East Perrine Coulee
Water Quality Monitoring Report

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Technical Report Summary
JC-EPC-05

November 2005
Twin Falls, Idaho

Introduction

The Idaho Association of Soil Conservation Districts (IASCD) completed monitoring of the East Perrine Coulee in October 2005. The East Perrine Coulee is diverted from the Twin Falls Main Canal approximately one and a half miles south east of Hansen and drains approximately 20,000 acres of land. Primary land use consists of irrigated-gravity flow agricultural land and residential areas. The East Perrine Coulee drains over the Snake River Canyon rim into the Snake River at river mile 612.7 (Buhidar 1998).

East Perrine Coulee is listed in the Upper Snake Rock Subbasin Assessment as a contributor of nutrients, bacteria *(Escherichia coli*) and sediment to the Middle Snake River (Buhidar 1998). The designated beneficial uses for the Middle Snake River are agricultural water supply, cold water aquatic life, salmonid spawning, and primary and secondary contact recreation (IDAPA 58.01.02.101(01)).

The TMDL targets set total suspended sediment for the tributaries of the Snake River at <80 mg/L (Table 1). Total phosphorous targets set for the East Perrine are not to exceed 0.10 mg/L. *Escherichia coli (E. coli)* limits for the coulee are set for secondary contact recreation, which are 576 colony forming units (cfu)/100mL. The target load reductions for the East Perrine Coulee are 55.6% for TSS, 25.3% for TP and 53.9% for *E. coli* (Rosen 2005).

Table 1. TMDL Targets for Middle Snake River.

Pollution	**TMDL Target for Snake River**
Total Suspended Sediment	Not to exceed 80 mg/L
Total Phosphorous	Not to exceed 0.10 mg/L
Bacteria (*E. coli*)	Not to exceed 576 col/100 mL

The East Perrine Coulee Project consists of two two- acre settling ponds located at Section 13 Township 10S Range 17E, HUC 17040212. The ponds were constructed to reduce sediment, phosphorous and *E. coli* in the East Perrine Coulee. Construction of the settling ponds began in March 2005 by the Twin Falls Canal Company and was completed in April 2005.

Monitoring Program

Three sites were monitored beginning in May 2005 and continued through October 2005 (Table 2). The sites were chosen to evaluate the quality of water entering into the settling ponds compared to water quality discharging from the ponds. Three drains discharge from the ponds and only two were sampled. The third drain had low flows throughout the irrigation season and is not a tributary to the Snake River. The three monitoring sites are shown in Figure 1.

Table 2. Monitoring site descriptions.

Site	Description
EP-3	20 meters above first settling pond
EP-2	South drain (Drain 35) below pond
EP-1	North drain (Perrine 1) below pond

Samples were collected for total suspended sediment (TSS), total volatile suspended sediment (TVSS), total phosphorous (TP), orthophorous (OP), and *E. coli.* Field parameters sampled were stream discharge, conductivity, total dissolved solids, pH, temperature (ºC), dissolved oxygen (mg/L and % saturation).

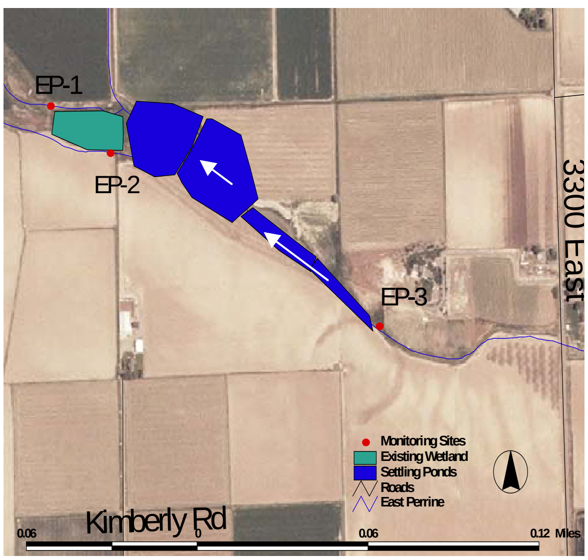

Figure 1. East Perrine Coulee monitoring sites. Arrows denote the direction of flow.

Results

Discharge

Stream discharge on the East Perrine Coulee is highly regulated by the Twin Falls Canal Company (TFCC). Mean stream discharge entering the ponds at EP3 was 23.41 cfs during the irrigation season (Table 3). This does not include samples in late April and early May when the site was inaccessible. Maximum stream discharge at EP3 was 43.71 cfs in October and minimum stream discharge was 12.58 cfs in August.

Stream discharge at EP1 averaged 10.93 cfs throughout the irrigation season. Stream discharge at EP2 averaged 5.59 cfs.
Stream discharge at EP1 and EP2 were added together to represent flow discharging from the ponds. Stream discharge was not significantly different from the sum of EP1 and EP2 compared to EP3 ($p= 0.0697$). It can therefore be assumed load reductions are due to BMP's rather than from differences in stream discharge.

Table 3. Discharge (cfs) statistics.

Statistics	EP1	EP2	EP1 + EP2	EP3
Mean	10.96	5.96	16.92	23.68
Min	6.02	1.36	10.81	12.58
Max	26.1	13.7	34.26	46.21
Std. Dev.	5.62	3.31	6.7	9.72

Total Suspended Sediment

Total suspended sediment (TSS) peaked in the early spring during the initial charging of the canal system and again in late summer. TSS at EP1 and EP2 combined exceeded instantaneous TMDL targets of 80 mg/L for 58% of the samples. This target was exceeded at EP3 from July through September (Figure 1). Stream discharge remained relatively constant throughout the sample period and is not directly correlated with TSS in this study. In fact, TSS peaks are closely correlated with the timing of surface irrigation of bean and corn crops along the coulee.

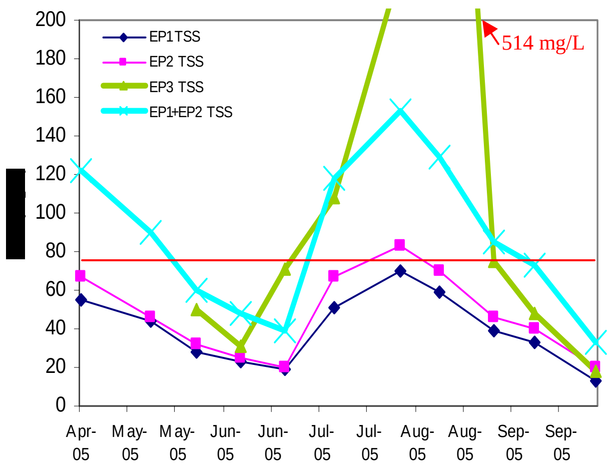

Figure 1. Total suspended sediment (mg/L). The 80 mg/L TMDL target is shown in red.

Table 4. Total suspended sediment means (mg/L) and loads (lbs/day).

Site	Mean Q (cfs)	Mean TSS (mg/L)	TSS Load (lbs/day)
EP1	10.93	39.45	2,324
EP2	5.59	46.91	1,413
EP3	23.43	126.89	16,025

Total suspended sediment will be calculated as pounds per day to compare with the 319 grant reductions. TSS averaged 126.89 mg/L (16,025 lbs/day) at EP3 during the sample period (Table 4). TSS at EP1 and EP2 averaged 39.45mg/L (2,324 lbs/day) and 46.91 mg/L (1,413 lbs/day) respectively. With EP1 and EP2 the combined average TSS discharging from the ponds was 86.36 mg/L (3,780 lbs/day). Total suspended sediment was reduced by 76% by the settling ponds. This is a 20% greater reduction than what was expected by the ponds.

Total Phosphorous

Total phosphorous (TP) is not to exceed 0.10 mg/L for the East Perrine Coulee to meet the Midsnake TMDL. TP limits were exceeded during every sample at EP3. The average TP level at EP3 was 0.28 mg/L (Table 5). Average TP levels at EP1 and EP2 were 0.22 mg/L. However, EP3 was not sampled in April or the beginning of May. Instantaneous TP levels were highest at EP1 and EP2 during these two sample dates (0.57 mg/L and 0.33 mg/L respectively). Average TP levels without these two sample dates at EP1 and EP2 are 0.17 mg/L. This average was used to calculate TP loads for EP1 and EP2.

Table 6. Mean phosphorous loads May through October and June through October.

Site	Mean Q (cfs)	Mean TP (mg/L) Jun- Oct	TP Load (lbs/day) Jun - Oct	Mean TP (mg/L) May- Oct	TP Load (lbs/day) May- Oct
EP1	10.93	0.17	10.02	0.22	12.96
EP2	5.59	0.17	5.12	0.22	6.63
EP3	23.43	0.28	35.36	0.28	35.36

Total phosphorous loads averaged 35.36 lbs/day at EP3 and 15.14 lbs/day combined at EP1 and EP2 from June through October. Total phosphorous was reduced 57% during the sample period by the settling ponds. This reduction is more than double the amount expected. TP also peaked in early spring and during the late summer months along with TSS (Figure 2). Orthophosphorous (OP) was also sampled during this study. Total phosphorous was only made up of 25% OP. Although the ponds were successful at reducing phosphorous levels, TP levels were almost double the allowable limit during the sample period.

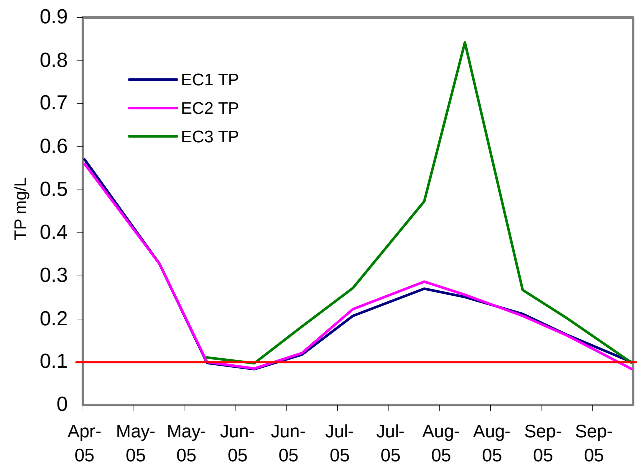

Figure 2. Total phosphorous (mg/L) levels in East Perrine Coulee. The 0.10 mg/L target is shown in red.

E. coli

E. coli exceeded TMDL limits for secondary contact recreation during the sample period once at EP1 and EP3. This limit was exceeded for two sample periods at EP2 during the early spring. EP3 was not sampled during the early spring when the exceedances occurred at EP1 and EP2. The *E. coli* data that was collected is shown in Table 7.

Loads for *E. coli* were calculated by adding the loads from EP1 and EP2 and comparing the total to *E. coli* loads at EP3 (Table 8). The averages at EP1 and EP2 that excluded the first two sample dates were used to calculate loads. *E. coli* loads were reduced 20.2% by the ponds. Although the levels of reduction are much less than what was written in the 319 grant (53.9%), *E. coli* levels were well below the TMDL target (<576) for most of the irrigation season at the discharge points. Potential sources of *E. coli* are from manure applications on adjacent fields. Nutrient management plans are recommended for fields along the East Perrine Coulee.

Table 7. E. coli levels at East Perrine. Averages include the first two sample dates and are also shown without those dates.

***E. coli* levels (cfu/100 mL)**			
Date	**EP1**	**EP 2**	**EP3**
25-Apr-05	520	650	na
17-May-05	>2400	>2400	na
31-May-05	190	110	37
14-Jun-05	69	100	78
28-Jun-05	100	130	520
13-Jul-05	240	200	560
3-Aug-05	170	200	580
15-Aug-05	Na	na	na
1-Sep-05	200	210	230
14-Sep-05	144	78	250
3-Oct-05	260	160	70
Average	**429**	**424**	**291**
Average without first two sample dates	**171**	**149**	**291**

Table 8. Mean E. coli levels and loads in cfu^9/ day.

Statistics	**EP1**	**EP2**	**EP1 + EP2**	**EP3**
MeanQ (cfs)	10.96	5.96	16.92	23.68
Mean E. coli (cfu)	171.63	148.5	320.13	290
E. coli loads (cfu^9)	45.87^9	20.29^9	132.43^9	166.1^9

Conclusions and Recommendations

The settling ponds on East Perrine were effective in reducing sediment, phosphorous and *E. coli*. TSS and TP reductions were greater than the proposed reductions set in the 319 grant proposal. Reductions in *E. coli* did not meet the set expectations; however the TMDL limits were only exceeded during the charging period (first two weeks after the irrigation system is turned on) at the lowest sites.

Settling ponds are designed by NRCS standards and specifications to be 65% effective (Wetzstein 2005). Therefore the settling ponds, during the first year of use, were as efficient as possible in removing the sediment. To further reduce sediment in the East Perrine Coulee, individual fields with excess erosion should be targeted. Settling ponds can be built at the individual tail drains to capture sediment before entering into the coulee. Increasing riparian buffers in critical areas and switching from surface to sprinkler irrigated croplands would also reduce sediment loads.

Phosphorous continues to be the biggest problem for the East Perrine Coulee. Even with the efficiency of the ponds more than 82% of TP samples exceeded TMDL limits. To increase reductions in phosphorous, wetland plants can be planted along the settling ponds to take up orthophosphorous. Targeting individual fields for TSS would also reduce the amount of total phosphorous entering into the system. Creating more wetlands and settling ponds along the East Perrine would further improve water quality.

E. coli levels were well below the TMDL target for most of the irrigation season. Heavy spring rains and intensive surface summer irrigation increased *E. coli* levels within the coulee system.

The same practices recommended to reduce TSS and TP would also reduce *E. coli* loads.

The East Perrine Coulee will be monitored again in the 2007 or 2008 irrigation season to track changes after the ponds mature. Further recommendations will be made to improve the water quality of this watershed.

Acknowledgements

Thanks to Kirk Campbell and Gary Bahr of the Idaho State Department of Agriculture for technical support on this project and Amy Jenkins of the IASCD for input on this document. Thanks to Mary Rosen (IASCD), Sonny Buhidar (DEQ), and Brian Olmstead (TFCC) for information on the East Perrine Coulee system.

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