Trinity River Authority of Texas

Enriching the Trinity basin as a resource for Texans

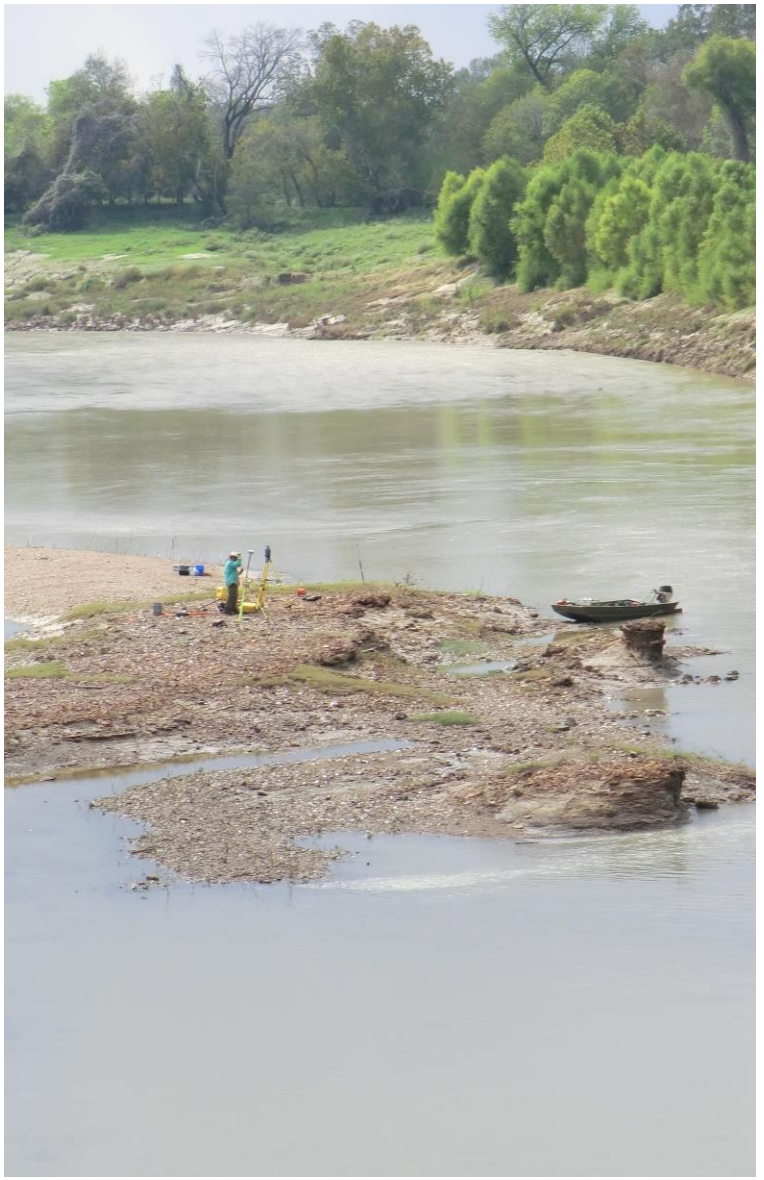
Environmental Flows and the Trinity River

Phase II

Wastewater Treatment ▪ Water Treatment ▪ Water Storage ▪ Lake Livingston ▪ Recreation

Background

- Phase I, 2014-2015
- Phase II, 2016-17
- Phase III, 2018-2020
- Scope (Generally):
  - Intensive Field Work
  - Data Processing
  - Modeling
  - Analysis
  - Reporting



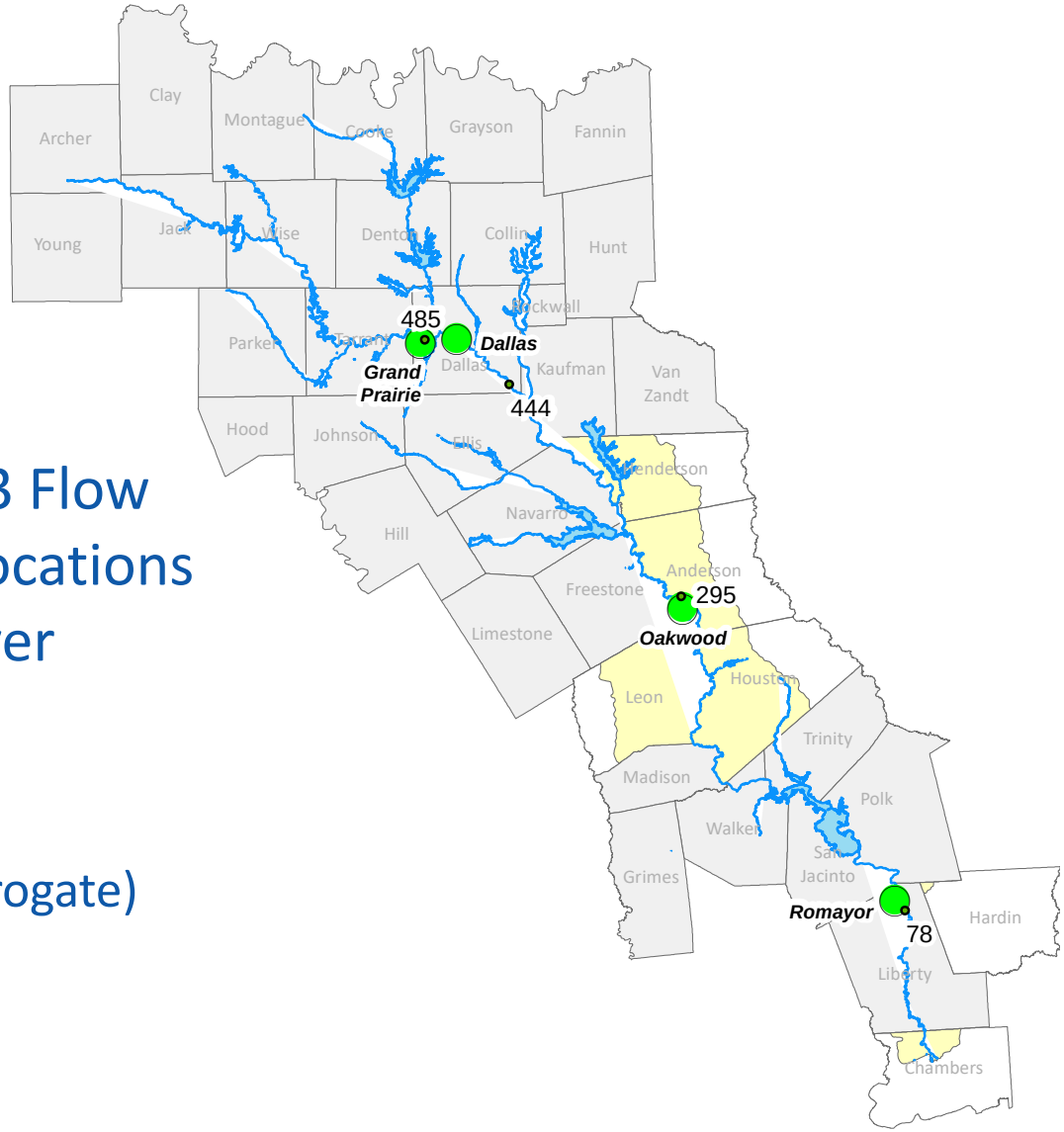
Background

- Project Intent:
  - Fill data gaps
  - Provide information for adaptive management
  - Demonstrate what is happening in the system at the SB3 flows
  - *Not intended to recommend flows*

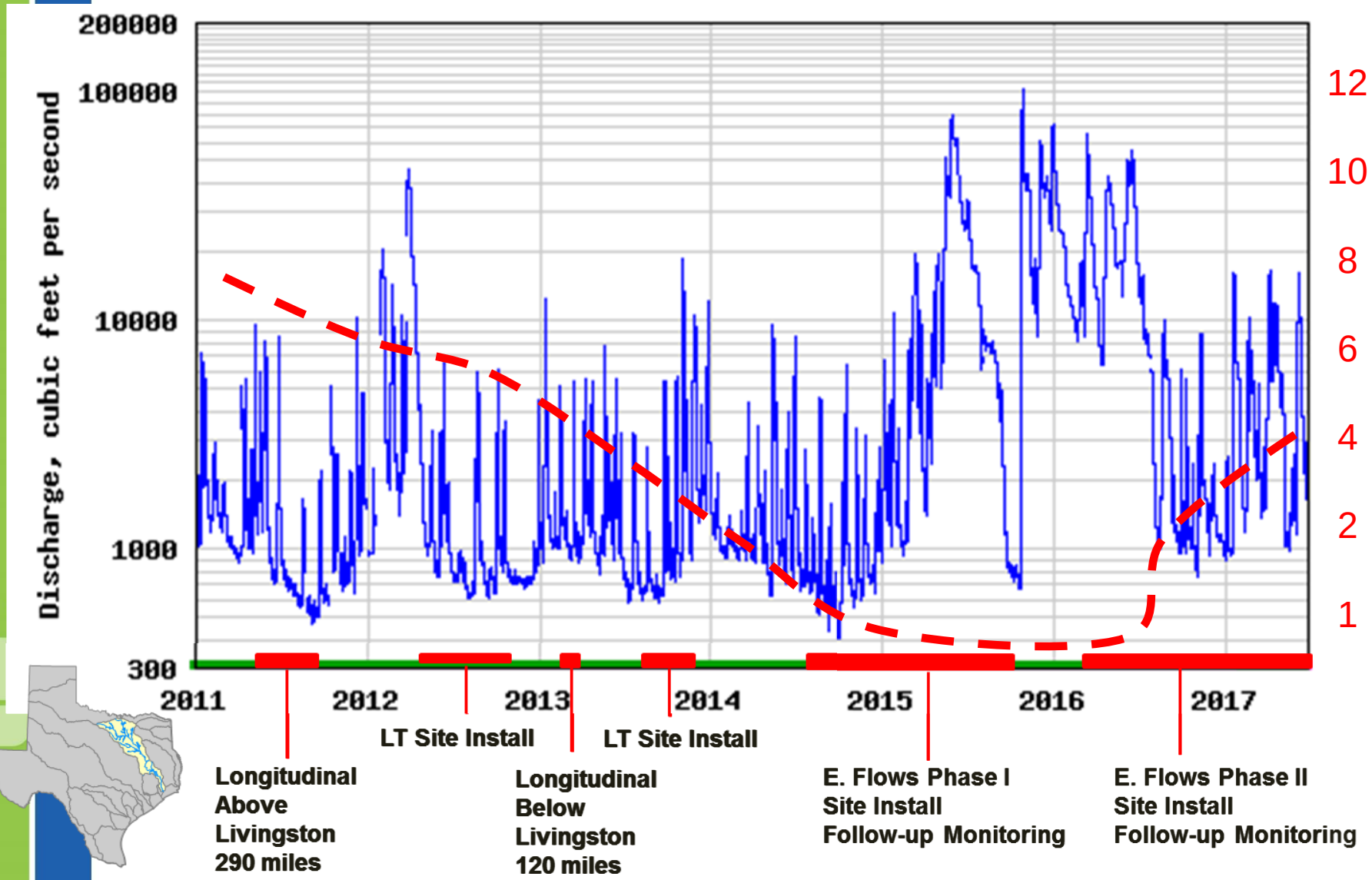
- Presentation Intent:
  - Infomercial
  - Summary of a Summary of a Summary

Background

- Research Goal:
  - Evaluate the SB3 Flow standards at 4 locations in the Trinity River
  - USGS Gages:
    - Grand Prairie
    - Dallas (444 surrogate)
    - Oakwood
    - Romayor



Background


Discharge, cubic feet per second
200000
100000
10000
1000
300
2011
2012
2013
2014
2015
2016
2017
12
10
8
6
4
2
1
LT Site Install
LT Site Install
Longitudinal
Above
Livingston
290 miles
Longitudinal
Below
Livingston
120 miles
E. Flows Phase I
Site Install
Follow-up Monitoring
E. Flows Phase II
Site Install
Follow-up Monitoring

High Flows

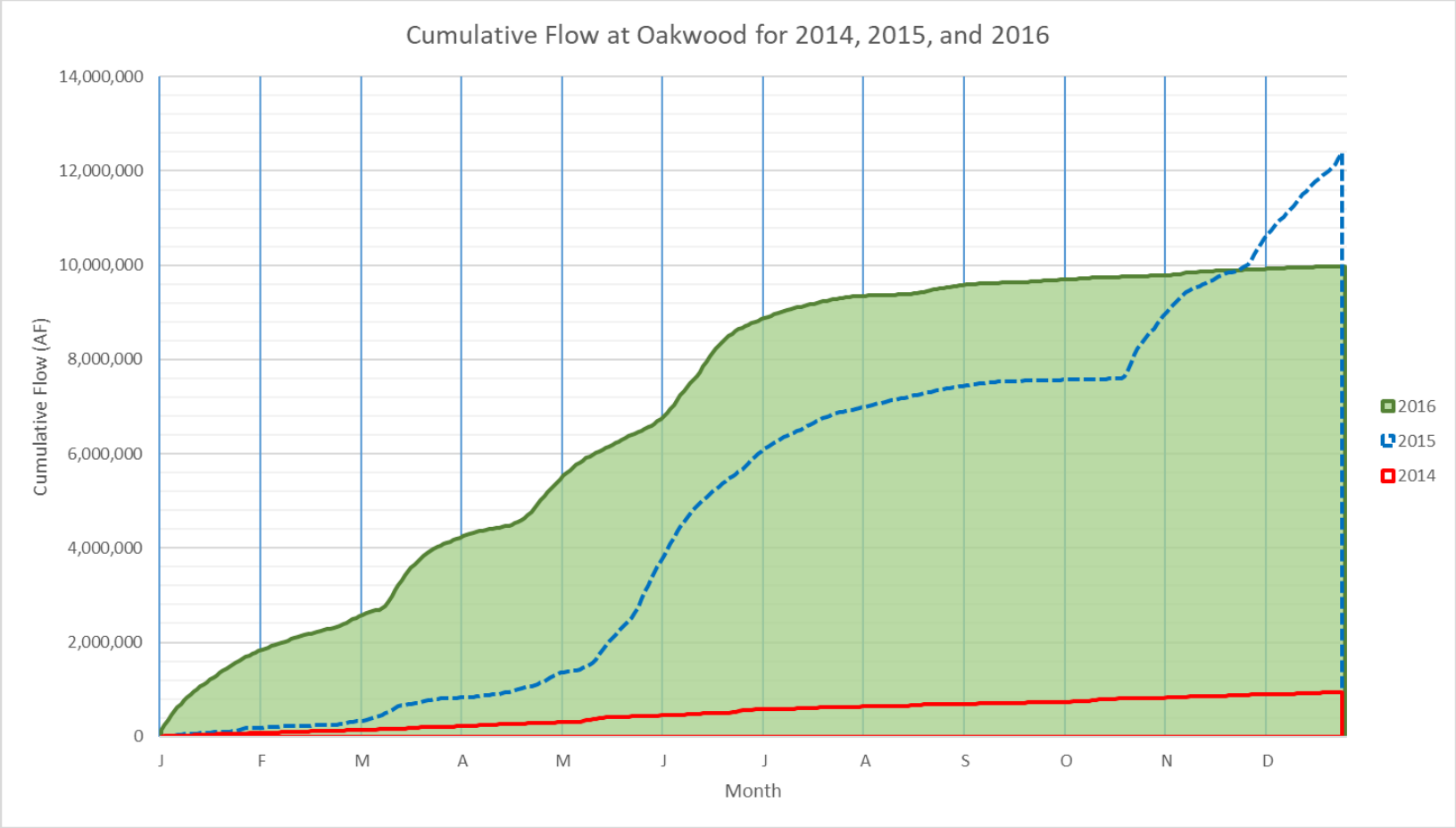
June 2015, RM 444 ~ 65,000 cfs

High Flows

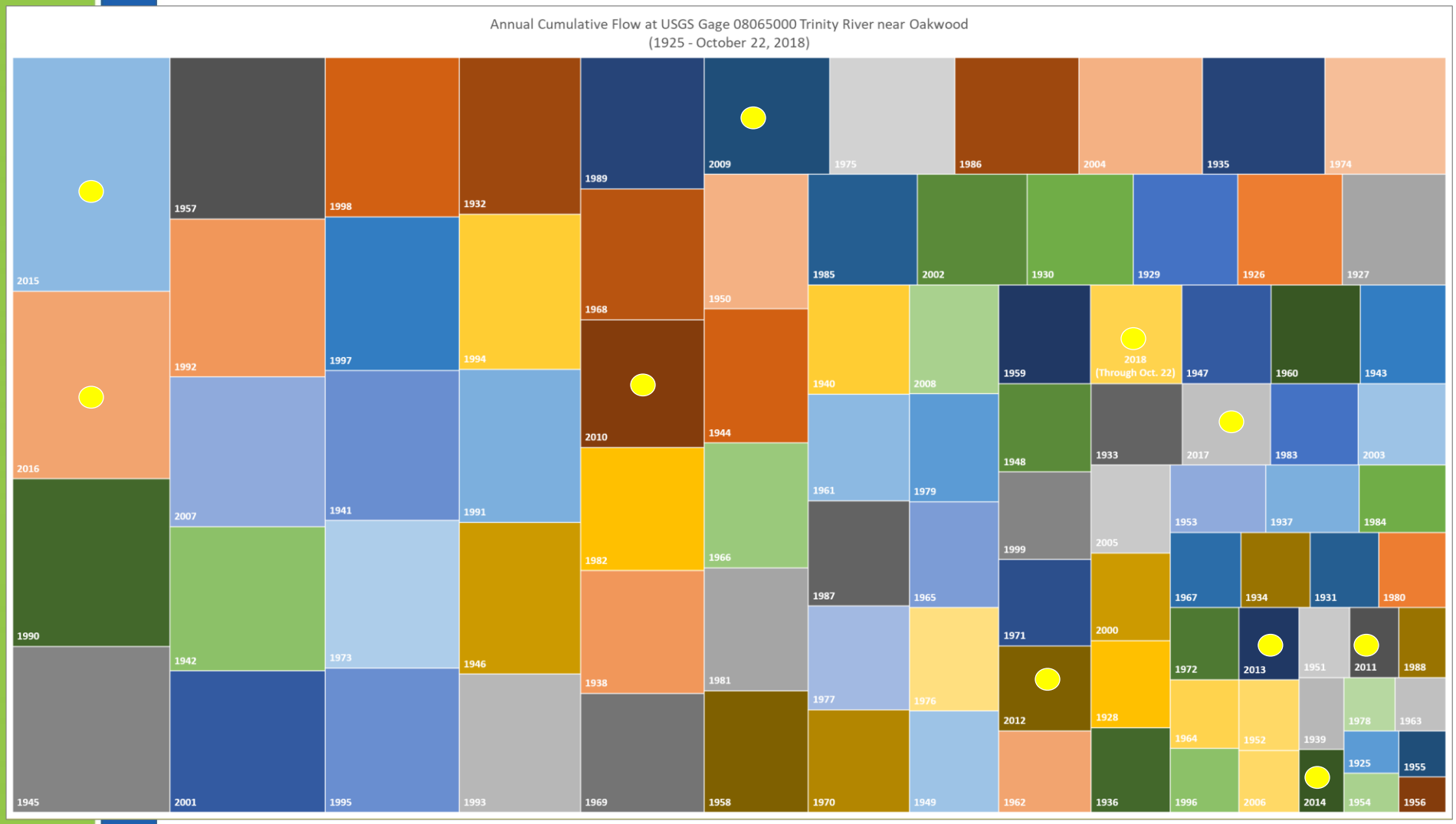
High Flows

High Flows

- Flooding and high releases in 2014, 2015 & 2016



High Flows


Annual Cumulative Flow at USGS Gage 08065000 Trinity River near Oakwood
(1925 - October 22, 2018)
2015
1957
1998
1932
1989
2009
1975
1986
2004
1935
1974
2016
1992
1997
1994
1968
1950
1985
2002
1930
1929
1926
1927
1990
2007
1941
1991
2010
1944
1940
2008
1959
2018 (Through Oct. 22)
1947
1960
1943
1945
1942
1973
1946
1982
1966
1961
1979
1948
1933
2017
1983
2003
2001
1995
1993
1938
1981
1987
1965
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1953
1937
1984
1969
1958
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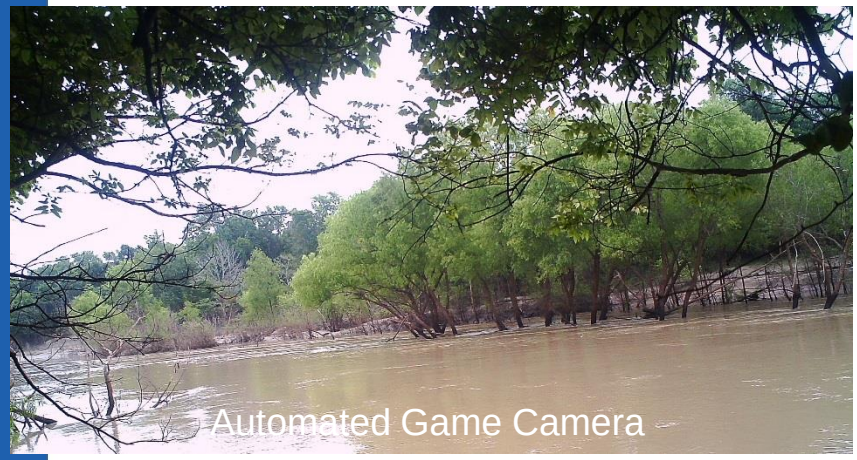
1976
1971
2000
1967
1934
1931
1980
1962
1936
1996
2006
2014
1954
1956
1964
1952
1939
1925
1955
1978
1963
2012
1928
1972
2013
1951
2011
1988

Field Work

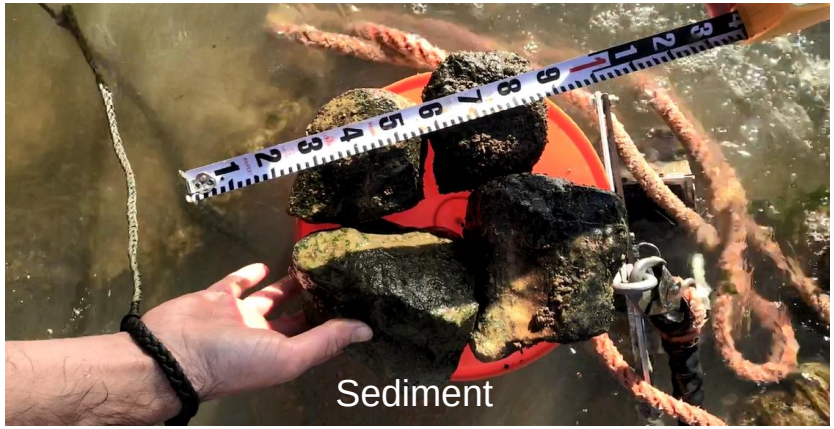
Linear Habitat

Benchmarks


Automated Game Camera

Riparian

Bathymetry

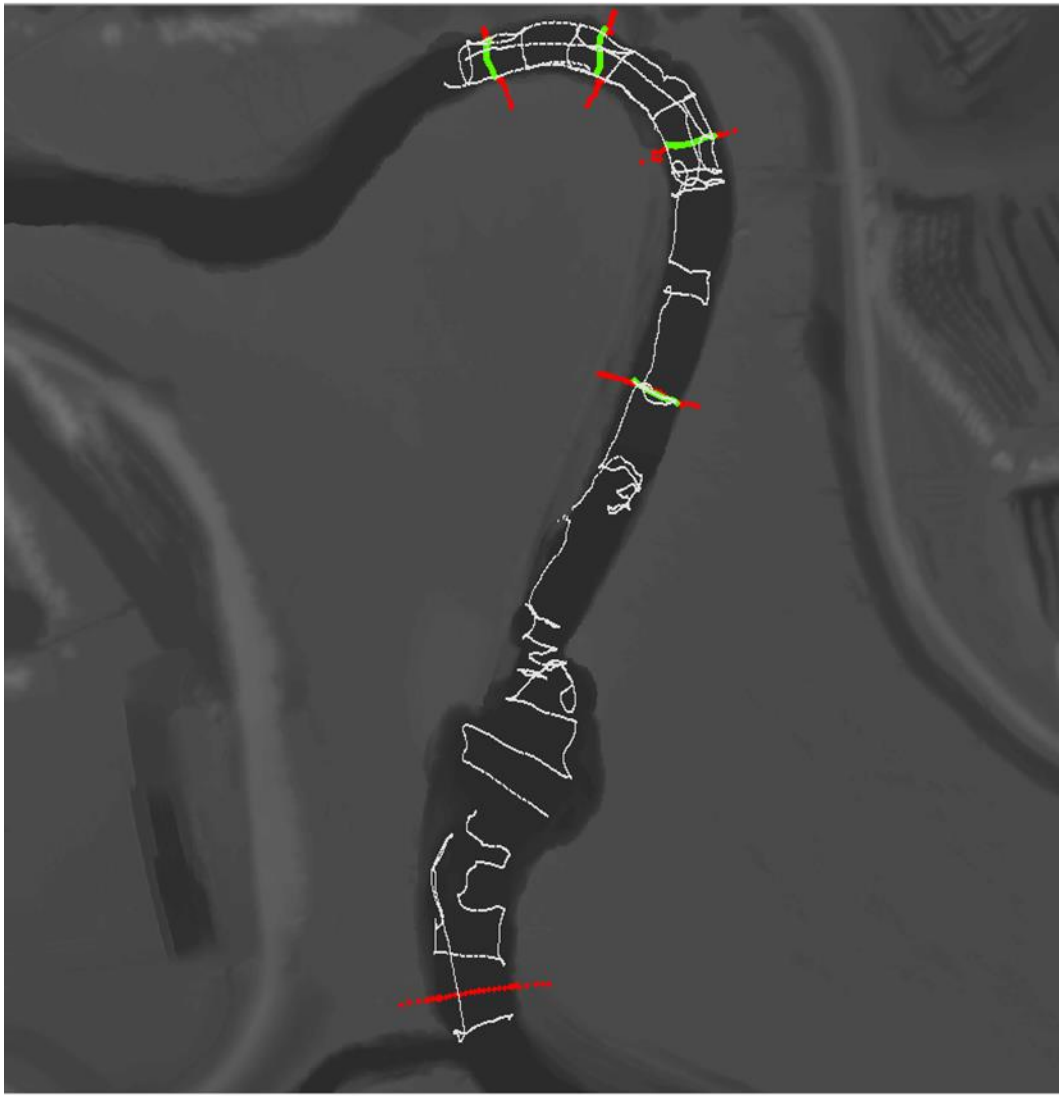

Sediment

Riparian Analysis

- Tree coring at Oakwood
- Many cores rotten from extended flooding in 2015/16

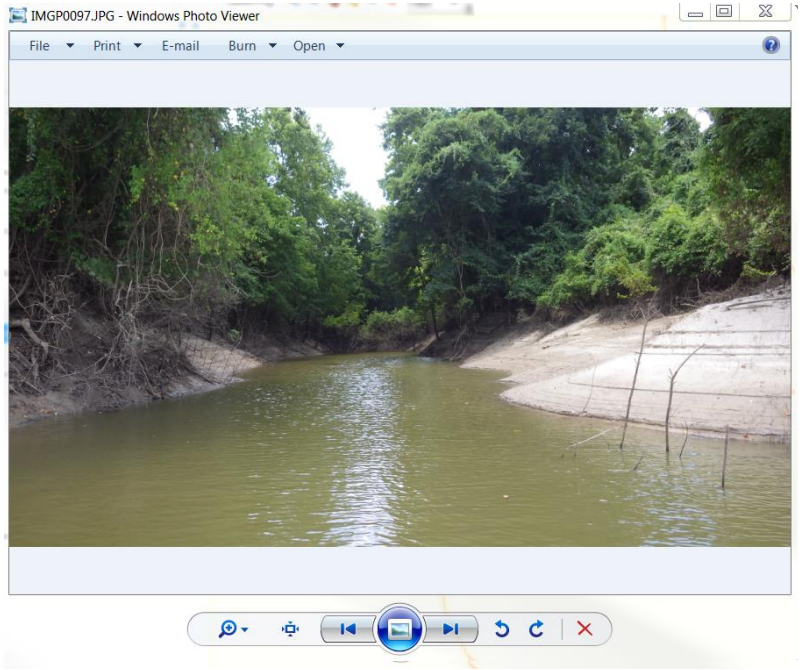
Data Processing - Survey

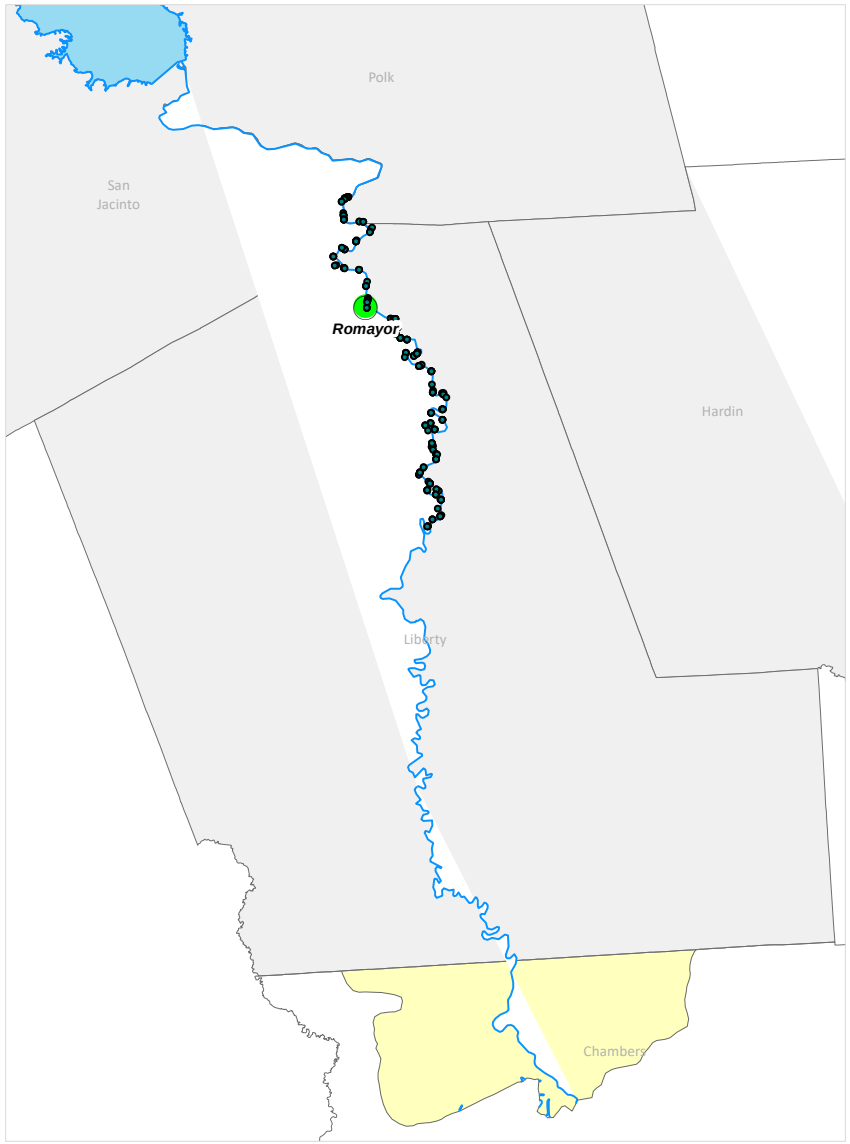
- Bathymetry
  - M9
  - Wading rod
- Topography
  - RTK GPS
  - Total Station
- DTM
  - LiDAR
  - USGS Topo
  - USGS DEM



Results

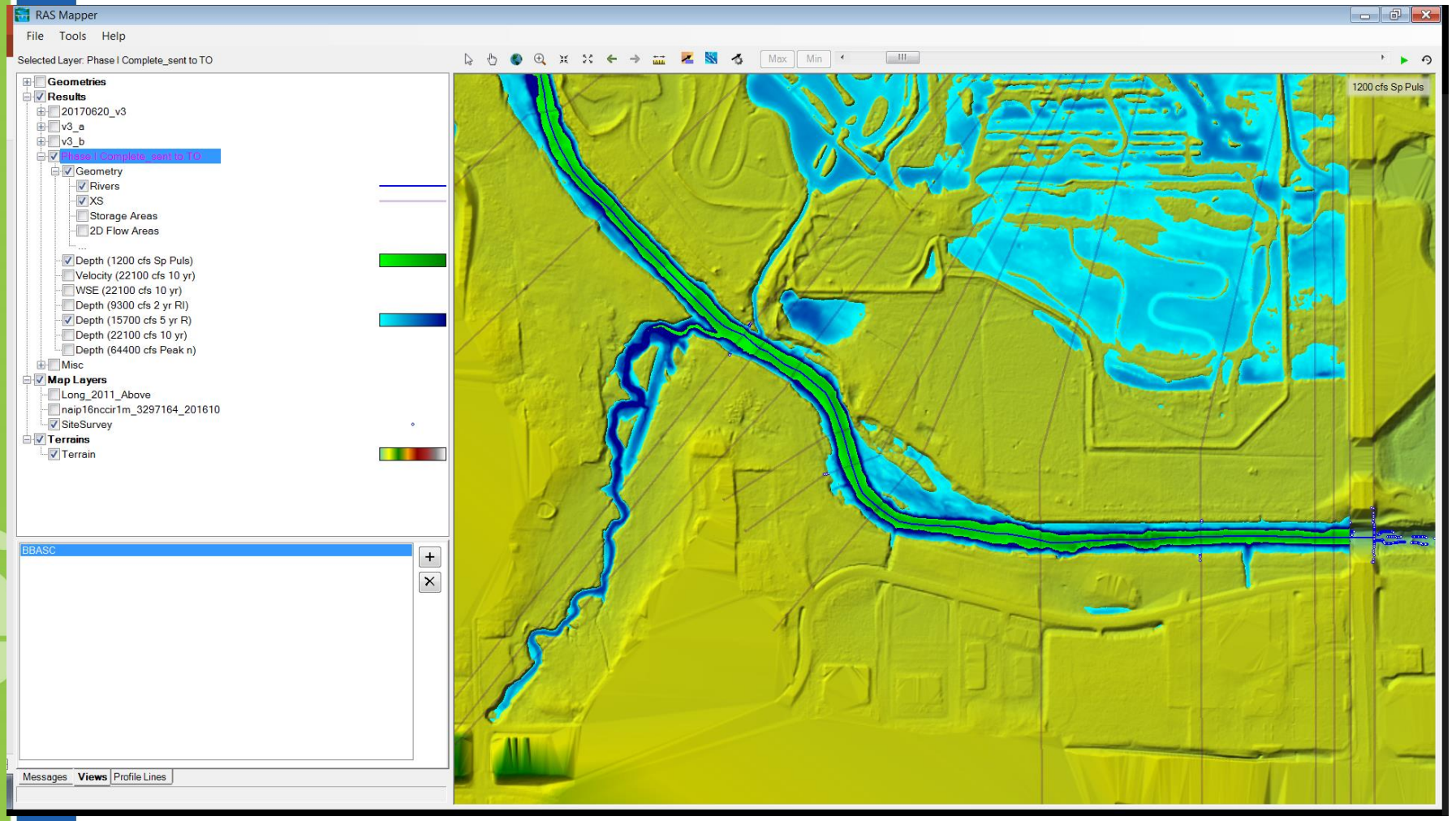
Linear Survey





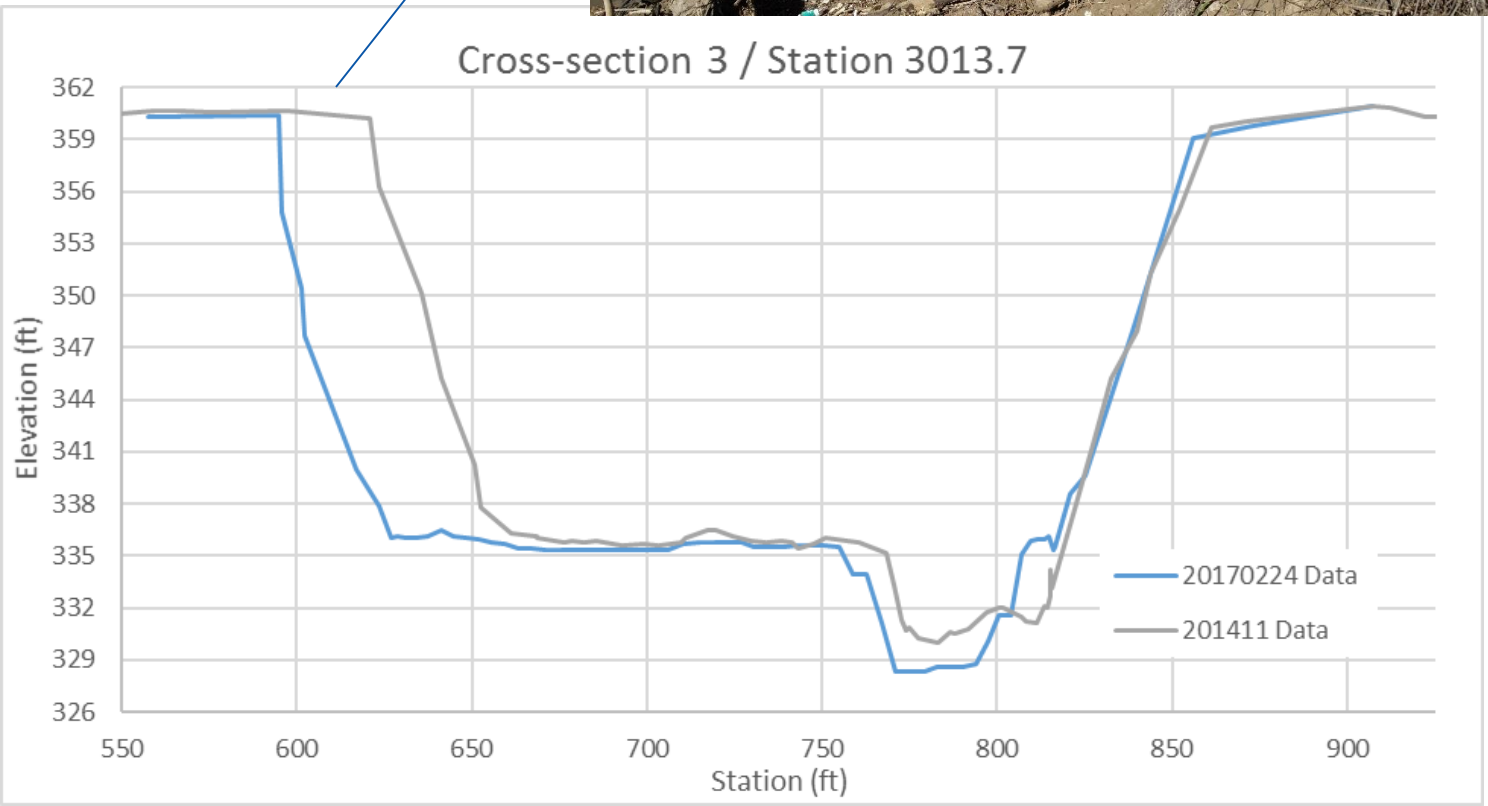
Modeling & Analysis

- Inundation modeling



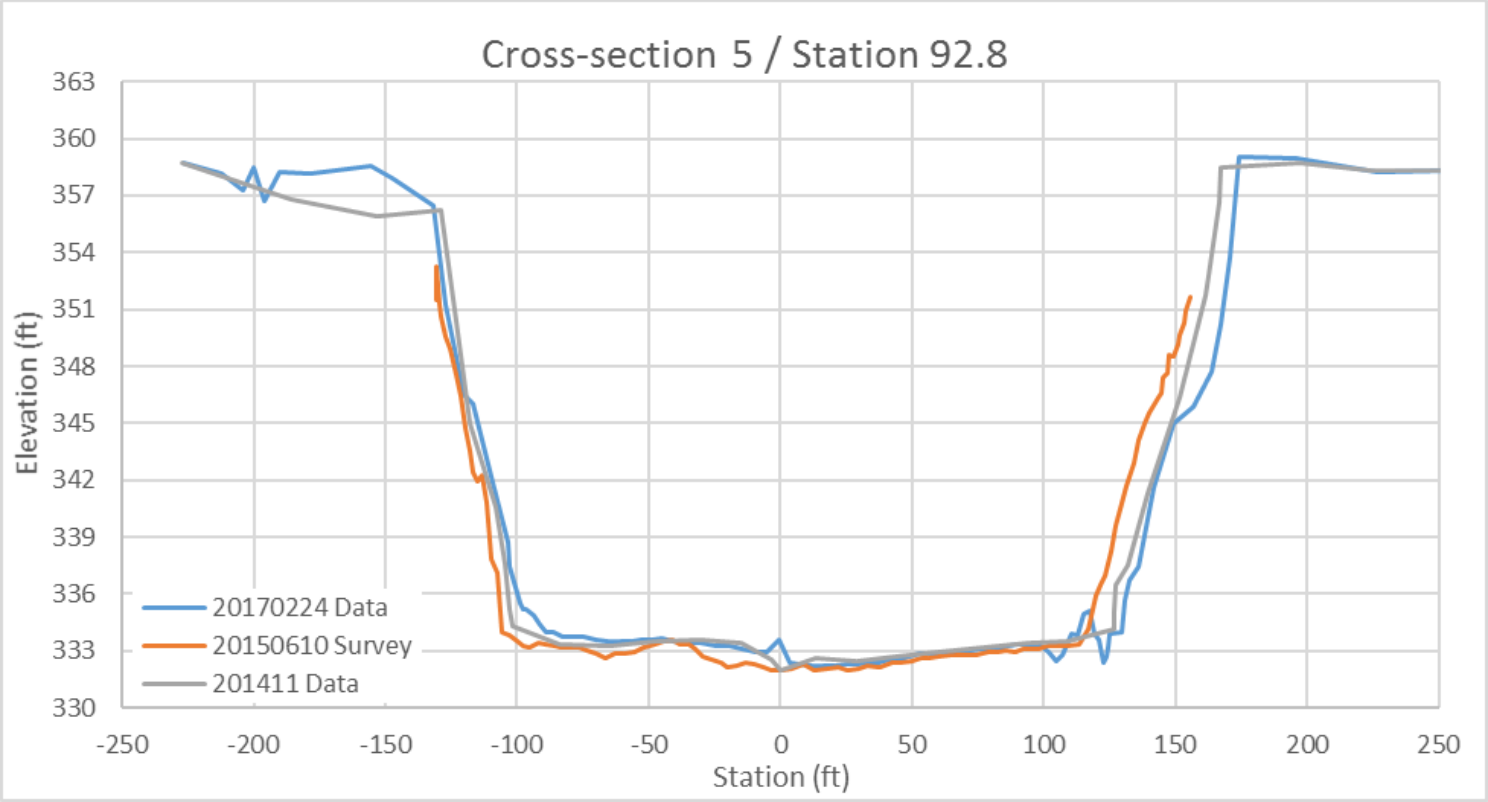
XS Migra

- River Mile 444 –

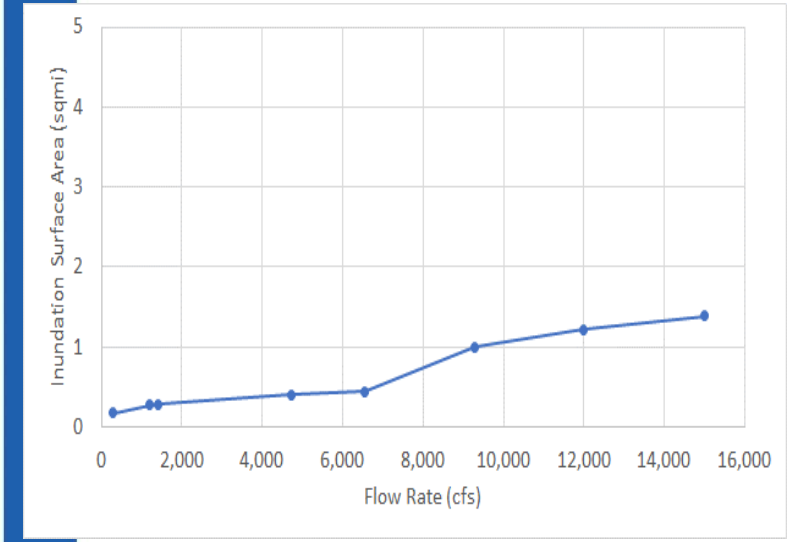


XS Migration Comparison

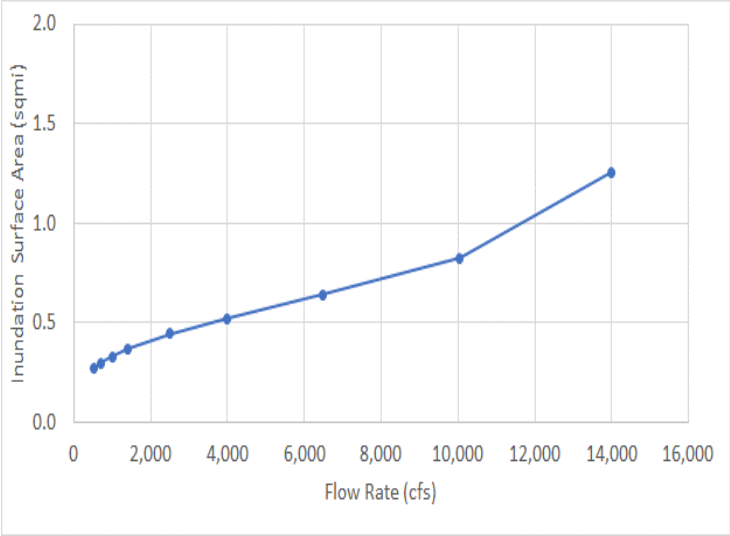
- River Mile 444 – Downstream of the failed lock structure



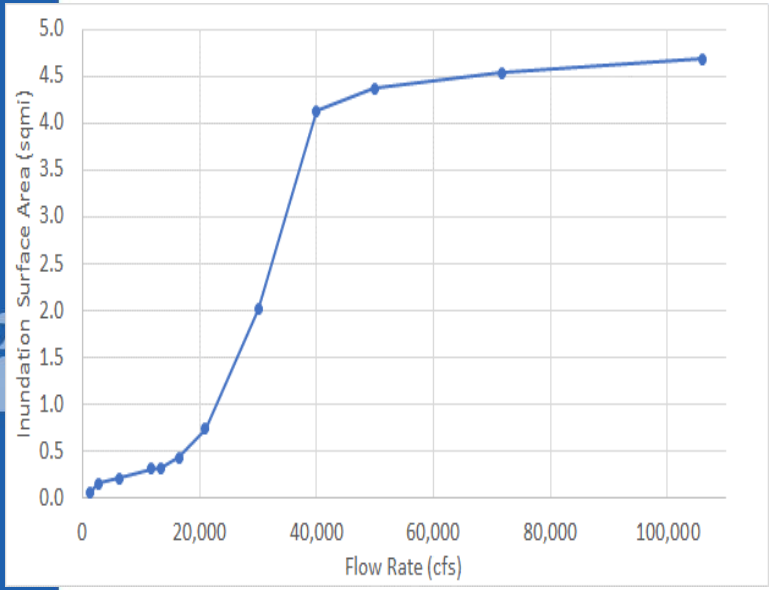
Inundation



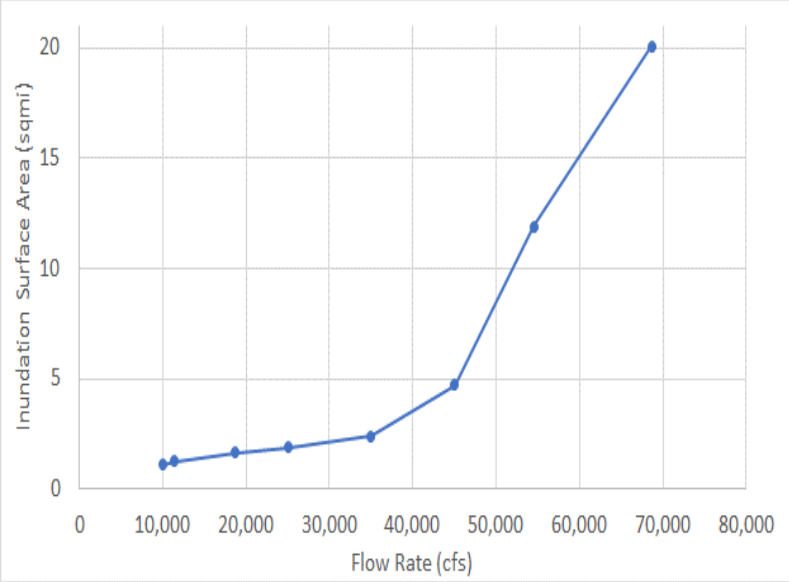
Grand Prairie



Loop 12



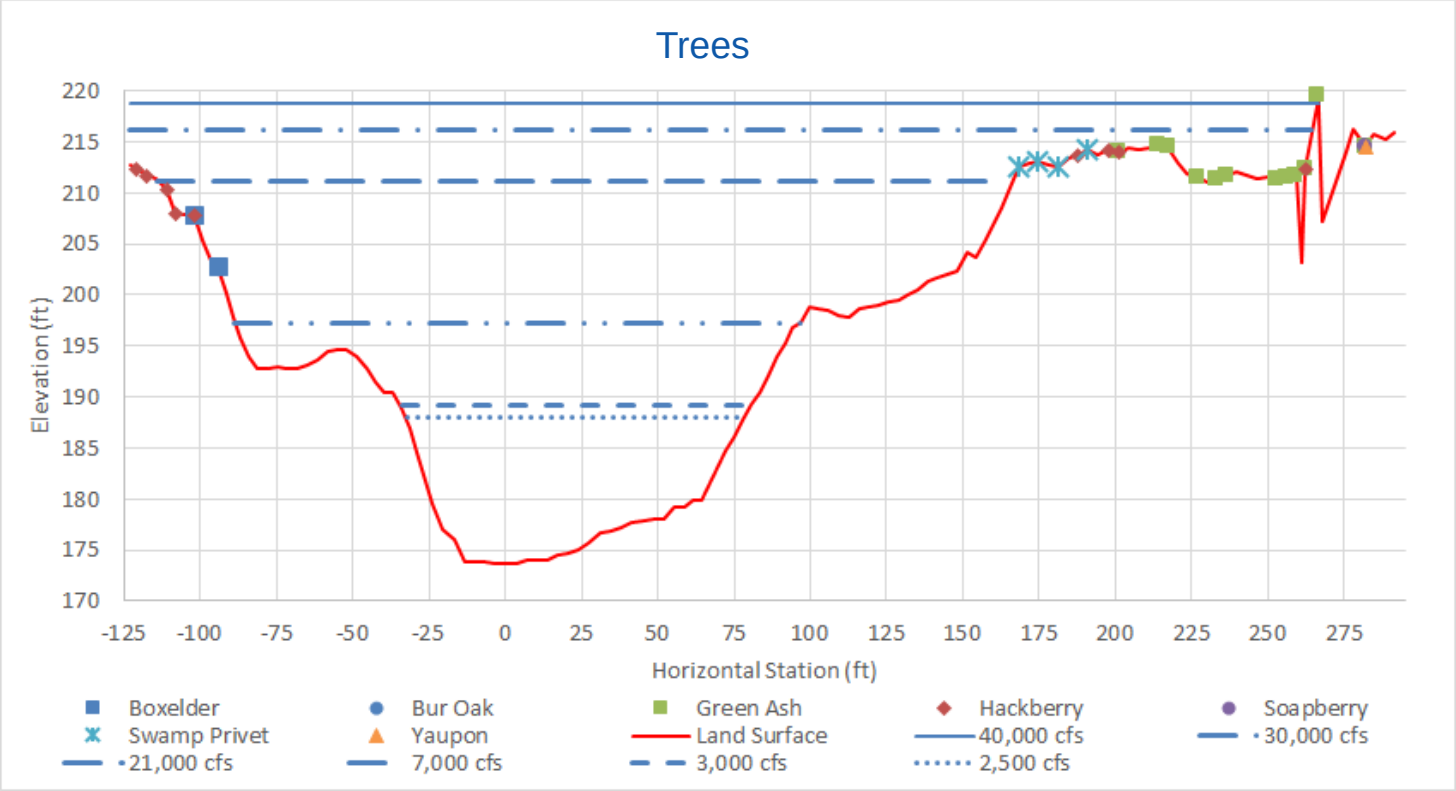
Oakwood



Romayor

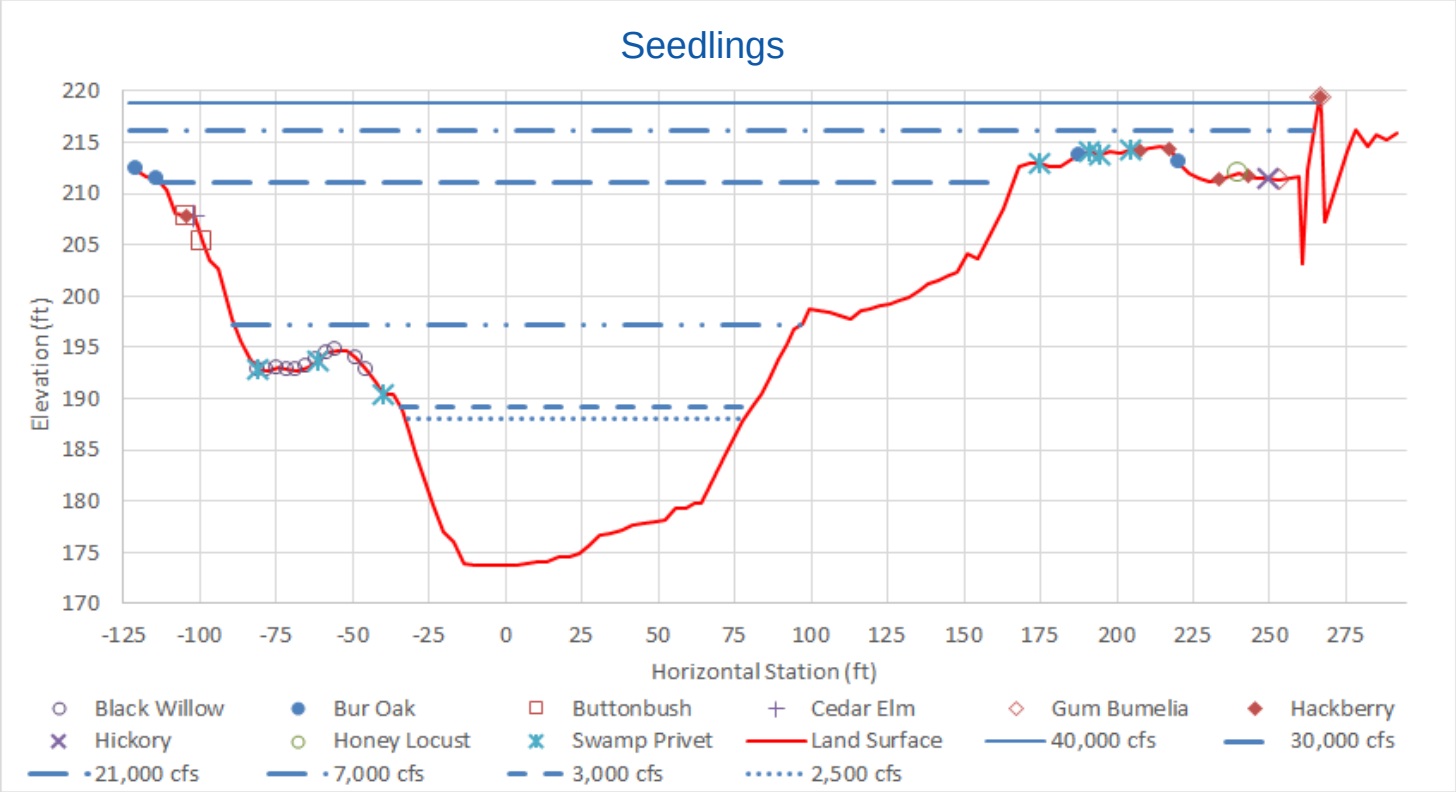
Riparian Recruitment Analysis

- Trees at Oakwood



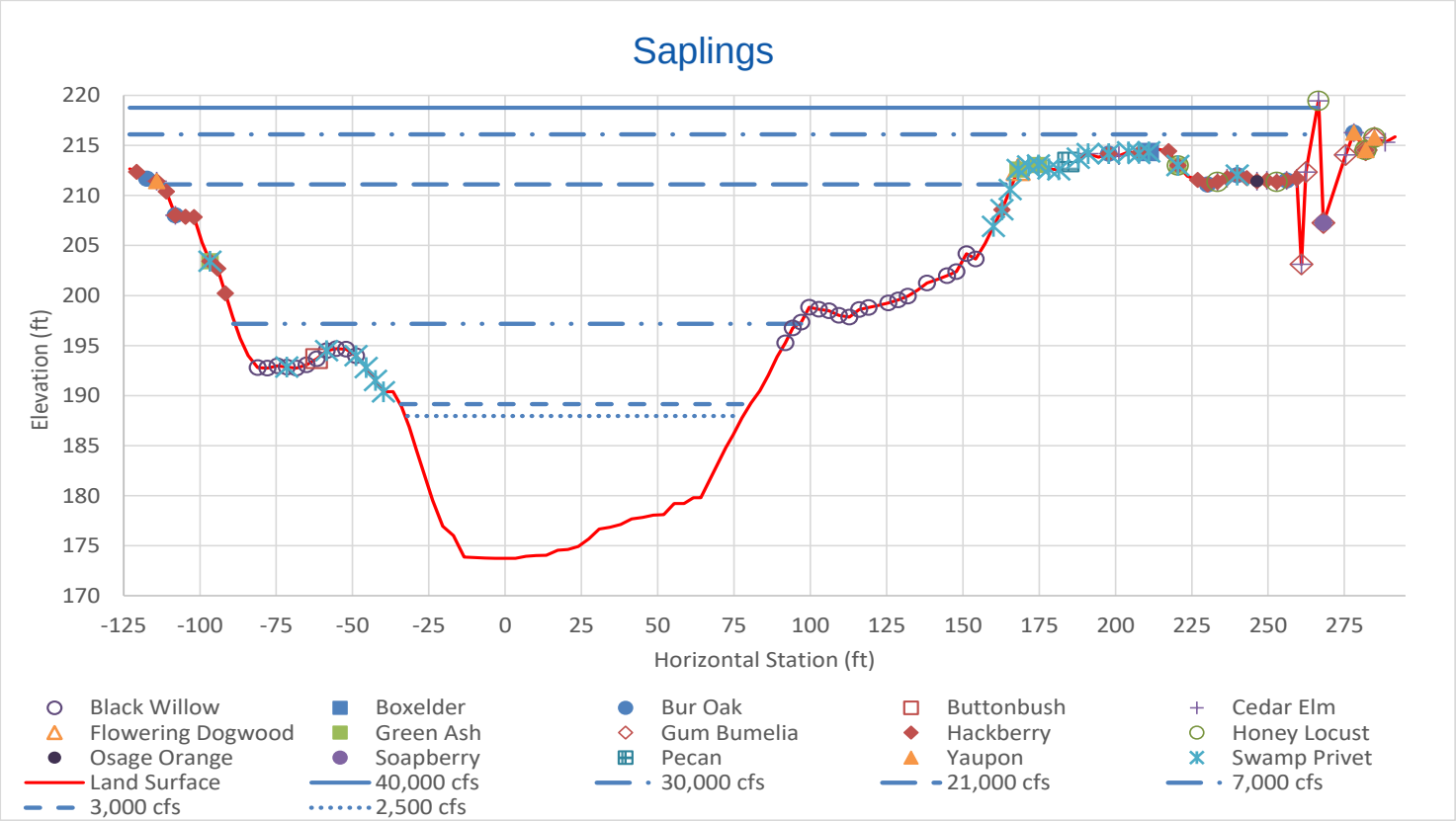
Riparian Recruitment Analysis

- Seedlings at Oakwood

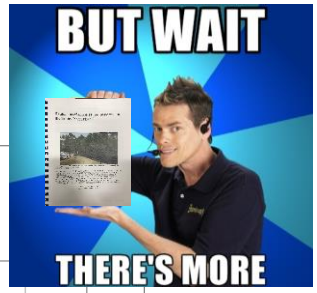


Riparian Recruitment Analysis

- Saplings at Oakwood



Sediment



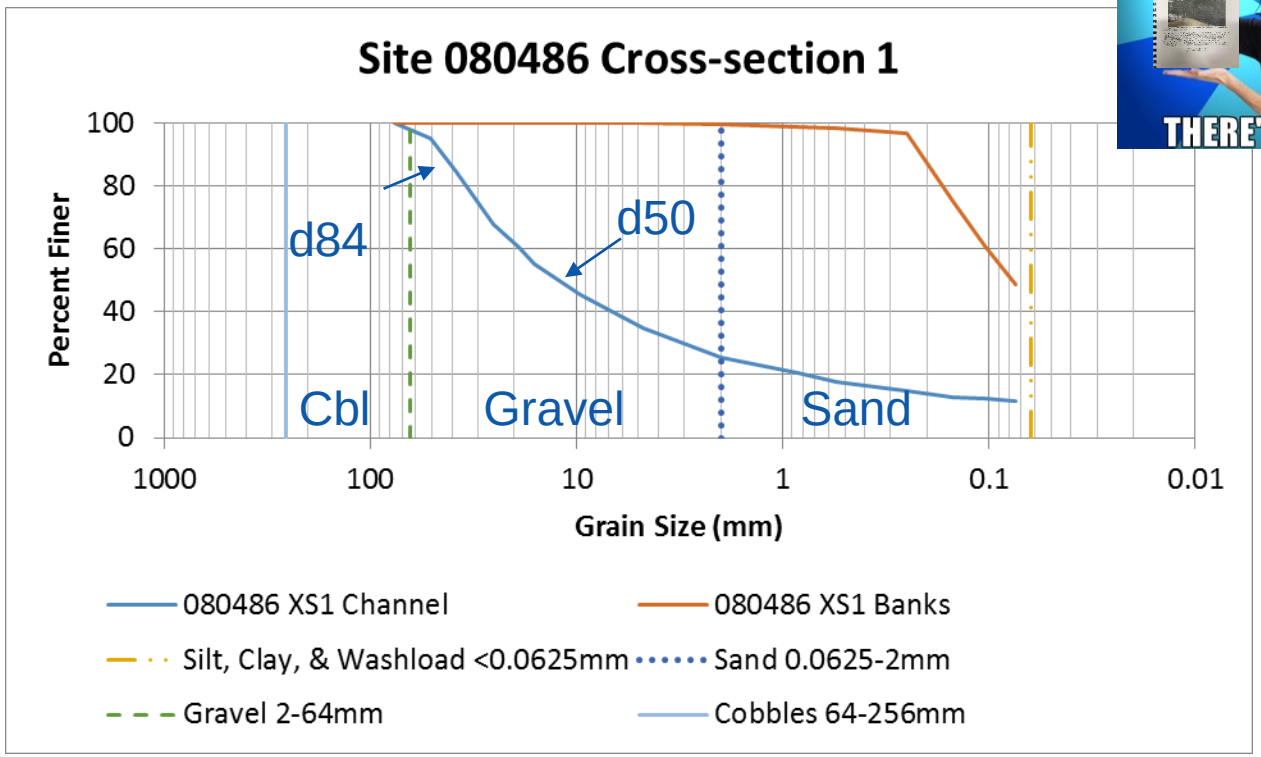
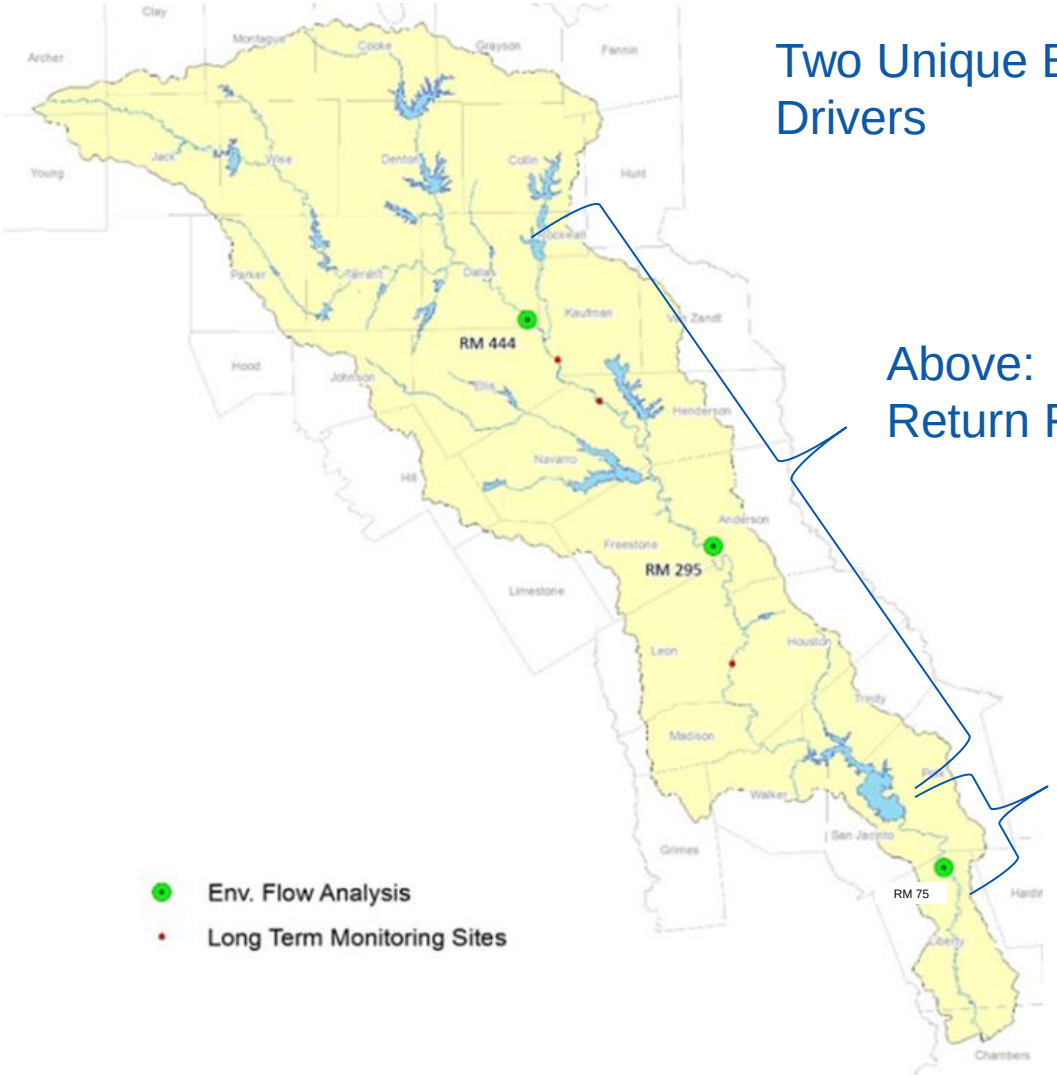


Table 1. Shear stress causing incipient motion

Shear stress (T) for transport of uniform sediments			
Sediment	D (in)	T (lb/sf)	Note
Cohesive compacted clay		***0.3***	*e=0.40*
Medium silt	0.001	0.001	
Fine sand	0.005	0.003	
Coarse sand	0.02	0.006	
Fine gravel	0.16	0.06	
Medium gravel	0.3	0.12	
Coarse gravel	0.6	0.25	
Very coarse gravel	1.3	0.54	
Small cobble	2.5	1.1	
Large cobble	5	2.3	

	Channel shear stress (lb/sf) and transportable grain size					
	XS3 Downstream		XS2 Mid		XS1 Upstream - Riffle	
Flow (cfs)	Shear stress	Grain size	Shear stress	Grain size	Shear stress	Grain size
300	0.010	Coarse sand	0.040	Coarse sand	1.070	Vry crs grvl*
1200	0.040	Coarse sand	0.080	Fine grvl	0.260	Coarse grvl
1420	0.050	Coarse sand	0.090	Fine grvl	0.250	Coarse grvl
2010	0.070	Fine grvl	0.110	Fine grvl	0.240	Med grvl
4740	0.14	Med grvl	0.140	Med grvl	0.240	Med grvl
6560	0.17	Med grvl	0.140	Med grvl	0.240	Med grvl
9300	0.19	Med grvl	0.140	Med grvl	0.230	Med grvl
12000	0.2	Med grvl	0.140	Med grvl	0.210	Med grvl
15000	0.21	Med grvl	0.140	Med grvl	0.220	Med grvl
		Note: * = erosion of compacted clay				

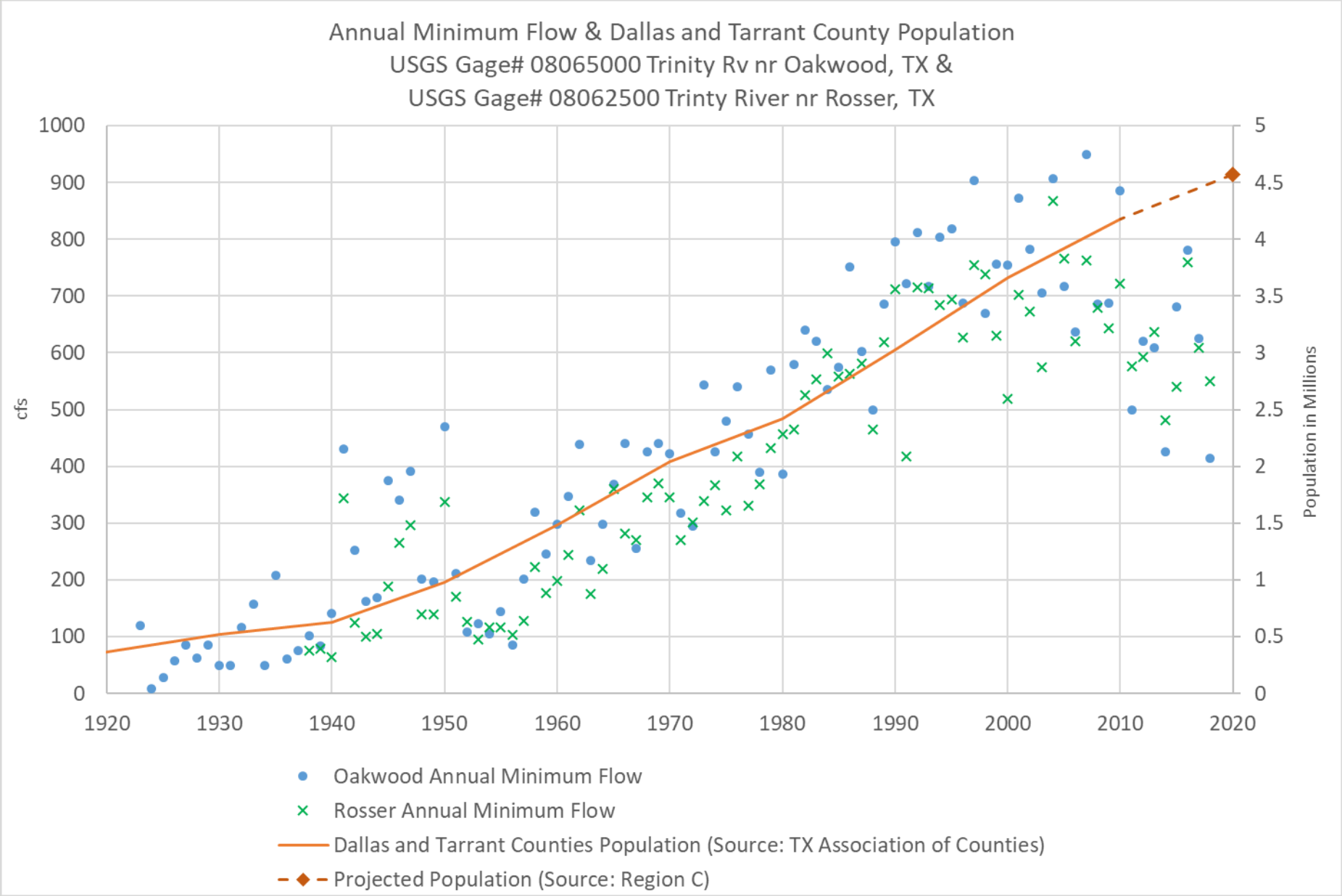
Baseflow Analysis

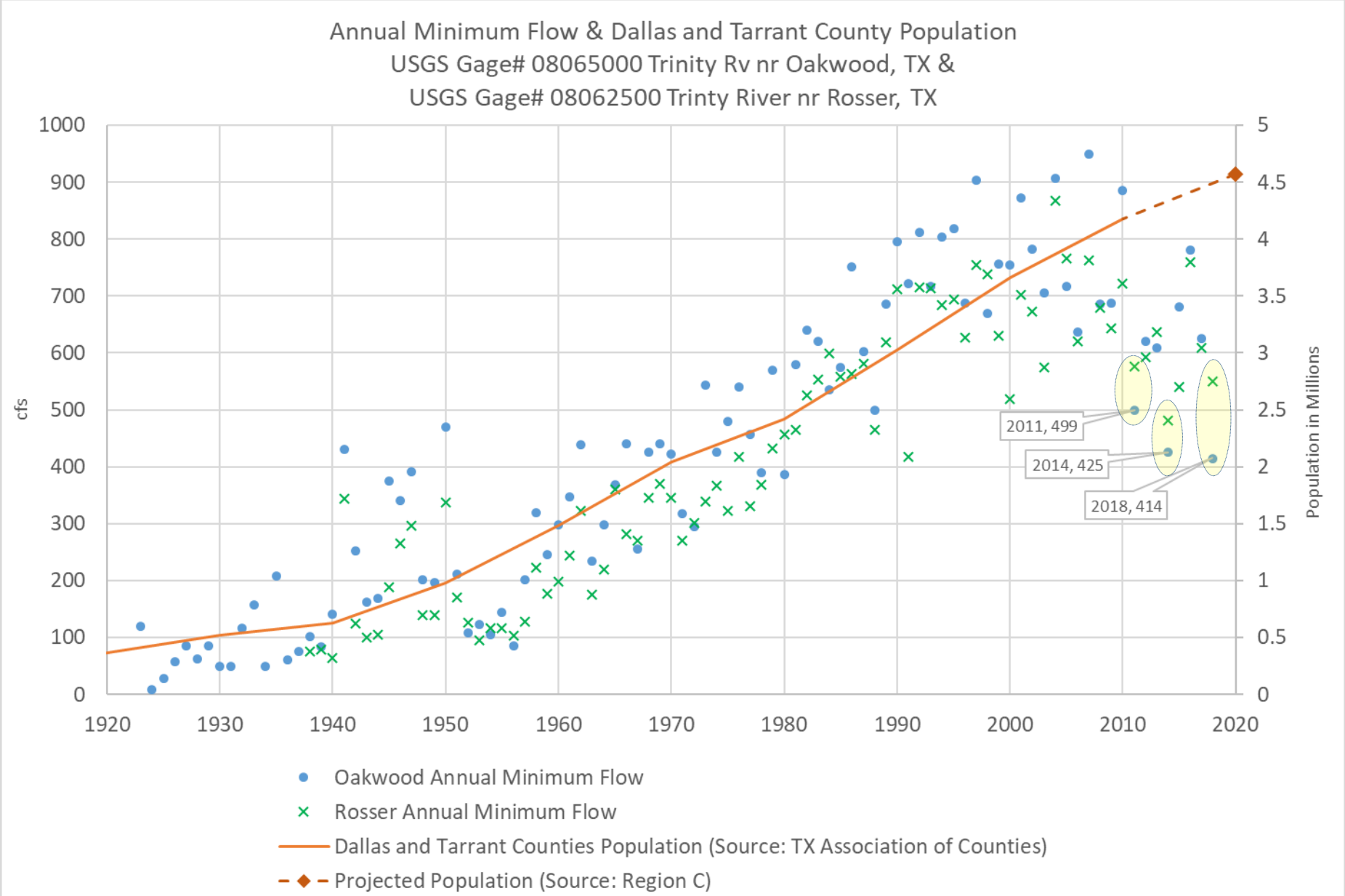


Two Unique Baseflow Drivers

Above:
Return Flows

Below:
Releases for Houston

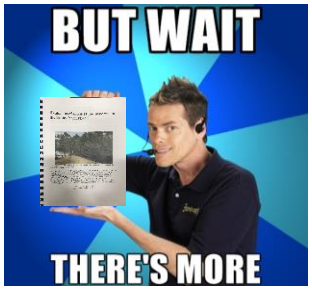

Annual Minimum Flow & Dallas and Tarrant County Population
USGS Gage# 08065000 Trinity Rv nr Oakwood, TX &
USGS Gage# 08062500 Trinty River nr Rosser, TX
cfs
Population in Millions
1000
900
800
700
600
500
400
300
200
100
0
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
1920
1930
1940
1950
1960
1970
1980
1990
2000
2010
2020
Oakwood Annual Minimum Flow
Rosser Annual Minimum Flow
Dallas and Tarrant Counties Population (Source: TX Association of Counties)
Projected Population (Source: Region C)


Annual Minimum Flow & Dallas and Tarrant County Population
USGS Gage# 08065000 Trinity Rv nr Oakwood, TX &
USGS Gage# 08062500 Trinty River nr Rosser, TX
cfs
Population in Millions
1000
900
800
700
600
500
400
300
200
100
0
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
1920
1930
1940
1950
1960
1970
1980
1990
2000
2010
2020
2011, 499
2014, 425
2018, 414
Oakwood Annual Minimum Flow
Rosser Annual Minimum Flow
Dallas and Tarrant Counties Population (Source: TX Association of Counties)
Projected Population (Source: Region C)

Baseflow Analysis

- Upper TR WQ Compact (Early 1970s)
  - NTMWD
  - Dallas
  - TRA
  - Fort Worth

- Return Flow Agreements (Overly Simplified Term: “Compact 30%”)
  - Protect downstream senior water rights and/or
  - Instream flows prior to SB3
  - SIMPLIFIED Water Rights/Agreements
    - Dallas 114,000 af/yr
    - NTMWD 32% of 63%
    - TRA 30%
    - Fort Worth 30%



WAM Scenarios

- Run 3
  - Full water rights utilization
  - 0 Return Flows
- Naturalized Flows
  - Pre-development conditions
- Compact 30%
  - Full water rights utilization
  - Added only “Compact 30%” return flows
- Trinity WAM Period of Record 1940-1996

WAM

	WAM CP 8WYGP								WAM CP 8TRQA			
	USGS Gage 08049500 West Fork Trinity River at Grand Prairie, TX											
	*Full Auth NO Return Flows (Run 3)				**Full Auth with ONLY Compact Minimum Return Flows (Run 3 Compact Mod)				Naturalized Flows			
	cfs	cfs	cfs	cfs	cfs	cfs	cfs	cfs	cfs	cfs	cfs	cfs
	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall
	Base	Base	Base	Base	Base	Base	Base	Base	Base	Base	Base	Base
	45	45	35	35	45	45	35	35	45	45	35	35
1940	399	102	592	192	442	150	631	235	740	442	1668	792
1941	739	1418	2733	681	780	1467	2775	722	1063	1843	3229	1421
1942	40	5122	475	267	81	5170	518	305	134	6065	811	770
1943	31	353	110	31	68	412	153	74	140	1161	400	90
1944	96	361	69	44	131	409	71	88	538	1247	243	287
1945	401	2275	218	35	449	2339	260	75	1137	3547	694	457
1946	511	512	216	289	564	561	195	330	1425	1063	493	868
1947	218	352	191	45	254	398	198	88	564	901	281	203
1948	310	248	64	1	359	298	87	43	852	513	215	31
1949	165	1741	317	90	210	1782	357	131	368	2716	748	612
1950	483	773	938	384	526	843	981	423	837	1879	1506	642
1951	33	48	102	6	75	96	145	47	130	266	688	23
1952	32	99	55	62	72	147	76	70	106	300	86	153
1953	14	137	69	28	55	179	61	76	65	466	130	481
1954	19	30	3	9	60	80	45	50	98	315	31	14
1955	15	77	56	13	55	125	74	54	51	318	320	152
1956	15	57	7	7	54	106	52	48	158	262	65	93
1957	33	3724	902	132	74	3777	944	173	317	7669	1189	669
1958	24	1410	31	97	58	1458	55	138	127	2527	107	153
1959	26	33	82	358	58	81	125	395	131	104	418	1680
1960	246	97	28	6	291	143	70	47	751	329	96	124
1961	127	100	176	40	169	149	218	82	520	393	440	133
1962	41	60	219	323	83	99	236	362	243	285	1024	1361
1963	28	138	12	0	66	185	54	41	68	625	46	0
1964	83	132	73	377	124	180	91	423	201	560	217	1153
1965	446	601	34	69	488	671	77	110	861	1328	155	297
1966	65	1078	193	89	105	1127	236	130	223	2675	463	342
1967	44	112	55	43	85	160	97	84	112	404	380	121
1968	178	848	82	47	201	913	125	88	517	2294	303	107
1969	147	1306	43	168	188	1355	85	209	492	2731	171	410
1970	319	1157	17	118	360	1205	59	158	634	2082	62	353
1971	663	56	83	295	710	104	126	330	1221	181	247	592
1972	151	86	0	119	192	134	42	160	283	697	0	319
1973	139	513	689	257	180	561	731	298	399	1101	1235	742
1974	170	99	138	884	211	147	179	926	337	362	300	2202
1975	681	1048	699	0	723	1097	740	41	1131	1555	1681	0
1976	85	336	83	98	124	376	115	138	249	929	313	468
1977	225	1425	6	2	275	1474	49	43	487	2492	44	8
1978	69	120	45	51	111	165	64	92	137	399	108	86
1979	163	916	345	26	206	983	388	65	342	2364	581	44
1980	102	369	4	150	145	358	22	158	334	526	18	440
1981	71	269	237	2084	115	322	303	2125	170	970	563	5441
1982	248	2673	1183	59	290	2721	1221	100	497	3659	1700	93
1983	90	213	190	80	131	261	233	121	231	589	473	126
1984	184	259	13	121	225	307	55	162	610	475	54	361
1985	119	523	60	103	160	571	103	131	543	1472	287	538
1986	191	386	813	98	233	435	841	127	500	1147	1375	372
1987	344	706	601	30	383	754	644	69	951	1448	1005	66
1988	69	77	77	94	112	126	120	120	211	217	267	139
1989	279	2155	2803	60	322	2217	2845	101	754	4901	4277	168
1990	301	6414	334	99	341	6463	377	140	570	7787	745	243
1991	2693	438	235	1431	2734	486	277	1472	3707	863	640	2402
1992	1834	1122	1019	164	1885	1171	1048	207	2462	1579	1399	328
1993	721	749	159	540	764	795	170	581	1256	1379	502	1355
1994	383	754	92	663	424	802	129	704	713	1360	350	1500
1995	285	1928	212	82	326	1976	241	123	481	2591	674	123
1996	274	145	112	471	315	182	153	513	514	309	200	1506
Mean	278	846	323	212	320	896	357	252	574	1556	627	590
% Years Target Met	75.4%	96.5%	80.7%	77.2%	100.0%	100.0%	98.2%	100.0%	100.0%	100.0%	94.7%	89.5%

	WAP CP 8TRDA								WAM CP 8TRQA			
	USGS Gage 08057000 Trinity River at Dallas, TX											
	*Full Auth NO Return Flows (Run 3)				**Full Auth with ONLY Compact Minimum Return Flows (Run 3 Compact Mod)				Naturalized Flows			
	cfs	cfs	cfs	cfs	cfs	cfs	cfs	cfs	cfs	cfs	cfs	cfs
	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall
	Base	Base	Base	Base	Base	Base	Base	Base	Base	Base	Base	Base
	50	70	40	50	50	70	40	50	50	70	40	5
1940	594	222	979	249	672	352	1085	344	1940	1601	3734	151
1941	989	1907	4218	756	1077	2047	4331	848	2439	3980	7225	236
1942	62	7948	849	336	147	8121	952	430	379	14540	2149	133
1943	39	638	141	33	108	788	225	118	265	3266	817	17
1944	243	682	81	59	311	818	125	155	1883	3879	474	52
1945	724	4024	412	126	807	4200	520	230	3659	9428	2300	150
1946	969	1112	630	485	1075	1254	680	575	4490	3638	2099	235
1947	494	510	516	48	559	640	528	134	1749	2126	1119	28
1948	561	476	163	0	642	633	251	51	2754	1693	678	
1949	422	2383	595	143	537	2502	697	241	1499	4838	1558	147
1950	980	1356	844	318	1055	1504	913	392	2975	4377	2906	184
1951	33	47	133	9	107	172	224	87	258	422	1708	3
1952	47	132	52	64	123	274	132	123	187	926	108	22
1953	27	376	58	18	111	484	77	105	168	1783	70	65
1954	37	118	7	17	128	264	102	107	258	738	154	8
1955	23	66	76	24	99	195	155	117	167	778	606	19
1956	28	111	0	14	106	245	90	87	292	484	45	9
1957	110	7661	1358	143	199	7701	1446	217	655	19481	2517	205
1958	183	2818	98	64	267	3025	178	150	714	7835	462	20
1959	123	114	123	649	211	226	211	777	601	340	1166	297
1960	423	119	111	0	536	217	229	67	1948	820	544	8
1961	365	259	267	62	461	397	373	151	1606	1207	808	23
1962	78	245	448	759	172	381	509	816	568	1074	2088	453
1963	36	282	12	0	109	412	119	79	168	1743	50	
1964	105	239	80	903	187	391	132	1022	396	1828	259	558
1965	712	1105	110	150	803	1277	212	264	2433	2948	598	93
1966	105	2268	305	160	181	2429	424	268	1033	8265	1035	59
1967	107	245	57	159	194	396	171	267	258	1423	989	30
1968	352	1463	123	93	421	1632	221	202	1191	6963	865	57
1969	194	2715	6	221	278	2878	36	319	1846	8285	351	65
1970	434	1557	60	262	515	1716	142	361	1842	5756	370	146
1971	1281	120	151	829	1375	262	256	928	4469	412	508	244
1972	178	167	7	296	247	294	100	399	578	1065	32	114
1973	401	1161	1497	893	483	1312	1574	1005	1447	4123	3635	325
1974	407	300	288	1526	490	427	407	1636	984	1405	941	696
1975	1433	2118	1166	0	1517	2268	1286	83	3176	4563	3131	
1976	237	831	214	153	330	954	323	261	564	2406	908	58
1977	416	2002	126	51	510	2126	227	160	1412	5983	344	10
1978	123	289	73	91	210	410	159	190	284	1104	194	15
1979	286	1666	388	30	370	1838	495	112	667	6173	864	3
1980	232	422	47	291	330	542	124	371	765	770	84	112
1981	112	729	946	3977	203	883	1080	4091	390	3059	2173	1435
1982	808	6924	2391	239	901	7075	2508	343	2415	11208	4348	32
1983	315	474	353	228	383	608	454	317	887	1350	935	59
1984	567	597	100	549	660	739	216	653	1749	1595	230	108
1985	538	1218	153	417	615	1368	260	517	1984	4715	930	162
1986	293	823	1319	384	377	968	1420	497	1959	3595	3529	136
1987	596	1222	891	240	664	1372	1000	350	3496	4143	2354	47
1988	187	237	364	225	259	386	472	323	786	614	641	34
1989	629	3656	4853	194	722	3819	4971	300	3098	10166	9591	46
1990	699	11449	487	168	773	11595	572	247	1827	20114	1626	35
1991	4705	1178	616	2309	4800	1313	736	2418	9705	2689	1396	534
1992	3182	2064	1836	818	3285	2214	1918	930	6806	3752	2926	148
1993	1471	1356	416	871	1566	1503	505	975	4723	4313	1711	339
1994	718	1668	522	2952	800	1818	637	3062	2148	4289	2890	637
1995	558	5160	431	80	650	5310	532	162	1204	8544	1293	17
1996	332	323	380	1505	416	463	499	1559	981	801	616	532
Mean	532	1603	578	450	616	1745	671	544	1739	4200	1538	164
% Years Target Met	86.0%	96.5%	91.2%	78.9%	100.0%	100.0%	98.2%	100.0%	100.0%	100.0%	98.2%	93.0%

	WAM CP 8TRQA								WAM CP 8TRQA			
	USGS Gage 08065000 Trinity River near Oakwood											
	*Full Auth NO Return Flows (Run 3)				**Full Auth with ONLY Compact Minimum Return Flows (Run 3 Compact Mod)				Naturalized Flows			
	cfs	cfs	cfs	cfs	cfs	cfs	cfs	cfs	cfs	cfs	cfs	cfs
	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall
	Base	Base	Base	Base	Base	Base	Base	Base	Base	Base	Base	Base
	340	450	250	260	340	450	250	260	340	450	250	260
1940	3982	2341	3426	1843	4211	2651	3670	2081	6293	5100	7260	4370
1941	5939	8449	11066	1057	6183	8764	11316	1292	8307	11603	15143	2986
1942	966	21435	3962	1523	1196	21791	4184	1765	2068	30205	5996	3866
1943	932	4422	2725	646	1148	4682	2966	776	1831	8754	4308	1465
1944	2242	11961	1969	244	2551	12269	2143	482	6490	17002	2934	870
1945	2108	24923	4867	852	2278	25267	5116	958	7504	30824	8039	3328
1946	5371	6765	5556	3916	5723	6967	5753	4153	10330	9572	7670	7860
1947	2816	4495	854	682	3042	4772	1021	912	6444	7297	2069	1274
1948	1164	5943	558	91	1332	6281	787	281	4451	9398	1398	116
1949	332	4322	2742	513	470	4616	2980	754	3172	9063	4287	2101
1950	5455	5263	1192	844	5722	5585	1379	1005	10494	9878	3907	2608
1951	408	583	977	130	653	881	1229	340	1098	1336	4287	242
1952	575	1108	931	120	802	1326	1155	335	1540	4950	1253	451
1953	747	4109	219	165	981	4281	387	385	1503	10566	313	927
1954	434	671	34	703	673	987	266	936	1196	2259	234	1248
1955	563	1036	254	183	790	1337	475	346	1120	2710	898	363
1956	270	607	54	125	498	911	251	349	921	1915	116	463
1957	734	9084	8088	3826	967	9405	8411	4044	1898	33852	10549	7543
1958	1216	12055	728	428	1447	12328	882	659	2467	18321	1483	1554
1959	2073	4171	2094	1440	2311	4501	2324	1698	4170	6054	3821	4802
1960	7391	931	337	223	7658	1203	588	427	12490	2408	1131	500
1961	8701	2585	1663	303	8987	2923	1902	471	11659	4687	3344	1297
1962	1089	1223	1080	1235	1335	1532	1319	1439	2440	3630	3733	6063
1963	230	1468	193	0	443	1535	392	222	553	4011	341	0
1964	702	514	274	1401	933	833	469	1542	1173	2712	561	7232
1965	2004	4627	872	255	2244	5202	1113	505	5348	10545	1677	1092
1966	516	11402	1059	450	744	11754	1302	699	1878	23271	2061	1072
1967	1389	658	425	1659	1672	980	676	1834	2362	2548	1963	6203
1968	4123	14566	1645	359	4308	14956	1880	606	6407	21338	3098	1083
1969	1496	14214	1149	487	1739	14548	1327	725	5062	21509	1754	1065
1970	1309	7467	698	1089	1540	7809	921	1297	4284	13733	1409	3429
1971	4102	299	794	2081	4500	613	947	2291	10848	917	1468	6052
1972	3302	453	82	656	3534	752	312	871	4674	1562	176	1949
1973	2844	8480	7122	5119	3079	8815	7343	5361	6062	14687	10069	9197
1974	5876	2082	912	7900	6112	2379	1123	8196	7513	4444	2087	15354
1975	6997	9101	3063	34	7236	9425	3321	242	9327	12356	5775	49
1976	1485	4724	3034	1581	1720	5019	3284	1827	2500	9537	4732	2883
1977	3494	8834	1146	101	3734	9154	1384	334	5494	14798	1657	210
1978	629	1472	282	290	864	1727	474	527	1341	3440	503	456
1979	1562	4699	2127	221	1804	5054	2379	436	3585	14831	3812	400
1980	1652	3214	276	289	1898	3505	468	442	3924	4545	466	1112
1981	440	1921	3666	4951	681	2245	3926	5224	1082	5454	9310	16357
1982	2496	8294	5741	653	2742	8621	5992	896	5804	12966	8513	878
1983	1934	3610	1297	401	2182	3919	1528	618	4482	5780	2646	892
1984	1998	2067	248	1432	2257	2354	478	1682	5829	5240	439	3018
1985	5792	5373	578	1964	6038	5705	817	2203	8989	10068	1501	5449
1986	5951	4936	5825	1479	6192	5265	6058	1735	8927	8839	8805	3891
1987	2990	4400	3386	285	3208	4725	3628	536	7711	8553	5544	689
1988	651	1243	393	1422	879	1538	637	1589	2484	2439	936	2089
1989	1542	12096	10947	323	1788	12514	11202	567	5671	21390	16234	595
1990	3359	30860	2724	1034	3573	31193	2951	1248	7092	39880	4668	1591
1991	16995	4486	1471	5985	17240	4807	1717	6241	23466	7838	3573	10957
1992	16025	10739	3479	955	16281	11064	3688	1207	21478	13490	5358	2262
1993	6044	8318	1205	3188	6298	8640	1436	3431	10239	12227	3144	7985
1994	8795	7952	1508	7662	9030	8279	1763	7915	10959	11667	4820	12762
1995	4751	20366	1940	800	4993	20690	2179	958	6106	24560	4029	1023
1996	1434	632	560	1381	1708	941	775	1577	3100	1527	1000	7616
Mean	3165	6387	2202	1385	3406	6699	2428	1605	5713	10774	3830	3389
% Years Target Met	94.7%	98.2%	89.5%	77.2%	100.0%	100.0%	100.0%	96.5%	100.0%	100.0%	94.7%	91.2%

*Most recent TCEQ Published WAM - Trinity River Basin WAM Run 3, Full Authorized Diversions, 100% Reuse, Last Updated 10/7/2014

**Run 3 Compact Mod was adapted from the most recent TCEQ Published WAM - Trinity River Basin WAM Run 3. Parameters: Full Authorized Diversions, Only NTMWD, TRA, FWVC, Dallas SS and Central Modified Reuse CI cards added, Created 20171026. Modification parameters include:

CI Cards from WAM Run 8 (min monthly discharges 2001-05) for the Upper Trinity River Water Quality Compact (Compact-NTMWD, TRA, TRWD, Dallas) were adjusted to reflect current permit and/or Compact agreements as follows:

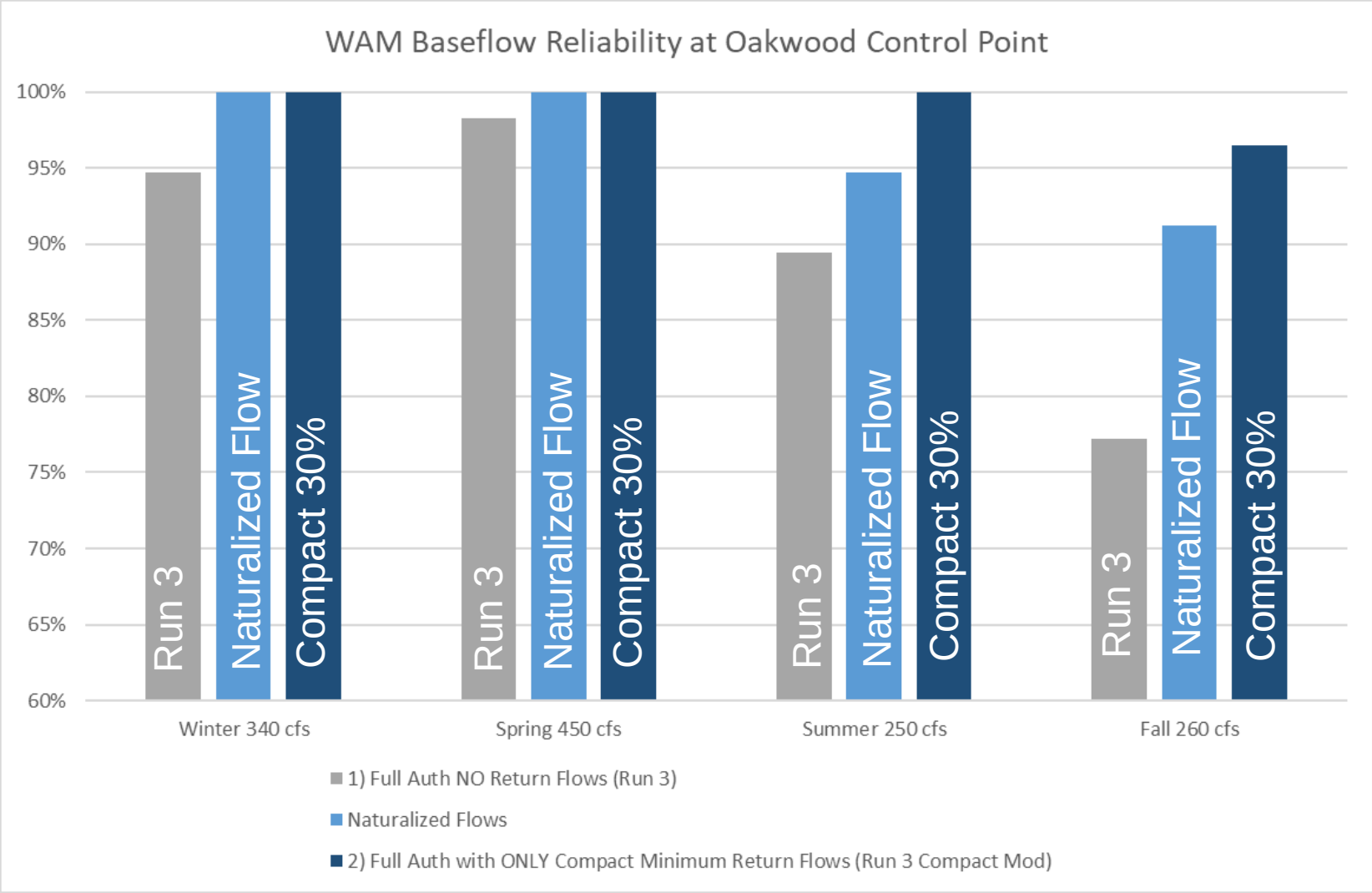
a) Dallas Central (B37) and Southside (B40) are required by permit to discharge 114,000 af/yr for Lake Livingston & Environmental Flows

b) North Texas Municipal Water District (NTMWD) is required by permit to let flow downstream 32% of their total in-basin derived supplies return flows (Control Points B63, B213, B71, B43, B42,& B76)

According to Region C (2016), 63% of NTMWD raw water supplies are from in-basin reservoirs, so selected NTMWD CI cards were adjusted to 63% for all values and control points (above), then 32% of that value was proportioned out based on the original monthly proportions.

c) TRA Central (B66), Ten Mile Creek (B135), and Red Oak Creek (B262) were adjusted to 30% per agreements with Houston to protect water in Livingston and the Compact

WAM Reliability



Results Summary

Table 12. SB3 flow assessment - 080444 Dallas

Site 080444 – Dallas Assessment of SB3 Flow Standards	Winter	Spring	Summer	Fall
	Subsistence			
	26 cfs	**37 cfs**	**22 cfs**	**15 cfs**
Flow is satisfied by existing or future water rights/return flow agreements*	Y 100%	Y 100%	Y 100%	Y 100%
SB2 WQ goals are met	N/a	N/a	N/a	N/a
	Base Flows			
	50 cfs	**70 cfs**	**40 cfs**	**50 cfs**
Flow is satisfied by existing or future water rights/return flow agreements*	Y 100%	Y 100%	Y 98.2%	Y 100%
SB2 WQ goals are met	N/a	DO – Y Temp – Y**	N/a	N/a
	High Flow Pulses			
Trigger Duration	**700 cfs 3 days**	**4,000 cfs 9 days**	**1,000 cfs 5 days**	**1,000 cfs 5 days**
Sediment and Channel Maintenance				
Moves dominant sediment through riffles	Y	Y	Y	Y
Moves dominant sediment through pools	Y	Y	Y	Y
Moves dominant riffle sediments through pools	N	N	N	N
Riparian trees				
Inundates riparian tree species	N	N	N	N
Inundates 50% of the riparian area	N	N	N	N
Inundates too long	N	N	N	N
If no inundation, what flow would begin to inundate riparian area	14,000 cfs (5 recent events >= 5 days)***			
Connection to Floodplain				
On-channel backwater habitats	N	N	N	N
Off channel backwater (trib and gullies) (OCBW)	N	N	N	N
If no connection, what flow would begin to connect OCBW	7,000 cfs (16 recent events >= 5 days)***			
What flow is overbank?	n/a			
National Weather Service Flood Triggers	Not Available			

Notes:
* - See Section 3.4 for additional information and methods, period of record, and reliability.
** - goal may not be met in some backwater locations during portions of an unusually hot summer afternoon
*** - For most recent 10 year period 2007-09-01 through 2017-08-31

Table 16. SB3 flow assessment - 080075 Romayor.

Site 080075 – Romayor Assessment of SB3 Flow Standards	Winter	Spring	Summer	Fall
	Subsistence			
	495 cfs	**700 cfs**	**200 cfs**	**230 cfs**
Flow is satisfied by existing or future water rights/return flow agreements*	Y 100%	Y 100%	Y 100%	Y 100%
SB2 WQ goals are met	N/a	N/a	N/a	N/a
	Base Flows			
	875 cfs	**1150 cfs**	**575 cfs**	**625 cfs**
Flow is satisfied by existing or future water rights/return flow agreements*	Y 100%	Yr 2020 –N 2030-70 -Y	Y 100%	Y 100%
SB2 WQ goals are met	No data	No data	No data	No data
	High Flow Pulses			
Trigger Duration	**8,000 cfs 7 days**	**10,000 cfs 9 days**	**4,000 cfs 5 days**	**4,000 cfs 5 days**
Sediment and Channel Maintenance				
Moves dominant sediment through riffles	Y	Y	Y	Y
Moves dominant sediment through pools	Y	Y	Y	Y
Moves dominant riffle sediments through pools	Y	Y	Y	Y
Riparian trees				
Inundates riparian tree species	N	N	N	N
Inundates 50% of the riparian area	N	N	N	N
Inundates too long	N	N	N	N
If no inundation, what flow would begin to inundate riparian area	18,000 cfs (26 recent events >= 5 days)**			
Connection to Floodplain				
On-channel backwater habitats	N	N	N	N
Off channel backwater (trib and gullies) (OCBW)	N	N	N	N
If no connection, what flow would begin to connect OCBW	12,000 cfs (35 recent events >= 5 days)**			
What flow is overbank?	70,000 cfs (3 recent events >= 5 days)**			
National Weather Service Flood Triggers	Minor – 86,650 cfs/Moderate – 93,125 cfs			

Notes: * - See Section 3.4 for additional information and methods, period of record, and reliability.
** - For most recent 10 year period 2007-09-01 through 2017-08-31

Summary of a Summary of a Summary

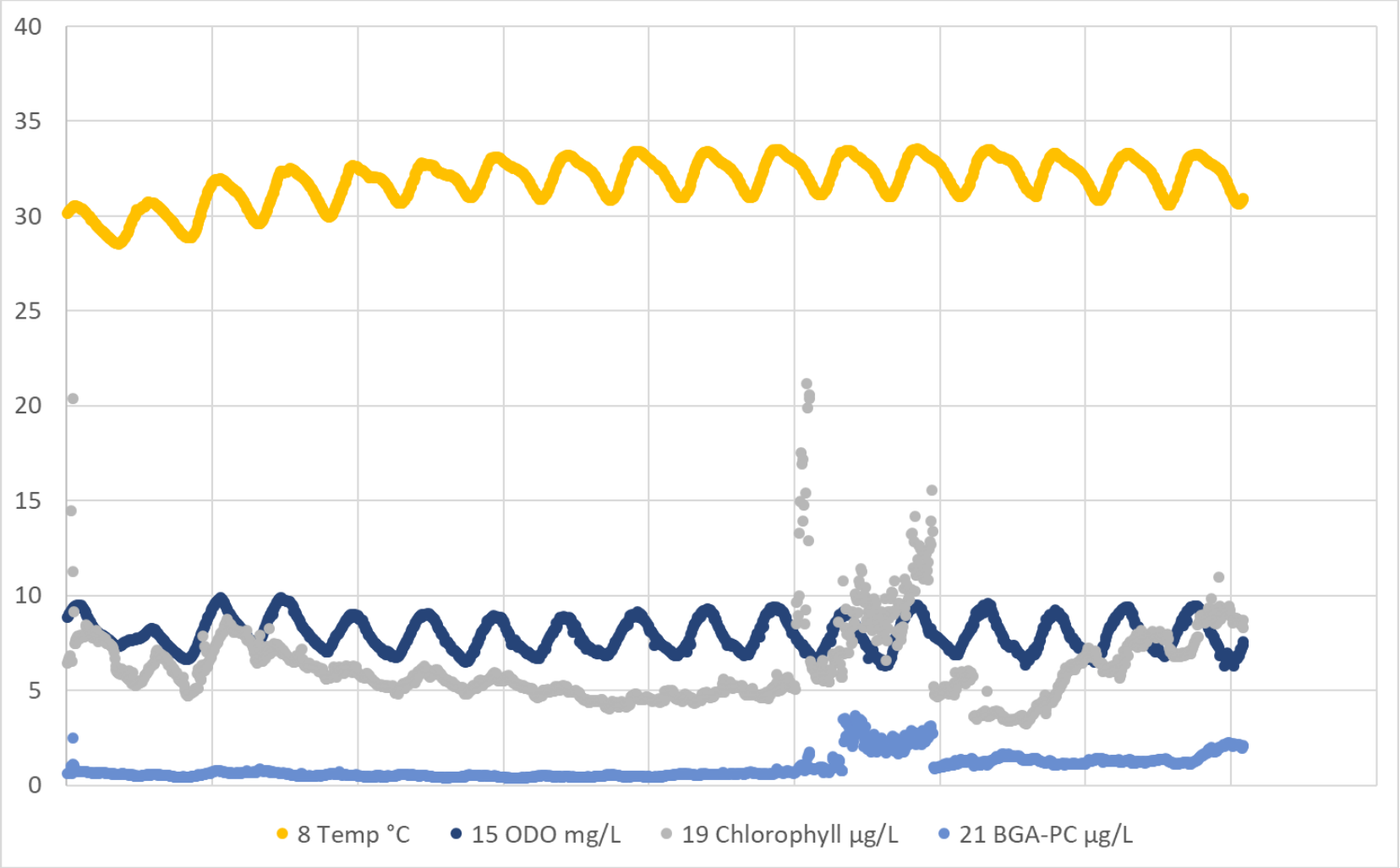
	GP	Dallas (444)	Oakwood	Romayor
	W | Sp | Su | F	W | Sp | Su | F	W | Sp | Su | F	W | Sp | Su | F
Subsistance (cfs)	19 | 25 | 23 | 21	26 | 37 | 22 | 15	120 | 160| 75 |100	495|700 |200 | 230
Satisfied by existing or future water rights/return flows?	Y	Y	Y	Y
Base	45 | 45 | 35 | 35	50 | 70 | 40 | 50	340 | 450 |250 |260	875| 1150 |575|625
Satisfied by existing or future water rights/return flows?	Y	Y	Y	Y - Post 2030
Pulses	300|1.2k |300|300	700| 4k | 1k | 1k	3k | 7k |2.5k | 2.5k	8k | 10k |4k | 4k
Sediment Regime Satisfiactory?	Y	Y	Y	Y
Riparian Inundated?	No Riparian Data	N	N	No Data
Overall Floodplain Connection?	N	N	N	N
What would connect Off Channel Back Water (OCBW)?	5,000	7,000	13,000	12,000
What would connect the Overbank?	30,000	25,000	30,000	70,000

- Base and subsistence flows are satisfied by contracts and water rights
- SB3 Pluses move sediment through the system
- SB3 Pulses do not inundate riparian areas or overbank

Phase III, Current Status

Phase III, Current Status

Phase III, Current Status



Phase III, Current Status

- Additional Survey
- >26 inches of rain at DFW in September /October (to date)

Many Thanks

Acknowledgements

This work could not have been completed without the hard work, blood, sweat, teeth, propellers, cell phones, drive shafts and grit given up by the dedicated field staff who persevere so we can all get to know the Trinity River a little better.

- Aqua Strategies
- Arroyo Environmental
- Baylor University
- RPS Espey
- TWDB
- TRA Field Crew
- TSJ BBASC/BBEST
- TPWD River Studies
- TCEQ CRP
- TCEQ

Questions?

SB3 Adopted Flow Standards

	8049500			
	Grand Prairie			
Season	Subsistence cfs	Base cfs	Pulse cfs	
Winter	19 cfs	45 cfs	Trigger	300 cfs
			Volume	3,500 af
			Duration	4 days
Spring	25 cfs	45 cfs	Trigger	1,200 cfs
			Volume	8,000 af
			Days	8 days
Summer	23 cfs	35 cfs	Trigger	300 cfs
			Volume	1,800 af
			Days	3 days
Fall	21 cfs	35 cfs	Trigger	300 cfs
			Volume	1,800 af
			Days	3 days

	8049500			
	Dallas			
Season	Subsistence cfs	Base cfs	Pulse cfs	
Winter	26 cfs	50 cfs	Trigger	700 cfs
			Volume	3,500 af
			Days	3 days
Spring	37 cfs	70 cfs	Trigger	4,000 cfs
			Volume	40,000 af
			Days	9 days
Summer	22 cfs	40 cfs	Trigger	1,000 cfs
			Volume	8,500 af
			Days	5 days
Fall	15 cfs	50 cfs	Trigger	1,000 cfs
			Volume	8,500 af
			Days	5 days

	8065000			
	Oakwood			
Season	Subsistence cfs	Base cfs	Pulse cfs	
Winter	120 cfs	340 cfs	Trigger	3,000 cfs
			Volume	18,000 af
			Days	5 days
Spring	160 cfs	450 cfs	Trigger	7,000 cfs
			Volume	130,000 af
			Days	11 days
Summer	75 cfs	250 cfs	Trigger	2,500 cfs
			Volume	23,000 af
			Days	5 days
Fall	100 cfs	260 cfs	Trigger	2,500 cfs
			Volume	23,000 af
			Days	5 days

	8066500			
	Romayor			
Season	Subsistence cfs	Base cfs	Pulse cfs	
Winter	495 cfs	875 cfs	Trigger	8,000 cfs
			Volume	80,000 af
			Days	7 days
Spring	700 cfs	1150 cfs	Trigger	10,000 cfs
			Volume	150,000 a
			Days	9 days
Summer	200 cfs	575 cfs	Trigger	4,000 cfs
			Volume	60,000 af
			Days	5 days
Fall	230 cfs	625 cfs	Trigger	4,000 cfs
			Volume	60,000 af
			Days	5 days

Instream Flow Studies

Instream Flow Studies

Project Planning & Recon

2011 & 2013 Longitudinal (435 miles)

Water Rights Analysis (WAM)

	WAM CP 8WYGP				WAP CP 8TRDA				WAM CP 8TROA			
	USGS Gage 08049500 West Fork Trinity River at Grand Prairie, TX				USGS Gage 08057000 Trinity River at Dallas, TX				USGS Gage 08065000 Trinity River near Oakwood			
SB3 Base Flow (cfs)	45	45	35	35	50	70	40	50	340	450	250	260
Season	W	Sp	Su	F	W	Sp	Su	F	W	Sp	Su	F
Full Auth. NO Return Flows (Run 3)	75.4%	96.5%	80.7%	77.2%	86.0%	96.5%	91.2%	78.9%	94.7%	98.2%	89.5%	77.2%
Naturalized Flows	100.0%	100.0%	94.7%	89.5%	100.0%	100.0%	98.2%	93.0%	100.0%	100.0%	94.7%	91.2%
Run3 Compact Mod	100.0%	100.0%	98.2%	100.0%	100.0%	100.0%	98.2%	100.0%	100.0%	100.0%	100.0%	96.5%

Above Livingston Average 99%

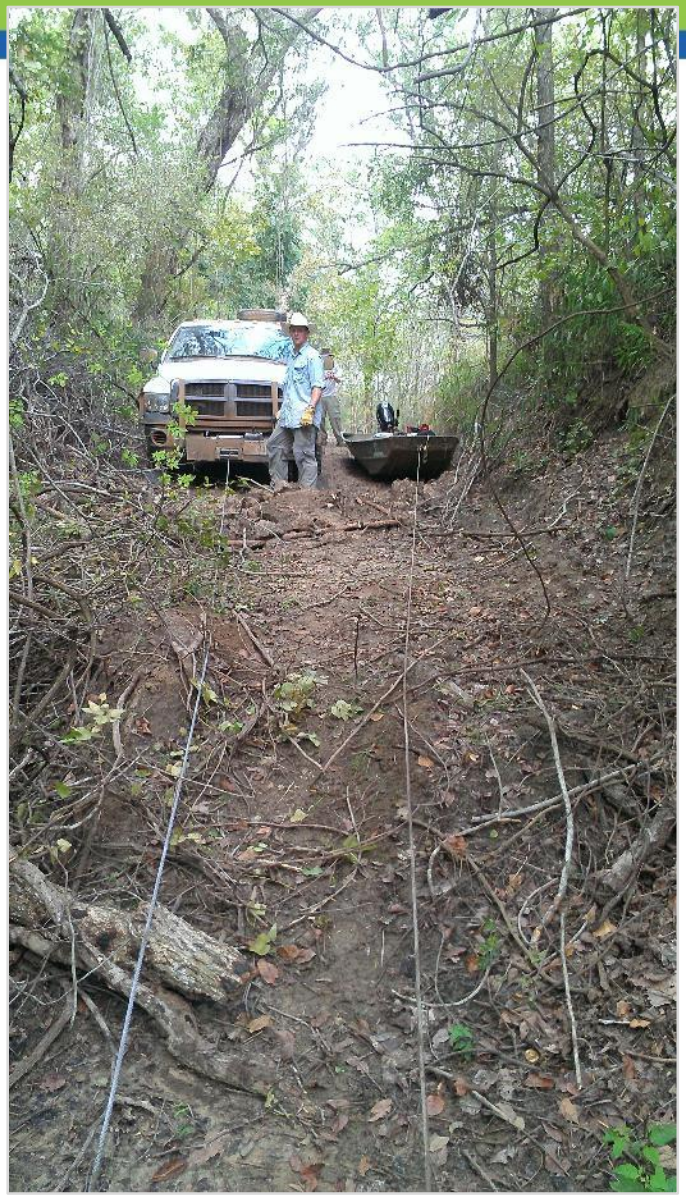
Below Livingston Average 96%

	SB3 Baseflow Targets at USGS Gage 08066500 Trinity River at Romayor, TX			
	Winter	Spring	Summer	Fall
Region H Water Demands (yr)	875	1150	575	230
2020	953	1045	1159	806
2030	1176	1289	1430	994
2040	1265	1387	1539	1070
2050	1298	1424	1580	1098
2060	1315	1442	1600	1112
2070	1327	1456	1615	1122

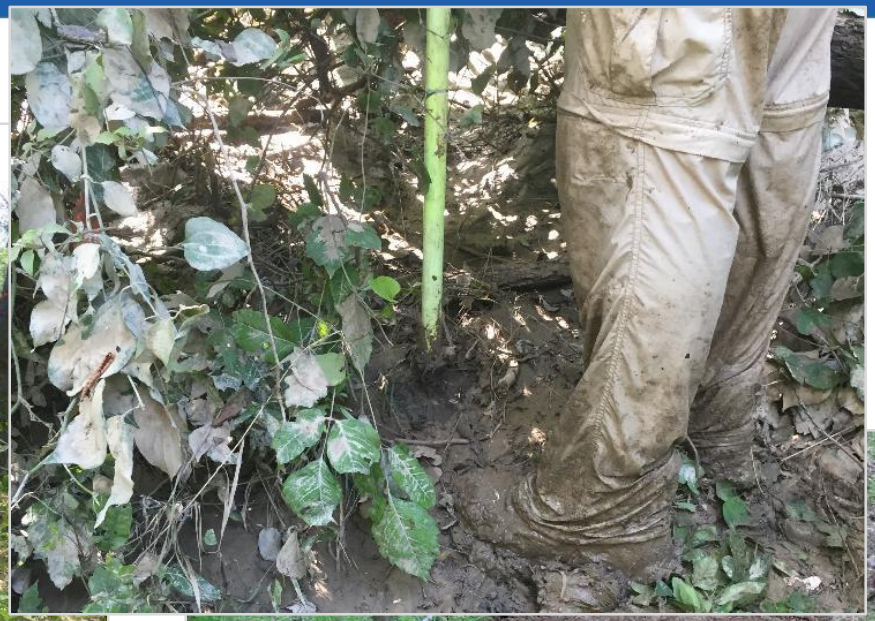
Project Planning & Recon

2012 Supplemental Biological

SB3 Phase I & II Data Collection

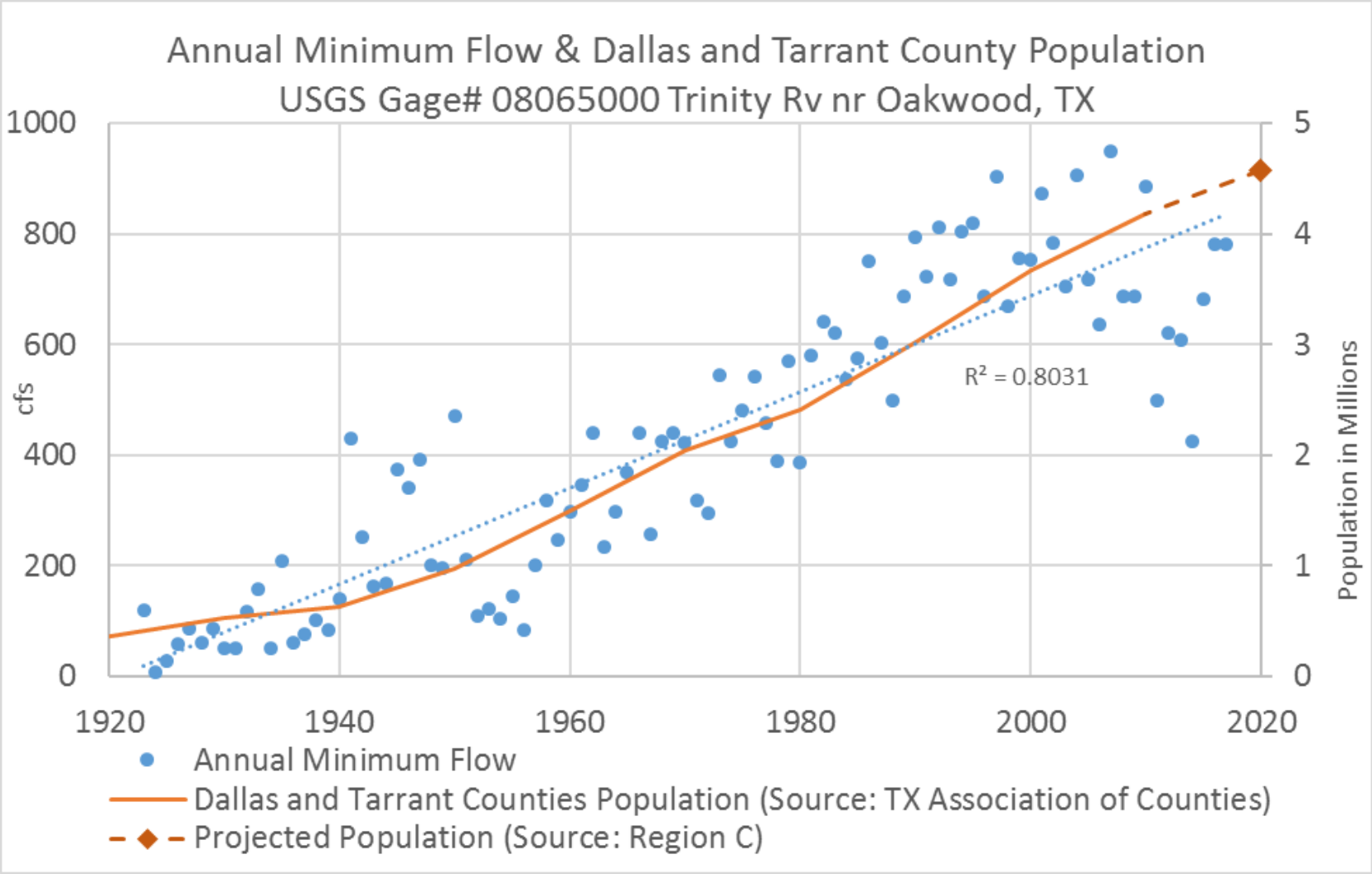


Hardened Bench Marks (LB and RB)



Survey Grade RTK GPS Data

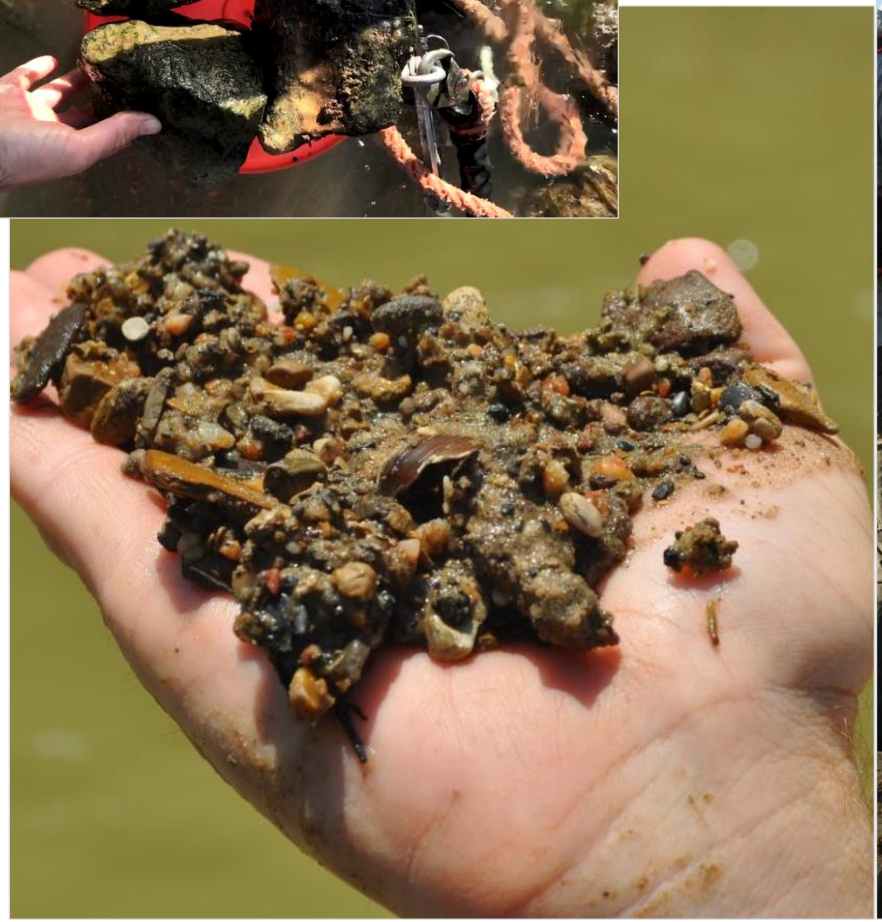
Baseflow Analysis



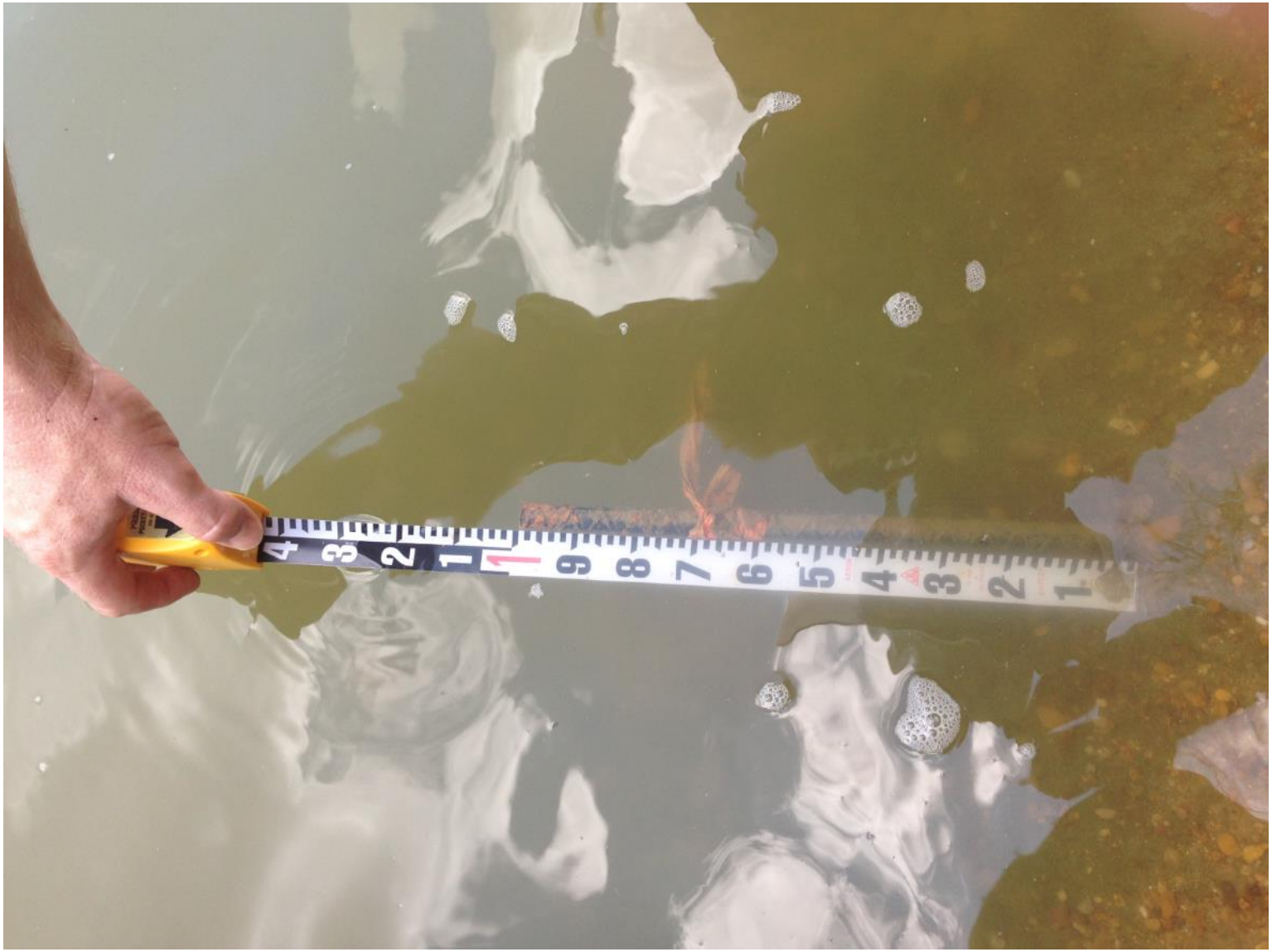
Survey Grade Topo and Bathymetry

Bathymetry

Sediment Samples



Installation / Monitoring of Bank Pins



Riparian Survey

Pressure Transducer Installation

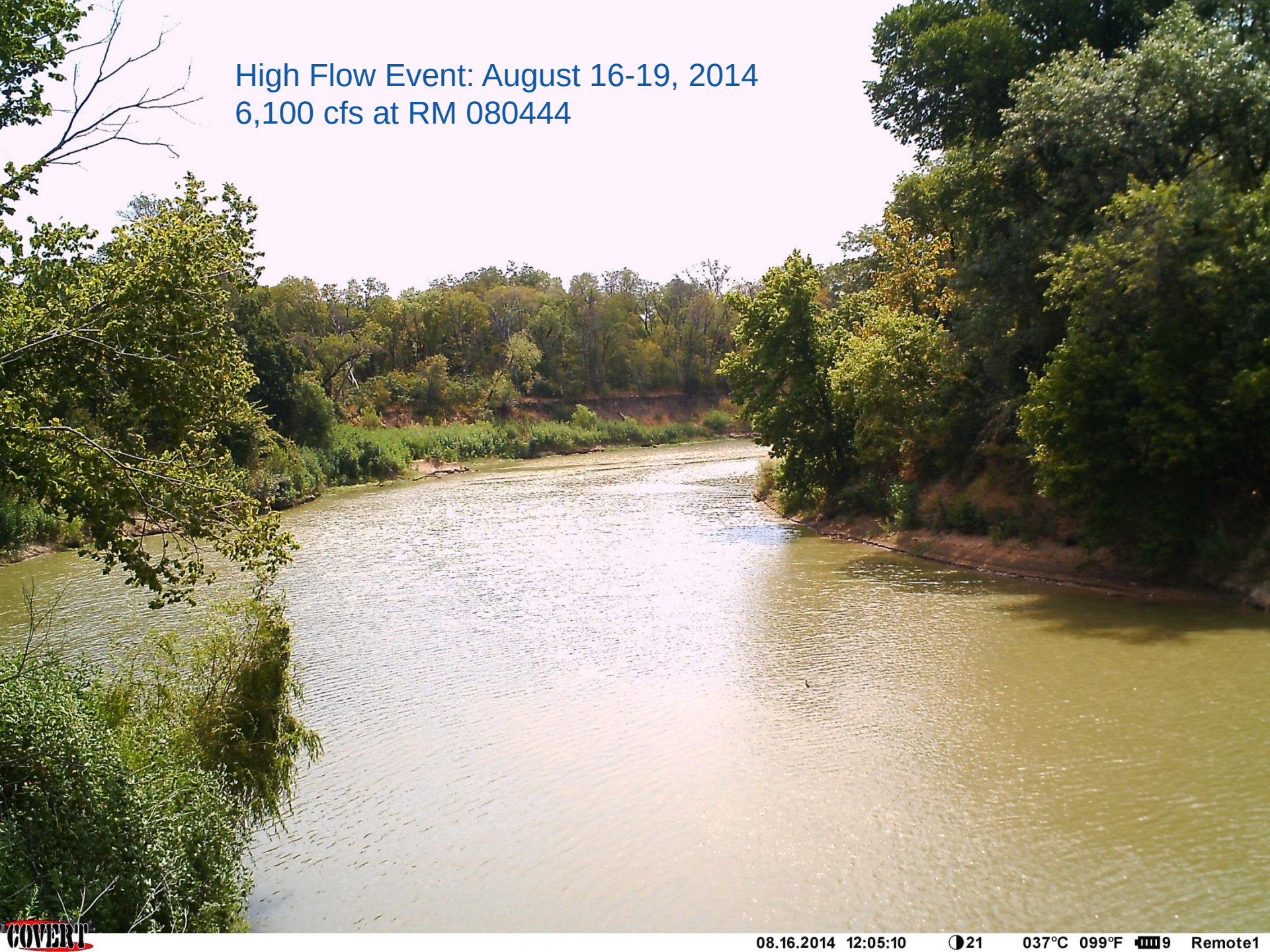
Water Quality

Field Photographs

080444 – Relic USACE Lock

080444 – Relic USACE Lock

Automated Game Camera Installation


High Flow Event: August 16-19, 2014
6,100 cfs at RM 080444
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COVERT
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Remote1

COVERT
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22
020°C 068°F
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Remote1

COVERT
08.17.2014 16:00:37
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Remote1

COVERT
08.17.2014 16:09:04
22
019°C 066°F
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Remote1

COVERT
08.17.2014 17:09:47
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021°C 070°F
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Remote1

COVERT
08.17.2014 18:03:55
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COVERT
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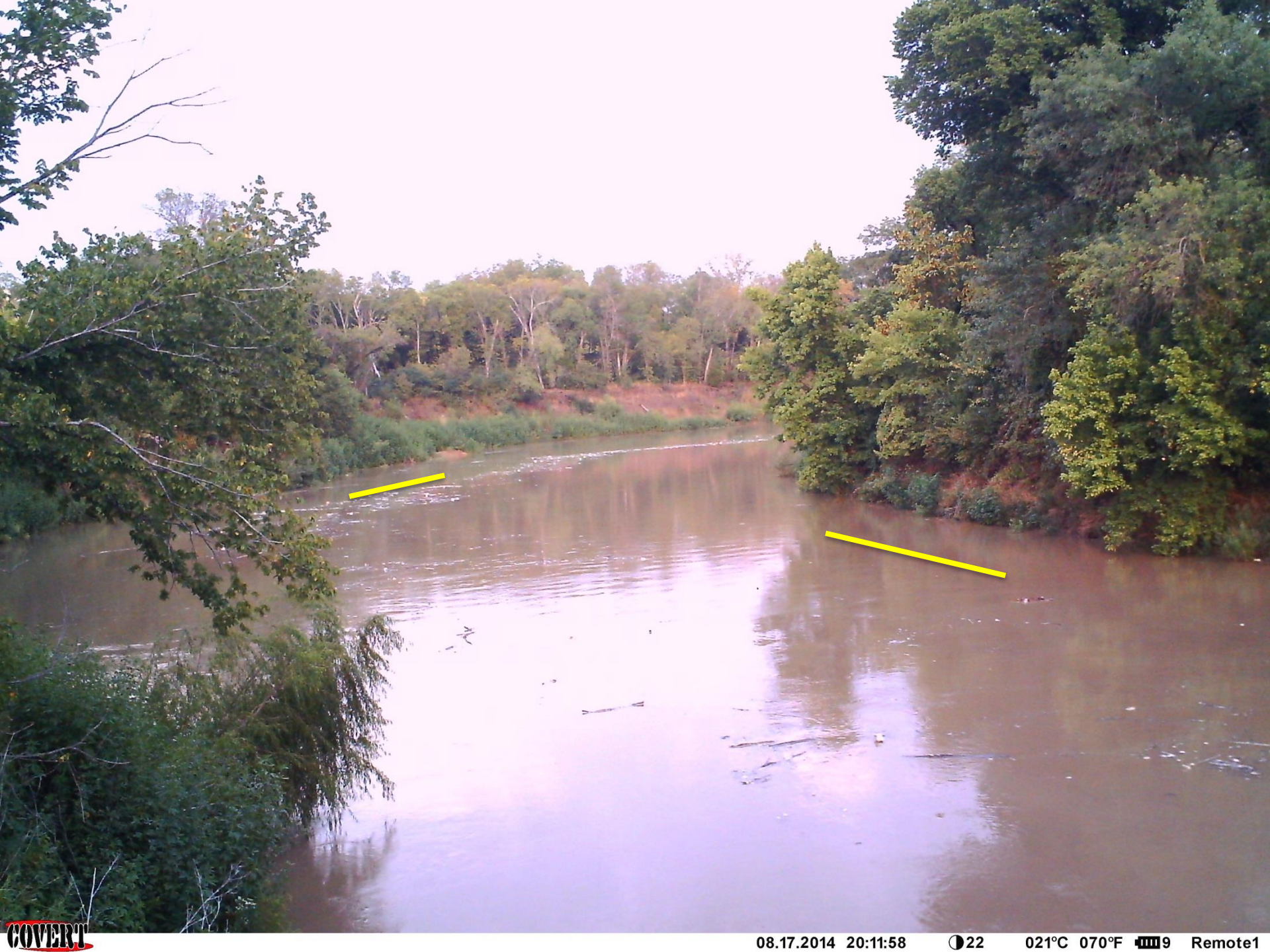
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Remote1

COVERT
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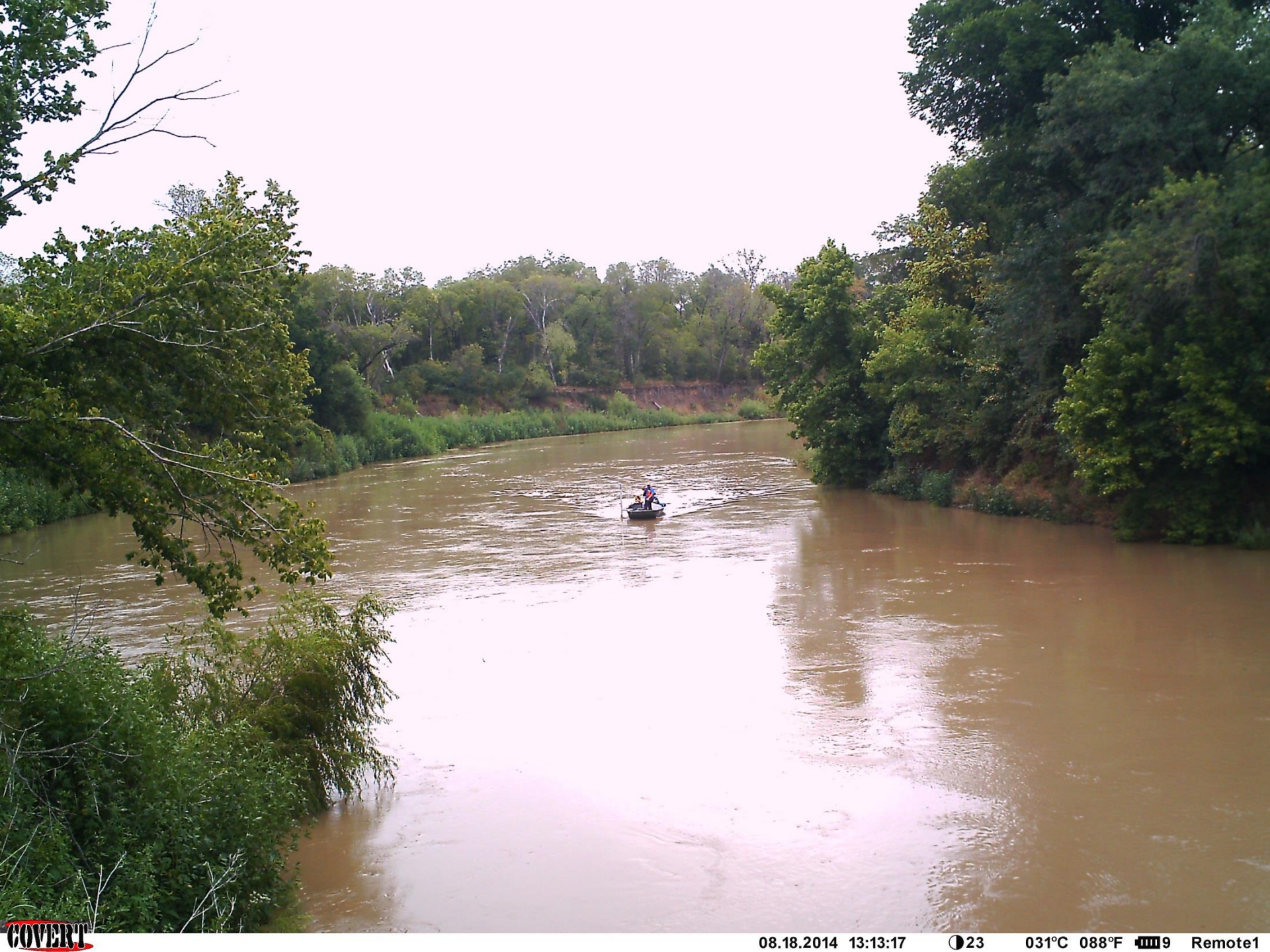
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COVERT
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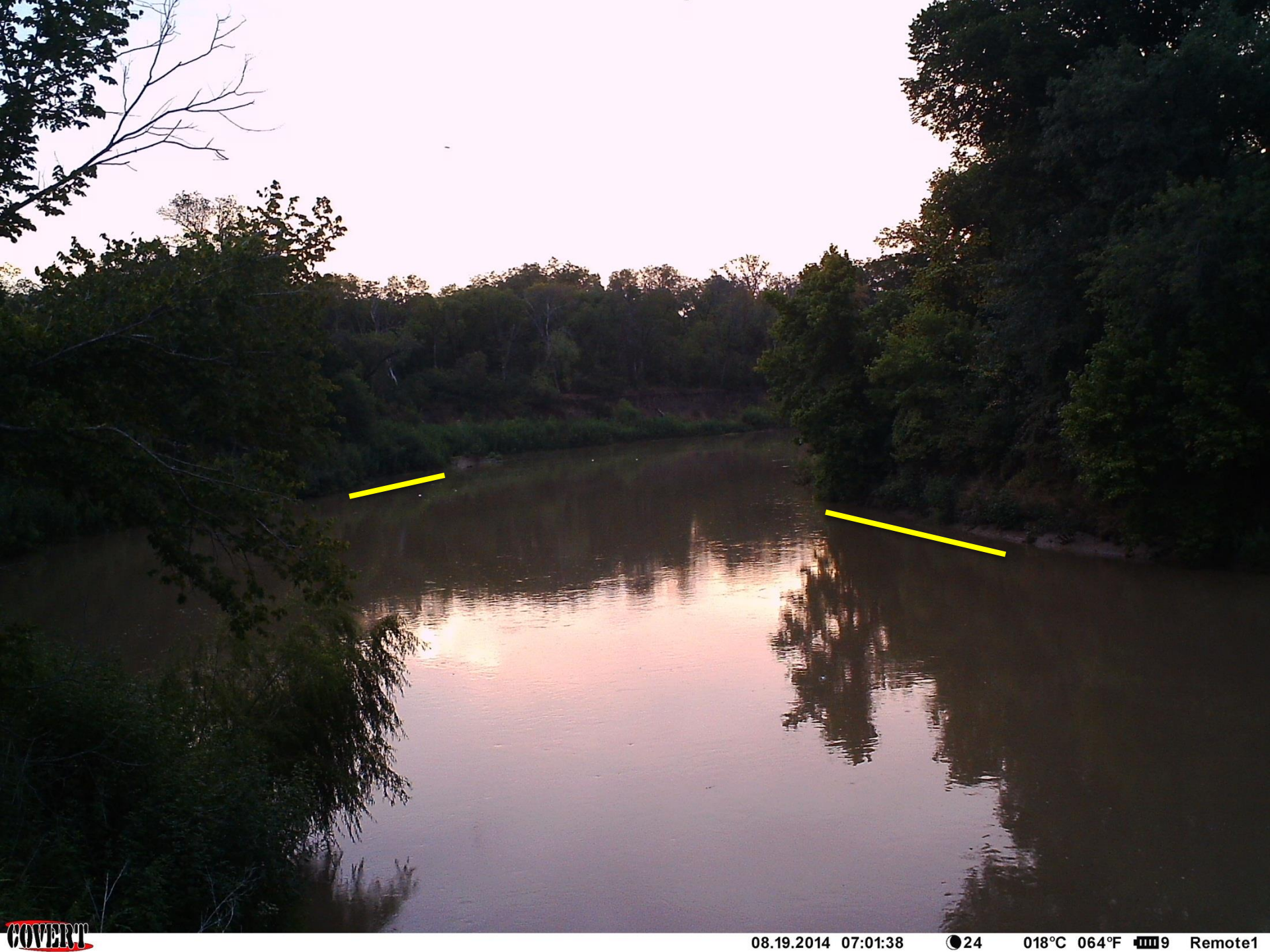
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Remote1

COVERT
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Remote1

COVERT
10.06.2014 20:22:04
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016°C 061°F
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Remote1

COVERT
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