



Water Quality Monitoring Report Gem County Drains April 15 through October 15, 2008



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ISDA Technical Report Summary W-32

March 2009

Introduction

At the request of the Lower Payette River Watershed Advisory Group (LPR WAG) and the Gem Soil and Water Conservation District (GSWCD), the Idaho State Department of Agriculture (ISDA) conducted a water quality monitoring program within Gem County, Idaho. The request asked for reevaluation of eight drains that reside in Gem County and discharge into the Lower Payette River (LPR). These same drains were monitored by ISDA in 1997. The drains (Figure 1) are as follows: Big 4 (B-4), Mesa (MS-1), Beacon (BC-1), Silverleaf (SL-1), Sand Hollow (SH-1), County Line (CL-1), Seven Mile Slough (7MS), and Tunnel No. 7 (T-7).

With the exception of Beacon Drain (BC-1), monitoring began on April 15, 2008 and ended on October 15, 2008. BC-1 monitoring started on April 15th, but due to denied access to the property the last sample was collected on

September 3, 2008. Samples were collected on a bi-weekly schedule for suspended sediment concentration (SSC), total phosphorus (TP), dissolved phosphorus (DP), and Escherichia Coli (*E-coli*). On-site measurements included discharge (CFS), temperature (°C), dissolve oxygen (DO), conductivity, total dissolved solids, and pH. All inorganic and on-site results can be found in Appendix A.

All of the sampling sites in 2008, except BC-1, were established at the same location as in 1997. ISDA collected water samples directly from BC-1 in 1997.

In 2008, a landowner informed ISDA that BC-1 does not discharge directly to the Lower Payette River. BC-1 actually supplies water to a man made wetland that was developed along the eastern edge of the LPR by several federal agencies. The outlet from the wetland (pg.1 photo) is where ISDA collected water quality samples in 2008. The

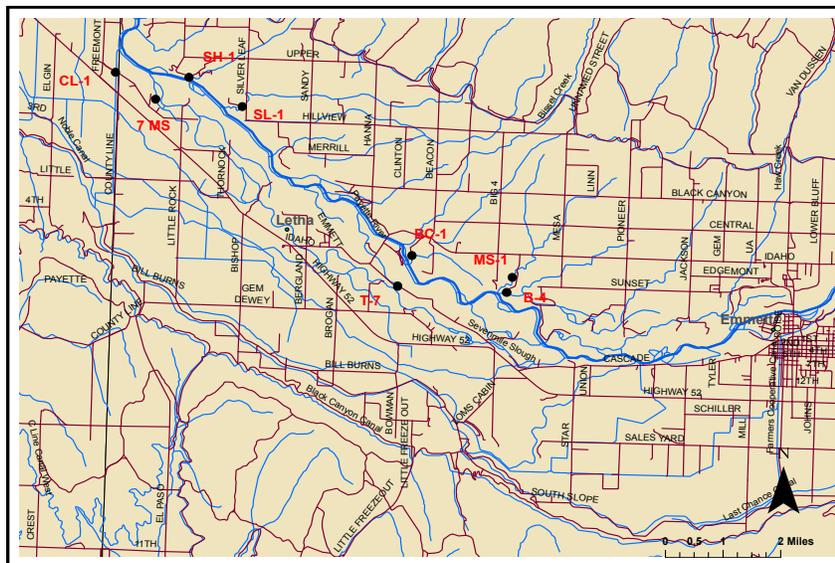


Figure 1. Gem County monitoring sites.

wetland discharges through a culvert under a dirt road and into a narrow grass waterway. The wetland's discharge water then merges with the lower part of Bissel Creek and discharges into a large beaver complex along the Payette River.

Results

Dissolved Oxygen (DO)

Two drains Big 4 (B-4) and Beacon (BC-1) exhibited DO levels that were below the state water quality criteria of 6.0 mg/L (Figure 2).

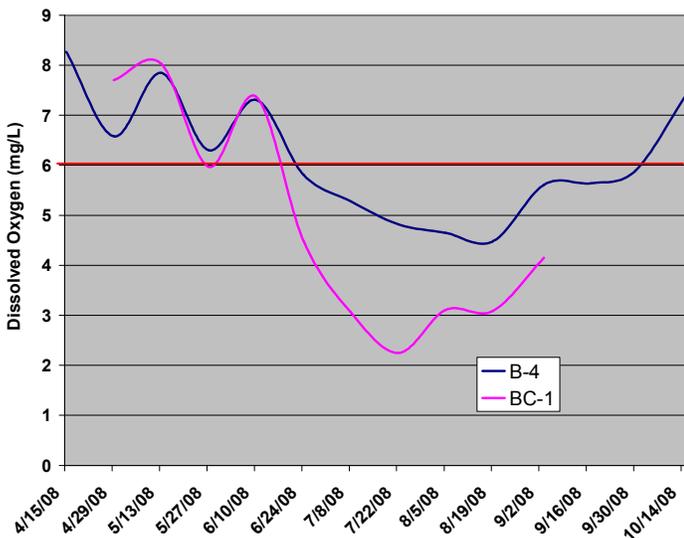


Figure 2. Dissolved Oxygen levels for B-4 and BC-1.

B-4's substrate becomes covered with aquatic vegetation as the season progresses. Since this site was usually sampled early in the morning the resulting low DO levels are probably a result of overnight plant respiration. BC-1's low DO is a result of the activities occurring within the wetland. Warm, slow moving water with heavy aquatic vegetation resulted in hypoxic conditions (low oxygen).

Discharge

Average discharge rates for the 2008 season were higher than the 1997 average discharge at B-4, MS-1, SH-1, and SL-1 (Figure 3). Discharge measurements at BC-1 were taken at two different locations in 1997 and 2008 and the average discharge was almost identical for both years 9.68 CFS and 9.60 CFS respectively.

The largest decrease in average discharge was seen at 7-MS where the average discharge in 1997 was 42.3 CFS and dropped to 24.2 CFS in 2008. The two other sites that showed decreases were CL-1 and T-7 (Figure 3).

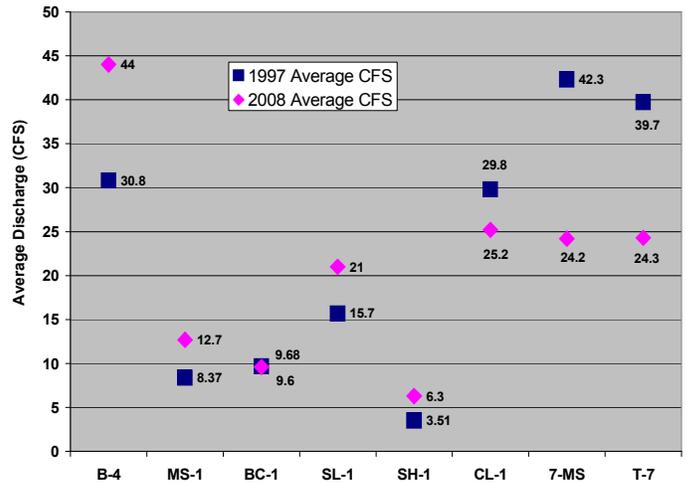


Figure 3. Average discharge rates.

Suspended Sediment Concentration (SSC) and Total Suspended Solids (TSS)

Two different analytical tests are being compared for the suspended sediment concentrations from 1997 and 2008. In 1997, total suspended solids (TSS) analytical technique was used while the suspended sediment concentration (SSC) analytical technique was used in 2008. U.S. Geological Survey research indicates that TSS and SSC values vary significantly when the particle size is > 0.062 mm (very fine sand) or the percentage of sand in the sample exceeds approximately one-quarter of the dry sediment mass (USGS, 2000).

Overall, the data compares favorably when comparing TSS values from 1997 and SSC values in 2008 (Figure 4). The largest percent difference occurred at SL-1 which showed a 28% reduction in average sediment concentration from 1997 to 2008.

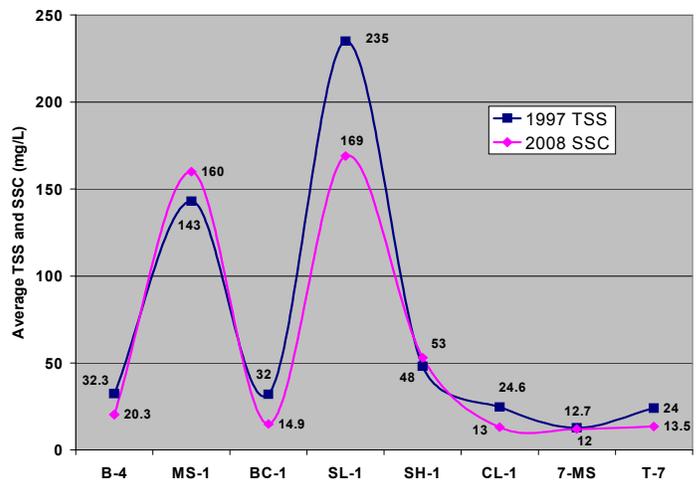


Figure 4. TSS (1997) compared to SSC (2008).

When comparing sediment loads (discharge x concentration) only two sites showed increases in sediment loads from 1997 to 2008 (Figure 5). Mesa (MS-1) and Sand Hollow (SH-1) both showed increased sediment loads in 2008. MS-1 had increases in both sediment concentration and discharge while SH-1 had an increase in discharge for 2008. The lower average sediment loading at CL-1, 7-MS, and T-7 were all based on a much lower average discharge (Figure 3 and 5).

Overall, the average sediment load for all eight sites was lower in 2008 (45,565 lbs/day) by 695 lbs/day when compared to 1997 data (46,260 lbs/day).

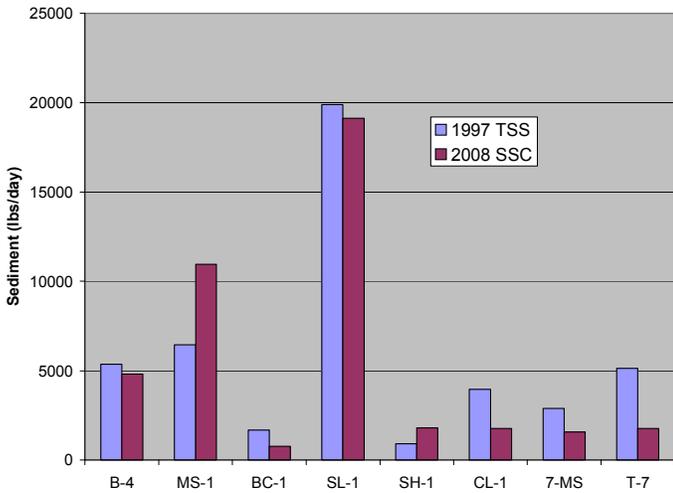


Figure 5. Average sediment load (lbs/day).

Total Phosphorus (TP)

With the exception of two sites, the average TP concentrations in 2008 were very comparable to the TP concentration in 1997 (Figure 6). MS-1 and BC-1 showed an average TP increase of 38% and 32% respectively, from 1997 to 2008.

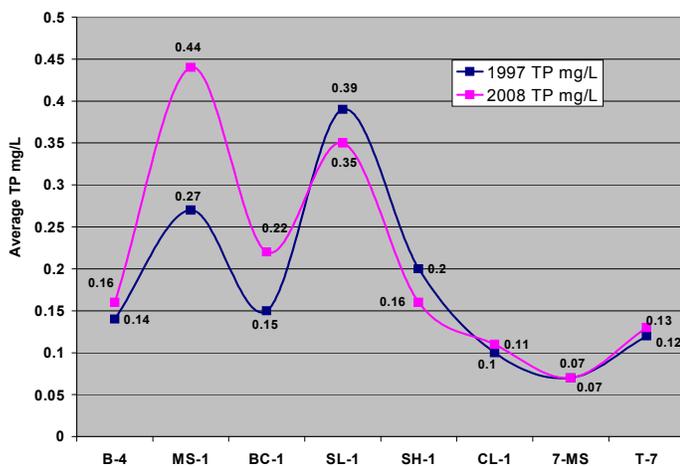


Figure 6. Average TP concentrations.

The average TP loading (lbs/day) showed an increase for the 2008 monitoring season at five of the eight stations (Figure 7). The largest increase for 2008 was at MS-1 and was due to an overall increase of average TP concentration (Figure 6). The small loading increase at BC-1 and SH-1 were also caused by an increase in average TP. The increase at B-4 and SL-1 were primarily due to an increase in discharge rate for the 2008 season. The decreased 2008 loading at CL-1, 7-MS, and T-7 were all due to lower discharge rates (Table 3 and Table 6).

The Snake River Hells Canyon Total Maximum Daily Load (SR-HC TMDL) set a TP allocation for the Lower Payette River of 1,032 lbs/day (IDEQ 2003). There was an overall TP load increase in 2008 of 27 lbs/day when compared to the 1997 data. The overall average TP load for 2008 was 165 lbs/day and 138 lbs/day for 1997. The 2008 TP load makes up approximately 16% of the total TP allocated by the SR-HC TMDL for the LPR.

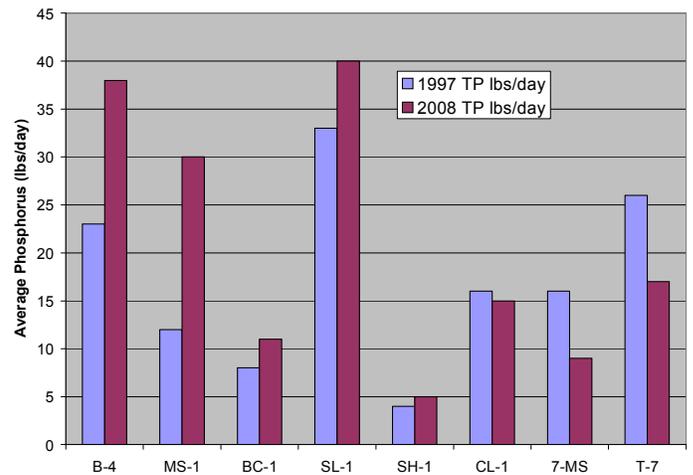


Figure 7. Average total phosphorus load (lbs/day).

Bacteria-Escherichia Coli (E-coli)

The bacteria samples collected in 1997 were tested for fecal coliform which is no longer used for determining water quality standards. The samples collected in 2008 were tested for *E-coli* which is the current water quality standard for bacteria. Due to the two different testing methods there will be no comparison of the two years of bacteria data.

The LPR has an established TMDL that requires the reduction of fecal coliform to meet primary contact water usage (IDEQ, 1999).

The new state criteria for *E-coli* bacteria (primary contact) is made up of a two step process using a trigger value of 406 colony forming units (CFU) that requires the geomean evaluation of the water body (IDAPA 58.1.02).

The 406 CFU trigger indicates a violation in *E-coli* concentration that requires 5 samples be collected over a 30 day period to calculate the monthly geomean for *E-coli*. A geomean concentration over 126 CFU indicates a water quality violation. ISDA did not conduct any geomean analysis during 2008.

Table 1 indicates that there were numerous exceedances of the one time *E-coli* concentration of 406 CFU. The largest percentage of the one time exceedance occurred at Mesa Drain (79%) with the lowest occurring at Sand Hollow (36%).

Table 1. *E-coli* results gray cells indicate ≥ 406 CFUs.

Date	B-4	MS-1	BC-1	SL-1	SH-1	CL-1	7-MS	T-7
4/15/2008	580	ND	140	17	1	140	2000	490
4/29/2008	440	>2400	>2400	250	390	730	1200	490
5/13/2008	580	2400	340	2000	650	220	250	690
5/27/2008	610	820	490	1700	410	1600	310	460
6/10/2008	340	2400	370	610	170	310	460	440
6/24/2008	2000	1200	770	820	140	1700	210	160
7/8/2008	310	1700	78	870	290	610	390	70
7/22/2008	410	650	>2400	870	150	1000	520	550
8/5/2008	310	1000	280	260	550	460	650	220
8/19/2008	650	980	260	580	1100	140	160	250
9/3/2008	490	690	1100	1200	580	820	280	280
9/17/2008	170	730	ND	200	120	170	520	610
9/30/2008	410	130	ND	120	63	330	650	180
10/15/2008	280	190	ND	86	250	64	410	58
Exceedances	64%	79%	45%	57%	36%	58%	57%	50%

Conclusion

These eight drains in Gem County still continue to provide large inputs of sediment, phosphorus, and bacteria into the LPR.

The average sediment load was slightly less in 2008 (45,565 lbs/day) when compared to the 1997 data (46,260 lbs/day). The primary reason for the lower sediment load was a significant reduction in discharge at three of the stations.

Even with the decrease in average discharge, the overall TP load increased by 27 lbs/day from 138 lbs/day in 1997 to 165 lbs/day in 2008. This reflects the overall increase in average TP concentrations at MS-1 and BC-1 and an increase of discharge at SL-1 and B-4. The Snake River Hells Canyon TMDL set a TP load reduction of 34% for the LPR. The average TP loading from the eight Gem County drains amounts to 16% of the TP allocation for the LPR.

Mesa Drain (MS-1) had the largest average concentration of TP (0.44 mg/L) and an average SSC concentration of 160 mg/L. Silverleaf (SL-1) had the second highest concentration of TP (0.35 mg/L) with an average SSC concentration of 169 mg/L.

The planted acreage in the Mesa drainage (2008) ap-

peared to consist primarily of corn. Furrow irrigated corn ground can cause excessive soil erosion and may be one of the reasons for the high TP and SSC concentrations.

The LPR has an established TMDL for bacteria (IDEQ, 1999). The data collected for *E-coli* in 2008 would indicate that the eight drains in Gem County are sources for excessive bacteria levels.

Recommendations

The Gem Soil and Water Conservation District should concentrate their efforts and money on two major areas in Gem County. The Silverleaf and Mesa drainages are the two major transporters of phosphorus and sediment. Evaluation of these drainages and proper placement of sediment ponds and possibly pump back systems could greatly reduce the loading into the LPR. Fencing and buffers along Mesa Drain would eliminate direct animal access and help with the removal of bacteria.

Additional funding could help address the Big-4 drainage. The Big-4 drainage is also a major source of bacteria and exclusion (fencing) of cattle along B-4 would help reduce bacteria levels. In addition, the majority of phosphorus in B-4 is dissolved and buffer strips would help filter irrigation return water that transports phosphorus back to the drain.

The LPR requires reductions in bacteria to meet the established TMDL. The LPR also needs to reduce phosphorus by approximately 34% to meet the SR-HC TMDL. Funding efforts through grants or other means should be sought by state and federal agencies, the LPR Watershed Advisory Group, and the Gem Soil and Water Conservation District to support implementation of BMPs within these drainages.

References

Idaho Administrative Code, Department of Environmental Quality. IDAPA 58.01.02., Water Quality Standards.

Idaho Department of Environmental Quality. 1999. Lower Payette River Subbasin Assessment and Total Maximum Daily Load.

Idaho Department of Environmental Quality. 2003. Brownlee Reservoir Subbasin Assessment and Total Maximum Daily Load.

Gray, J.R., Glysson, G.D., Turcios, L.M., Schwarz, G.E., 2000, Comparability of Suspended Sediment Concentrations and Total Suspended Solids Data: U.S. Geological Survey Water Resources Investigation Report 00-4191.

Appendix A

Big-4

Date	DO	Temp.	%sat.	Cond.	TDS	pH	Discharge	SSC	TP	OP	E-coli
4/15/2008	8.27	8.3	70.3	504	247	8.15	19.43	10.4	0.172	0.083	580
4/29/2008	6.58	12.8	61.9	355	174	7.91	35.23	52.9	0.235	0.084	440
5/13/2008	7.85	9.9	69.2	267.2	131	7.55	38.5	22.7	0.265	0.158	580
5/27/2008	6.3	14.4	61.8	235	115	7.47	44.2	40.8	0.184	0.083	610
6/10/2008	7.31	12.7	68.9	279	136	7.47	47.1	30.8	0.131	0.039	340
6/24/2008	5.81	16.6	59.6	296	145	7.43	45.8	19.3	0.2	0.122	2000
7/8/2008	5.28	18	55.7	289.2	142	7.58	42.5	13.8	0.206	0.2	310
7/22/2008	4.82	19.6	52.6	261	128	7.91	50.1	17.8	0.157	0.101	410
8/5/2008	4.65	18.2	49.5	277	136	7.63	53.1	11.7	0.157	0.1	310
8/19/2008	4.48	19.1	48.5	269	132	7.83	56.2	17.1	0.146	0.09	650
9/3/2008	5.61	13.9	54.3	286	140	7.56	52.3	10.4	0.104	0.07	490
9/17/2008	5.64	14.9	55.7	285	140	7.72	48.2	9.8	0.094	0.071	170
9/30/2008	5.89	14.4	57.6	306	150	7.87	52	8.5	0.078	0.052	410
10/15/2008	7.41	10.9	67.2	329	161	7.72	38.7	19.1	0.075	0.04	280

Mesa

Date	DO	Temp.	%sat.	Cond.	TDS	pH	Discharge	SSC	TP	OP	E-coli
4/15/2008	no water						0				
4/29/2008	10.4	8.6	89.1	102.4	50	7.87	15.34	86.8	1.36	0.58	>2400
5/13/2008	11.24	6.9	92.5	93.4	46	7.88	12.6	305.3	0.797	0.431	2400
5/27/2008	9.47	12.9	90	71.2	35	7.85	12.6	120	0.384	0.211	820
6/10/2008	10.66	9.9	94.2	82	40	7.89	6.54	93.8	0.397	0.184	2400
6/24/2008	9.28	15	92	89.5	44	7.78	10.4	425	0.687	0.249	1200
7/8/2008	8.79	16.7	90.5	100	49	7.73	11.5	231	0.425	0.175	1700
7/22/2008	7.66	19.8	84	80	39	7.75	17.4	268	0.368	0.098	650
8/5/2008	8.36	16.9	86.4	76.6	38	7.96	15.5	165	0.326	0.127	1000
8/19/2008	7.74	18.2	82.2	97.1	48	7.88	12.4	123	0.352	0.181	980
9/3/2008	9.71	12.1	90.2	108	53	7.72	13.1	134	0.29	0.122	690
9/17/2008	9.28	13.7	89.3	96.6	47	7.62	17.2	81.9	0.182	0.06	730
9/30/2008	9.6	13.2	91.7	105	51	7.81	16.1	36	0.104	0.047	130
10/15/2008	11.37	8.3	96.9	114	56	7.64	5.04	14.2	0.039	0.019	190

Beacon

Date	DO	Temp.	%sat.	Cond.	TDS	pH	Discharge	SSC	TP	OP	E-coli
4/15/2008				648	318	8.32	2	27.6	0.156	0.081	140
4/29/2008	7.7	11	70.6	307	150	7.78	11.8	45	0.382	0.234	>2400
5/13/2008	8.03	9.5	70.2	294.6	144	7.74	10.59	20.8	0.404	0.28	340
5/27/2008	5.97	14	58	197.7	97	7.79	12.6	19.4	0.151	0.099	490
6/10/2008	7.37	12.2	68.7	243	119	7.78	9.22	12.3	0.105	0.055	370
6/24/2008	4.49	18.9	48.7	320	157	7.59	7.6	10.9	0.277	0.204	770
7/8/2008	3.06	19.4	33.3	348	170	7.45	9.8	5.1	0.232	0.197	78
7/22/2008	2.25	20.9	25.1	276	135	7.5	13.1	5.3	0.306	0.229	>2400
8/5/2008	3.11	19.9	34.2	267.1	131	7.62	12.24	8.3	0.213	0.149	280
8/19/2008	3.09	19.8	33.8	285	140	7.77	8.35	4.8	0.13	0.092	260
9/3/2008	4.15	13.7	40	325	159	7.5	8.24	4.9	0.111	0.065	1100
9/17/2008	locked out										
9/30/2008	locked out										
10/15/2008	locked out										

Silverleaf

Date	DO	Temp.	%sat.	Cond.	TDS	pH	Discharge	B-4 SSC	TP	OP	E-coli
4/15/2008	12.2	6.1	98.4	625	306	8.69	2.14	28.8	0.252	0.198	17
4/29/2008	9.88	11.3	90.3	247.9	121	8.12	8.95	290.7	0.438	0.125	250
5/13/2008	10.89	8.7	93.8	191.7	94	8.04	15.57	297.1	0.581	0.182	2000
5/27/2008	9.22	12.9	87.4	197.4	97	7.96	16.21	399	0.573	0.113	1700
6/10/2008	10.08	11.4	92.3	210	103	8.06	14.4	129	0.301	0.118	610
6/24/2008	8.99	14.9	89	245	120	7.93	14.8	280	0.425	0.169	820
7/8/2008	8.64	16.4	88.3	226	111	7.69	21.2	226	0.397	0.167	870
7/22/2008	8.01	19	86.3	218	107	7.89	22.4	285	0.466	0.164	870
8/5/2008	8.73	16.9	89.8	210	103	8.07	26	125	0.319	0.142	260
8/19/2008	7.92	17.7	83.1	234	115	7.97	24.9	66.7	0.253	0.153	580
9/3/2008	9.58	12.9	90.7	238	117	7.93	70.4	70.4	0.222	0.119	1200
9/17/2008	9.34	14	90.6	274	134	7.41	23.7	43.4	0.195	0.118	200
9/30/2008	9.47	13.3	90.4	321	157	7.75	24.2	51.1	0.205	0.141	120
10/15/2008	9.75	11.1	88.7	501	246	7.99	9.63	71.3	0.299	0.205	86

Appendix A

Sand Hollow

Date	DO	Temp.	%sat.	Cond.	TDS	pH	Discharge	SSC	TP	OP	E-coli
4/15/2008	9.67	10.4	86.5	461	226	8.06	0.5	3.4	0.186	0.16	1
4/29/2008	10.08	11.9	93.2	81.9	40	7.72	4.64	22	0.102	0.031	390
5/13/2008	10.79	9.4	94.3	91.9	45	7.93	6.05	64	0.248	0.083	650
5/27/2008	8.77	13.5	85	61.2	30	8.18	7.26	57.8	0.125	0.049	410
6/10/2008	9.29	12.1	86.6	70.5	35	7.87	8.14	25.4	0.083	0.03	170
6/24/2008	8.51	16.5	87	65.7	32	7.88	6.88	41.9	0.12	0.05	140
7/8/2008	7.82	18.2	82.9	83	41	7.58	2.9	94.8	0.247	0.094	290
7/22/2008	7.1	20.5	79.5	68.7	34	7.45	10.6	68.3	0.202	0.066	150
8/5/2008	7.93	17.6	83.5	75	37	8	9.93	146	0.253	0.067	550
8/19/2008	7.35	19.5	80.2	79.5	39	7.83	6.25	85	0.208	0.057	1100
9/3/2008	9.05	12.4	84.6	159	78	7.82	5.63	80.3	0.189	0.038	580
9/17/2008	8.85	14.8	87.4	98.5	48	7.25	5.33	22	0.074	0.026	120
9/30/2008	8.79	13.8	84.9	124	61	7.7	5.41	23.7	0.08	0.036	63
10/15/2008	10.6	9	91.5	100	49	7.78	8.21	13.2	0.065	0.035	250

County Line

Date	DO	Temp.	%sat.	Cond.	TDS	pH	Discharge	SSC	TP	OP	E-coli
4/15/2008	10.92	8.2	92.6	136.8	67	8.1	30.35	19.4	0.086	0.016	140
4/29/2008	10.77	11.3	98.4	113.3	56	7.9	26.4	23.6	0.08	0.025	730
5/13/2008	12.13	10.3	108.6	93.4	46	8.07	40.3	11.3	0.079	0.035	220
5/27/2008	9.16	13.1	87.1	92.7	45	8	46.4	24.5	0.16	0.076	1600
6/10/2008	10.43	12.3	97.4	133.8	66	7.9	53.4	19.8	0.064	0.021	310
6/24/2008	10.66	17.1	110.6	240	118	7.92	7.69	4.4	0.14	0.1	1700
7/8/2008	10.02	18.6	107.3	203	100	7.7	9.5	5.2	0.11	0.092	610
7/22/2008	6.29	20	69.2	197	96	7.58	13.6	8.4	0.224	0.152	1000
8/5/2008	7.55	18.5	80.5	227	111	7.77	13.5	10.4	0.166	0.12	460
8/19/2008	8.55	18.9	91.9	245	120	7.94	12.1	11.6	0.139	0.094	140
9/3/2008	9.5	14.8	93.9	181	89	7.86	12.58	9.4	0.103	0.066	820
9/17/2008	10.25	16.4	104.8	175	86	7.6	13.5	15	0.111	0.064	170
9/30/2008	8.99	15.1	89.3	115	56	7.65	34.9	10.9	0.052	0.025	330
10/15/2008	11.02	10.1	98.1	112	55	7.74	38.7	7.4	0.036	0.017	64

7mi. Slough

Date	DO	Temp.	%sat.	Cond.	TDS	pH	CFS	SSC	TP	OP	E-coli
4/15/2008	11.29	7.6	94.2	165.3	81	7.97	59.48	23.3	0.114	0.023	2000
4/29/2008	9.71	12.7	91	115	56	7.8	46.87	18.5	0.105	0.023	1200
5/13/2008	11.06	11.5	101.3	129.4	63	7.78	55.02	13.5	0.088	0.029	250
5/27/2008	8.16	14.7	80.6	103.2	51	7.85	23.84	22.3	0.102	0.02	310
6/10/2008	9.92	14.2	96.5	116	57	7.6	25.48	15.9	0.08	0.02	460
6/24/2008	9.16	19	97	171.1	84	7.88	13.54	11.4	0.071	0.026	210
7/8/2008	7.89	21.1	88.9	176	86	7.57	1.62	13	0.079	0.029	390
7/22/2008	7.03	21.4	69.9	107	52	7.6	15.18	10.6	0.08	0.028	520
8/5/2008	7.56	21.1	84.7	120	59	7.74	23.51	12.8	0.072	0.02	650
8/19/2008	7.27	21.4	82.3	114	56	7.78	18.72	6.3	0.06	0.016	180
9/3/2008	8.38	14.7	82.8	129	63	7.73	10.11	4.6	0.04	0.018	280
9/17/2008	8.13	16.2	82.6	161	79	7.34	9.37	6.9	0.071	0.033	520
9/30/2008	7.91	14.4	77.5	152	75	7.55	12.72	4.7	0.044	0.012	650
10/15/2008	10.4	9.5	90.8	138	68	7.7	24.3	5.1	0.03	0.013	410

Tunnel 7

Date	DO	Temp.	%sat.	Cond.	TDS	pH	Discharge	SSC	TP	OP	E-coli
4/15/2008	12.87	10.2	114.5	182	89	8.77	15.1	17.9	0.133	0.057	490
4/29/2008	9.98	13.3	95.1	185.3	91	7.94	25.2	20.7	0.152	0.07	490
5/13/2008	11.82	11.7	109.1	163.2	80	8.17	41	11.7	0.14	0.084	690
5/27/2008	9.11	15.6	91.5	174.8	86	7.84	42.3	20.2	0.131	0.065	460
6/10/2008	10.46	14.5	102.8	187	91	7.92	31.9	18	0.132	0.064	440
6/24/2008	12.14	19.4	131.4	163.8	80	8.1	2.86	7.2	0.148	0.107	160
7/8/2008	9.49	20.7	106.2	189	93	7.51	4.2	5.3	0.148	0.106	70
7/22/2008	8.3	20.5	93.2	222	109	7.73	13.3	16.4	0.286	0.077	550
8/5/2008	10.05	20.1	111.2	202	99	7.99	15.2	9.9	0.105	0.066	220
8/19/2008	9.93	20.4	109.9	191.1	94	8.06	22.8	15.5	0.116	0.076	250
9/3/2008	10.42	15.4	104.5	185	91	7.85	24.2	11.8	0.093	0.057	280
9/17/2008	10.31	16.6	105.5	187	92	7.67	25.6	12.5	0.098	0.06	610
9/30/2008	10.33	15.4	103.4	171	84	7.75	36.7	15.7	0.092	0.055	180
10/15/2008	11.77	11.5	108	205	101	7.93	39.6	6.2	0.074	0.052	58