/29/2011	Chloride	14.2
WHI0066	2011-0483	2/22/2011	Chloride	21.6
WHI0066	2011-0251	1/25/2011	Chloride	24
WHI0066	2010-3937	12/28/2010	Chloride	15.2
WHI0066	2010-3648	11/21/2010	Chloride	13.7
WHI0066	2010-3408	10/26/2010	Chloride	14.3
WHI0066	2010-3048	9/21/2010	Chloride	9.93
WHI0066	2010-2357	8/10/2010	Chloride	12.1
WHI0066	2010-1973	7/20/2010	Chloride	9.28
WHI0066	2010-1541	6/16/2010	Chloride	10.3
WHI0066	2010-1107	5/4/2010	Chloride	6.88
WHI0066	2010-0910	4/13/2010	Chloride	8.24
WHI0066	2010-0674	3/16/2010	Chloride	9.9

ADEQ Historical Monitoring Data for Chloride at **Station WHI0066** (Crooked Creek below Harrison, Arkansas).

	ADEQ Lab			Concentration
Station ID	Number	Date Sampled	Parameter	(mg/L)
WHI0066	2010-0486	2/23/2010	Chloride	8.81
WHI0066	2010-0096	1/12/2010	Chloride	9.76
WHI0066	2009-3179	12/1/2009	Chloride	8.1
WHI0066	2009-2975	11/3/2009	Chloride	6.6
WHI0066	2009-2731	10/13/2009	Chloride	4.55
WHI0066	2009-2419	9/15/2009	Chloride	7.4
WHI0066	2009-2077	8/10/2009	Chloride	7.14
WHI0066	2009-1834	7/21/2009	Chloride	5.29
WHI0066	2009-1568	6/23/2009	Chloride	8.59
WHI0066	2009-1281	5/19/2009	Chloride	8.64
WHI0066	2009-0909	4/7/2009	Chloride	7.76
WHI0066	2009-0434	2/17/2009	Chloride	8.82
WHI0066	2009-0103	1/13/2009	Chloride	7.09
WHI0066	2008-3498	12/9/2008	Chloride	13.1
WHI0066	2008-3353	11/24/2008	Chloride	12
WHI0066	2008-3071	10/21/2008	Chloride	9.25
WHI0066	2008-3068	10/21/2008	Chloride	5.99
WHI0066	2008-2763	9/16/2008	Chloride	6.62
WHI0066	2008-2515	8/19/2008	Chloride	9.64
WHI0066	2008-2172	7/15/2008	Chloride	8.5
WHI0066	2008-1935	6/17/2008	Chloride	7.35
WHI0066	2008-1516	5/13/2008	Chloride	7.56
WHI0066	2008-1198	4/1/2008	Chloride	4.29
WHI0066	2009-0675	3/17/2008	Chloride	10.6
WHI0066	2008-0950	3/3/2008	Chloride	3.16
WHI0066	2008-0804	2/19/2008	Chloride	11.2
WHI0066	2008-0127	1/15/2008	Chloride	19.3
WHI0066	2007-3031	12/4/2007	Chloride	25.6
WHI0066	2007-2854	11/13/2007	Chloride	23.2
WHI0066	2007-2530	10/2/2007	Chloride	19.3
WHI0066	2007-2343	9/5/2007	Chloride	20.6
WHI0066	2007-2086	7/17/2007	Chloride	11.1
WHI0066	2007-1854	6/19/2007	Chloride	14.6
WHI0066	2007-1546	5/15/2007	Chloride	11
WHI0066	2007-1136	4/10/2007	Chloride	13.8
WHI0066	2007-1015	3/27/2007	Chloride	11.2
WHI0066	2007-0754	2/27/2007	Chloride	10.1
WHI0066	2007-0379	1/16/2007	Chloride	7.36
WHI0066	2006-3204	12/12/2006	Chloride	8.94
WHI0066	2006-2871	10/31/2006	Chloride	15.4
WHI0066	2006-2691	10/10/2006	Chloride	22.4

ADEQ Historical Monitoring Data for Chloride at **Station WHI0066** (Crooked Creek below Harrison, Arkansas).

	ADEQ Lab			Concentration
Station ID	Number	Date Sampled	Parameter	(mg/L)
WHI0066	2006-2484	9/12/2006	Chloride	12.9
WHI0066	2006-2297	8/15/2006	Chloride	26.6
WHI0066	2006-2082	7/18/2006	Chloride	21.7
WHI0066	2006-1840	6/20/2006	Chloride	17.1
WHI0066	2006-1089	5/16/2006	Chloride	9.39
WHI0066	2006-0878	4/18/2006	Chloride	16.9
WHI0066	2006-0573	3/7/2006	Chloride	23.2
WHI0066	2006-0237	1/31/2006	Chloride	15.9
WHI0066	2006-0011	1/3/2006	Chloride	21.3
WHI0066	2005-3490	12/13/2005	Chloride	21.1
WHI0066	2005-3335	11/15/2005	Chloride	10.6
WHI0066	2005-3099	10/18/2005	Chloride	21.5
WHI0066	2005-2618	9/13/2005	Chloride	25.2
WHI0066	2005-2264	8/16/2005	Chloride	17.3
WHI0066	2005-2032	7/26/2005	Chloride	21.5
WHI0066	2005-1482	6/14/2005	Chloride	17.2
WHI0066	2005-1250	5/17/2005	Chloride	12.3
WHI0066	2005-0920	4/12/2005	Chloride	6.47
WHI0066	2005-0582	3/15/2005	Chloride	11.8
WHI0066	2005-0311	2/8/2005	Chloride	10.8
WHI0066	2005-0106	1/11/2005	Chloride	9.86
WHI0066	2004-3176	12/14/2004	Chloride	10.5
WHI0066	2004-3032	11/16/2004	Chloride	11.4
WHI0066	2004-2783	10/19/2004	Chloride	16.7
WHI0066	2004-2585	9/28/2004	Chloride	21.9
WHI0066	2004-2325	8/24/2004	Chloride	18.2
WHI0066	2004-1943	7/27/2004	Chloride	14
WHI0066	2004-1564	6/22/2004	Chloride	7.2
WHI0066	2004-1410	5/25/2004	Chloride	10.7
WHI0066	2004-1169	4/27/2004	Chloride	8.15
WHI0066	2004-0803	3/30/2004	Chloride	12.2
WHI0066	2004-0537	2/24/2004	Chloride	14.9
WHI0066	2004-0288	1/27/2004	Chloride	12.8
WHI0066	2003-3087	12/16/2003	Chloride	17.4
WHI0066	2003-2918	11/18/2003	Chloride	11.3
WHI0066	2003-2654	10/21/2003	Chloride	22.6
WHI0066	2003-2355	9/9/2003	Chloride	20
WHI0066	2003-2068	8/5/2003	Chloride	16.2

ADEQ Historical Monitoring Data for Chloride at **Stations WHI0048A/WHI0193** (Crooked Creek west of Yellville at Kelly's Slab).

	ADEQ Lab			Concentration
Station ID	Number	Date Sampled	Parameter	(mg/L)
WHI0193	2013-2444	7/9/2013	Chloride	8.32
WHI0193	2013-2054	6/4/2013	Chloride	6.28
WHI0193	2013-1552	5/7/2013	Chloride	4.96
WHI0193	2013-0971	4/2/2013	Chloride	6.3
WHI0193	2013-0640	3/5/2013	Chloride	6.58
WHI0193	2013-0470	2/19/2013	Chloride	7.4
WHI0193	2013-0068	1/8/2013	Chloride	10.3
WHI0193	2012-3781	12/4/2012	Chloride	10.3
WHI0193	2012-3485	11/5/2012	Chloride	10.3
WHI0193	2012-3199	10/9/2012	Chloride	10.2
WHI0193	2012-2836	9/11/2012	Chloride	9.48
WHI0193	2012-2390	8/7/2012	Chloride	9.41
WHI0193	2012-2038	7/10/2012	Chloride	8.37
WHI0193	2012-1786	6/12/2012	Chloride	7.85
WHI0193	2012-1558	5/22/2012	Chloride	7.19
WHI0193	2012-1086	4/10/2012	Chloride	5.42
WHI0193	2012-0795	3/13/2012	Chloride	4.24
WHI0193	2012-0439	2/14/2012	Chloride	5.31
WHI0193	2012-0097	1/10/2012	Chloride	6.9
WHI0193	2011-3732	12/5/2011	Chloride	5.8
WHI0193	2011-3434	11/1/2011	Chloride	9.16
WHI0193	2011-3116	10/4/2011	Chloride	9
WHI0193	2011-2785	9/6/2011	Chloride	9.86
WHI0193	2011-2749	8/30/2011	Chloride	9.02
WHI0193	2011-2020	7/5/2011	Chloride	7.78
WHI0193	2011-1625	6/7/2011	Chloride	6.85
WHI0193	2011-1236	5/3/2011	Chloride	3.44
WHI0193	2011-0951	4/5/2011	Chloride	8.26
WHI0193	2011-0512	3/1/2011	Chloride	8.97
WHI0193	2011-0333	2/7/2011	Chloride	9.95
WHI0193	2011-0099	1/18/2011	Chloride	9.84
WHI0193	2010-3792	12/7/2010	Chloride	8.28
WHI0193	2010-3615	11/16/2010	Chloride	8.55
WHI0193	2010-3320	10/19/2010	Chloride	8.26
WHI0193	2010-3117	9/28/2010	Chloride	7.5
WHI0193	2010-2556	8/17/2010	Chloride	7.76
WHI0193	2010-1781	7/6/2010	Chloride	7.75
WHI0193	2010-1462	6/8/2010	Chloride	5.8
WHI0193	2010-1184	5/11/2010	Chloride	4.18
WHI0193	2010-0816	4/6/2010	Chloride	4.71
WHI0193	2010-0525	3/2/2010	Chloride	5.98

ADEQ Historical Monitoring Data for Chloride at **Stations WHI0048A/WHI0193** (Crooked Creek west of Yellville at Kelly's Slab).

	ADEQ Lab			Concentration
Station ID	Number	Date Sampled	Parameter	(mg/L)
WHI0193	2010-0385	2/16/2010	Chloride	5.68
WHI0193	2010-0147	1/19/2010	Chloride	6.43
WHI0193	2009-3279	12/8/2009	Chloride	5.44
WHI0193	2009-3043	11/17/2009	Chloride	5.07
WHI0193	2009-2786	10/20/2009	Chloride	4.96
WHI0193	2009-2303	9/1/2009	Chloride	7.61
WHI0193	2009-2148	8/19/2009	Chloride	7.07
WHI0193	2009-1879	7/28/2009	Chloride	6.16
WHI0193	2009-1445	6/9/2009	Chloride	6.41
WHI0193	2009-1126	5/5/2009	Chloride	4.06
WHI0193	2009-1054	4/28/2009	Chloride	5.58
WHI0193	2009-0602	3/10/2009	Chloride	6.87
WHI0193	2009-0408	2/10/2009	Chloride	5.61
WHI0193	2009-0220	1/20/2009	Chloride	8.16
WHI0193	2008-3517	12/9/2008	Chloride	8.32
WHI0193	2008-3273	11/18/2008	Chloride	7.46
WHI0193	2008-2934	10/7/2008	Chloride	6.14
WHI0193	2008-2700	9/9/2008	Chloride	4.63
WHI0193	2008-2436	8/12/2008	Chloride	4.5
WHI0193	2008-2115	7/8/2008	Chloride	5.16
WHI0193	2008-1858	6/10/2008	Chloride	6.77
WHI0193	2008-1595	5/20/2008	Chloride	5.32
WHI0193	2008-1314	4/15/2008	Chloride	5.09
WHI0193	2008-1008	3/11/2008	Chloride	7.08
WHI0193	2008-0298	2/4/2008	Chloride	10.7
WHI0193	2008-0033	1/8/2008	Chloride	10
WHI0193	2007-3131	12/11/2007	Chloride	10.4
WHI0193	2007-2933	11/27/2007	Chloride	11.9
WHI0193	2007-2618	10/16/2007	Chloride	10.7
WHI0193	2007-2409	9/18/2007	Chloride	10.4
WHI0193	2007-2260	8/7/2007	Chloride	10.1
WHI0193	2007-1998	7/10/2007	Chloride	5.61
WHI0193	2007-1699	6/5/2007	Chloride	7.83
WHI0193	2007-1387	5/1/2007	Chloride	5.97
WHI0193	2007-1074	4/3/2007	Chloride	7.86
WHI0193	2007-0821	3/13/2007	Chloride	7.33
WHI0193	2007-0547	2/6/2007	Chloride	7.06
WHI0193	2007-0421	1/23/2007	Chloride	6.52
WHI0193	2006-3281	12/19/2006	Chloride	8
WHI0193	2006-3064	11/28/2006	Chloride	7.54
WHI0193	2006-2752	10/17/2006	Chloride	4.23

ADEQ Historical Monitoring Data for Chloride at **Stations WHI0048A/WHI0193** (Crooked Creek west of Yellville at Kelly's Slab).

	ADEQ Lab			Concentration
Station ID	Number	Date Sampled	Parameter	(mg/L)
WHI0193	2006-2549	9/19/2006	Chloride	11.9
WHI0193	2006-2237	8/8/2006	Chloride	10.2
WHI0048A	2006-1993	7/11/2006	Chloride	8.3
WHI0048A	2006-1737	6/6/2006	Chloride	7.65
WHI0048A	2006-1000	5/2/2006	Chloride	4.59
WHI0048A	2006-0759	4/4/2006	Chloride	8.18
WHI0048A	2006-0516	2/28/2006	Chloride	10.5
WHI0048A	2006-0328	2/7/2006	Chloride	9.64
WHI0048A	2006-0077	1/10/2006	Chloride	10.5
WHI0048A	2005-3398	12/6/2005	Chloride	10.3
WHI0048A	2005-3270	11/8/2005	Chloride	11.8
WHI0048A	2005-2911	10/4/2005	Chloride	9.37
WHI0048A	2005-1702	7/5/2005	Chloride	9.72
WHI0048A	2005-1431	6/7/2005	Chloride	7.78
WHI0048A	2005-1206	5/10/2005	Chloride	6.96
WHI0048A	2005-0809	4/5/2005	Chloride	5.97
WHI0048A	2005-0485	3/1/2005	Chloride	6.31
WHI0048A	2005-0264	2/1/2005	Chloride	7.11
WHI0048A	2005-0027	1/4/2005	Chloride	3.77
WHI0048A	2004-3088	12/7/2004	Chloride	5.7
WHI0048A	2004-2884	11/2/2004	Chloride	5.41
WHI0048A	2004-2077	8/10/2004	Chloride	9.45
WHI0048A	2004-1661	7/6/2004	Chloride	7.33
WHI0048A	2004-1468	6/8/2004	Chloride	7.34
WHI0048A	2004-1259	5/11/2004	Chloride	36.1
WHI0048A	2004-0872	4/6/2004	Chloride	7.48
WHI0048A	2004-0634	3/9/2004	Chloride	6.83
WHI0048A	2004-0332	2/3/2004	Chloride	7.83
WHI0048A	2004-0130	1/13/2004	Chloride	8.76
WHI0048A	2003-3030	12/9/2003	Chloride	7.5
WHI0048A	2003-2750	11/4/2003	Chloride	11.2
WHI0048A	2003-2559	10/14/2003	Chloride	10
WHI0048A	2003-2374	9/16/2003	Chloride	9.4
WHI0048A	2003-2165	8/19/2003	Chloride	10.3

ADEQ Historical Monitoring Data for Chloride at **Station WHI0048B** (Crooked Creek 2 miles south of Flippin, Arkansas).

	ADEQ Lab			Concentration
Station ID	Number	Date Sampled	Parameter	(mg/L)
WHI0048B	2013-2050	6/4/2013	Chloride	6.38
WHI0048B	2013-1548	5/7/2013	Chloride	4.71
WHI0048B	2013-0967	4/2/2013	Chloride	6.23
WHI0048B	2013-0636	3/5/2013	Chloride	6.59
WHI0048B	2013-0466	2/19/2013	Chloride	7.42
WHI0048B	2012-1082	4/10/2012	Chloride	5.38
WHI0048B	2012-0791	3/13/2012	Chloride	4.29
WHI0048B	2012-0435	2/14/2012	Chloride	5.36
WHI0048B	2012-0093	1/10/2012	Chloride	6.84
WHI0048B	2011-3728	12/5/2011	Chloride	6.01
WHI0048B	2011-1621	6/7/2011	Chloride	6.05
WHI0048B	2011-1232	5/3/2011	Chloride	3.38
WHI0048B	2011-0947	4/5/2011	Chloride	7.71
WHI0048B	2011-0508	3/1/2011	Chloride	9.18
WHI0048B	2010-1457	6/8/2010	Chloride	5.85
WHI0048B	2010-1179	5/11/2010	Chloride	4.58
WHI0048B	2010-0811	4/6/2010	Chloride	4.51
WHI0048B	2010-0520	3/2/2010	Chloride	6.09
WHI0048B	2010-0380	2/16/2010	Chloride	5.66
WHI0048B	2010-0142	1/19/2010	Chloride	6.33
WHI0048B	2009-3274	12/8/2009	Chloride	5.68
WHI0048B	2009-3038	11/17/2009	Chloride	5.3
WHI0048B	2009-2781	10/20/2009	Chloride	4.85
WHI0048B	2009-2143	8/19/2009	Chloride	6.9
WHI0048B	2009-1874	7/28/2009	Chloride	6.06
WHI0048B	2009-1440	6/9/2009	Chloride	6.36
WHI0048B	2009-1121	5/5/2009	Chloride	4.47
WHI0048B	2009-1049	4/28/2009	Chloride	6.21
WHI0048B	2009-0597	3/10/2009	Chloride	6.87
WHI0048B	2009-0403	2/10/2009	Chloride	5.79
WHI0048B	2008-2929	10/7/2008	Chloride	6.26
WHI0048B	2008-2695	9/9/2008	Chloride	4.64
WHI0048B	2008-2431	8/12/2008	Chloride	4.3
WHI0048B	2008-2110	7/8/2008	Chloride	5.04
WHI0048B	2008-1853	6/10/2008	Chloride	6.6
WHI0048B	2008-1590	5/20/2008	Chloride	5.16
WHI0048B	2008-1309	4/15/2008	Chloride	5.26
WHI0048B	2008-1003	3/11/2008	Chloride	6.62
WHI0048B	2007-1993	7/10/2007	Chloride	4.84
WHI0048B	2007-1382	5/1/2007	Chloride	6.01
WHI0048B	2007-1069	4/3/2007	Chloride	7.55

ADEQ Historical Monitoring Data for Chloride at **Station WHI0048B** (Crooked Creek 2 miles south of Flippin, Arkansas).

·	ADEQ Lab			Concentration
Station ID	Number	Date Sampled	Parameter	(mg/L)
WHI0048B	2007-0816	3/13/2007	Chloride	7.32
WHI0048B	2007-0542	2/6/2007	Chloride	7.02
WHI0048B	2007-0416	1/23/2007	Chloride	6.44
WHI0048B	2006-1001	5/2/2006	Chloride	4.51
WHI0048B	2005-1207	5/10/2005	Chloride	6.99
WHI0048B	2005-0810	4/5/2005	Chloride	6
WHI0048B	2005-0486	3/1/2005	Chloride	6.3
WHI0048B	2005-0265	2/1/2005	Chloride	7
WHI0048B	2005-0028	1/4/2005	Chloride	5.2
WHI0048B	2004-3089	12/7/2004	Chloride	5.34
WHI0048B	2004-2885	11/2/2004	Chloride	4.86
WHI0048B	2004-1662	7/6/2004	Chloride	7.17
WHI0048B	2004-1469	6/8/2004	Chloride	7.36
WHI0048B	2004-1260	5/11/2004	Chloride	6.04
WHI0048B	2004-0873	4/6/2004	Chloride	7.49
WHI0048B	2004-0635	3/9/2004	Chloride	6.89
WHI0048B	2004-0333	2/3/2004	Chloride	7.84
WHI0048B	2003-3031	12/9/2003	Chloride	7.15

ADEQ Historical Monitoring Data for Chloride at **Station WHI0048C** (Crooked Creek at Hwy 101, 2 miles north of Rea Valley, AR).

	ADEQ Lab	-		Concentration
Station ID	Number	Date Sampled	Parameter	(mg/L)
WHI0048C	2013-2051	6/4/2013	Chloride	5.56
WHI0048C	2013-1549	5/7/2013	Chloride	4.95
WHI0048C	2013-0968	4/2/2013	Chloride	6.07
WHI0048C	2013-0637	3/5/2013	Chloride	6.5
WHI0048C	2013-0467	2/19/2013	Chloride	6.23
WHI0048C	2012-1083	4/10/2012	Chloride	5.36
WHI0048C	2012-0792	3/13/2012	Chloride	4.39
WHI0048C	2012-0436	2/14/2012	Chloride	5.26
WHI0048C	2012-0094	1/10/2012	Chloride	6.54
WHI0048C	2011-3729	12/5/2011	Chloride	5.41
WHI0048C	2011-1622	6/7/2011	Chloride	6
WHI0048C	2011-1233	5/3/2011	Chloride	3.5
WHI0048C	2011-0948	4/5/2011	Chloride	6.86
WHI0048C	2011-0509	3/1/2011	Chloride	9.68
WHI0048C	2010-3113	9/28/2010	Chloride	6.98
WHI0048C	2010-1777	7/6/2010	Chloride	6.2
WHI0048C	2010-1458	6/8/2010	Chloride	5.62
WHI0048C	2010-1180	5/11/2010	Chloride	4.13
WHI0048C	2010-0812	4/6/2010	Chloride	4.5
WHI0048C	2010-0521	3/2/2010	Chloride	6
WHI0048C	2010-0381	2/16/2010	Chloride	5.81
WHI0048C	2010-0143	1/19/2010	Chloride	6.06
WHI0048C	2009-3275	12/8/2009	Chloride	5.41
WHI0048C	2009-3039	11/17/2009	Chloride	5.08
WHI0048C	2009-2782	10/20/2009	Chloride	4.88
WHI0048C	2009-2299	9/1/2009	Chloride	6.38
WHI0048C	2009-2144	8/19/2009	Chloride	5.91
WHI0048C	2009-1875	7/28/2009	Chloride	5.45
WHI0048C	2009-1441	6/9/2009	Chloride	6.33
WHI0048C	2009-1122	5/5/2009	Chloride	3.9
WHI0048C	2009-1050	4/28/2009	Chloride	6.09
WHI0048C	2009-0598	3/10/2009	Chloride	6.71
WHI0048C	2009-0404	2/10/2009	Chloride	5.81
WHI0048C	2008-2930	10/7/2008	Chloride	6.36
WHI0048C	2008-2696	9/9/2008	Chloride	4.63
WHI0048C	2008-2432	8/12/2008	Chloride	4.38
WHI0048C	2008-2111	7/8/2008	Chloride	4.71
WHI0048C	2008-1854	6/10/2008	Chloride	6.08
WHI0048C	2008-1591	5/20/2008	Chloride	5.13
WHI0048C	2008-1310	4/15/2008	Chloride	5.13
WHI0048C	2008-1004	3/11/2008	Chloride	6.82

ADEQ Historical Monitoring Data for Chloride at **Station WHI0048C** (Crooked Creek at Hwy 101, 2 miles north of Rea Valley, AR).

	ADEQ Lab			Concentration
Station ID	Number	Date Sampled	Parameter	(mg/L)
WHI0048C	2007-1994	7/10/2007	Chloride	1.81
WHI0048C	2007-1383	5/1/2007	Chloride	6.42
WHI0048C	2007-1070	4/3/2007	Chloride	7.48
WHI0048C	2007-0817	3/13/2007	Chloride	7.21
WHI0048C	2007-0543	2/6/2007	Chloride	7.37
WHI0048C	2007-0417	1/23/2007	Chloride	6.35
WHI0048C	2006-1738	6/6/2006	Chloride	7.07
WHI0048C	2006-1002	5/2/2006	Chloride	4.61
WHI0048C	2006-0760	4/4/2006	Chloride	8.07
WHI0048C	2006-0329	2/7/2006	Chloride	6.53
WHI0048C	2005-1432	6/7/2005	Chloride	7.02
WHI0048C	2005-1208	5/10/2005	Chloride	6.58
WHI0048C	2005-0811	4/5/2005	Chloride	5.99
WHI0048C	2005-0487	3/1/2005	Chloride	6.37
WHI0048C	2005-0266	2/1/2005	Chloride	7.09
WHI0048C	2005-0029	1/4/2005	Chloride	11.7
WHI0048C	2004-3090	12/7/2004	Chloride	5.58
WHI0048C	2004-2886	11/2/2004	Chloride	4.1
WHI0048C	2004-1663	7/6/2004	Chloride	6.26
WHI0048C	2004-1470	6/8/2004	Chloride	6.56
WHI0048C	2004-1261	5/11/2004	Chloride	6.08
WHI0048C	2004-0874	4/6/2004	Chloride	7.55
WHI0048C	2004-0636	3/9/2004	Chloride	6.71
WHI0048C	2004-0334	2/3/2004	Chloride	7.53
WHI0048C	2004-0131	1/13/2004	Chloride	8.59
WHI0048C	2003-3032	12/9/2003	Chloride	7.36