Idaho State Department of Agriculture
Division of Agricultural Resources

Big Willow Creek
Water Quality Monitoring Report
April 2007 through October 2007

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ISDA Technical Report Summary W-24

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Introduction

At the request of the Lower Payette River Watershed Advisory Group the Idaho State Department of Agriculture (ISDA) conducted a water quality monitoring program on Big Willow Creek. Big Willow Creek resides in the Lower Payette River (LPR) Hydrological Unit Code 17050122 (Figure 1).

The Idaho Department of Environmental Quality (IDEQ) recently completed and submitted a temperature total maximum daily load (TMDL) for Big Willow Creek to the Environmental Protection Agency (EPA) for approval. The temperature TMDL is based on potential natural vegetation (PNV) needed to properly shade and cool Big Willow Creek's water to meet the designated use for cold water aquatic life.

Big Willow Creek confluences with the Payette Slough which in turn is partially routed into the Lower Payette Canal for irrigation water conveyance north towards Weiser Idaho. The Lower Payette Canal finally confluences with the Weiser River.

ISDA tested for total phosphorus, dissolved phosphorus, suspended sediment, and Escherichia coli bacteria (*E-coli*). In addition, field parameters for dissolved oxygen, temperature, conductivity, total dissolved solids, pH and discharge were monitored during this project.

There were three stations established on Big Willow Creek. The lowest station in the watershed (BWC-1) was located approximately 0.60 miles upstream of Bluff Road. This station had to be moved further upstream to avoid a push-up diversion used for irrigation. Station (BWC-2) was established just downstream of Sucker Creek Road and below where Sucker Creek confluences with Big Willow Creek. The background or reference station (BWC-3) was established in the upper watershed where Willow Creek crosses under Big Flat Road (Figure 1).

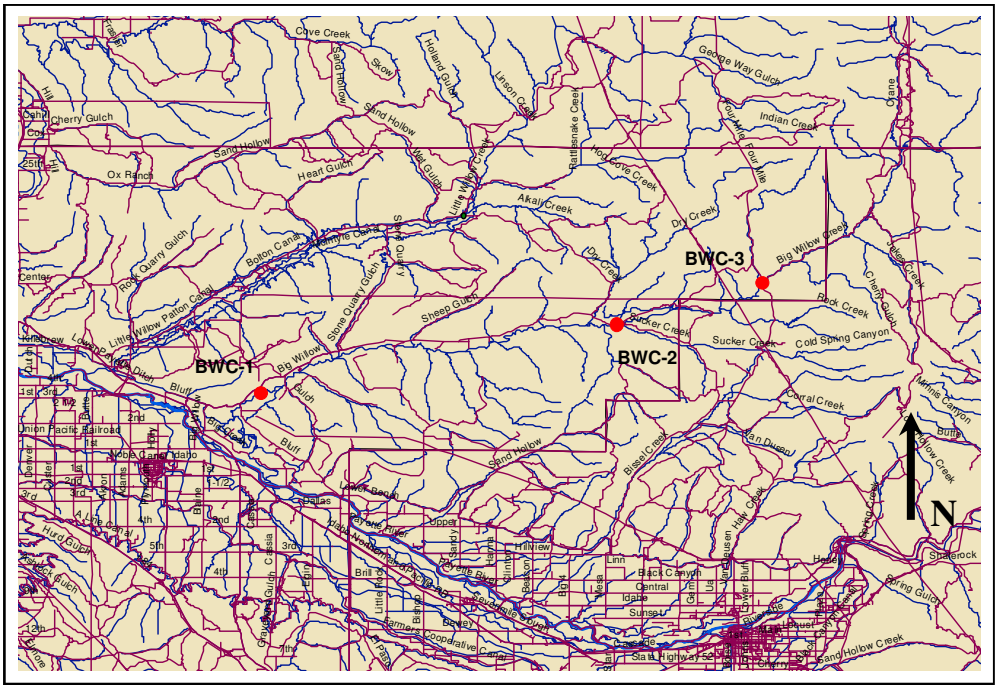

Figure 1. Big Willow Creek Monitoring Locations.

General Results

Suspended Sediment Concentration (SSC)

Suspended sediment samples were collected at all locations to determine if suspended sediment concentrations (SSC) were at acceptable levels. At no time did any station exceed the low risk value of 25-100 mg/L (DFO, 2000) which is considered the threshold concentration for quality fish habitat. Average SSC concentrations where very low throughout the study with BWC-1 at 6.1 mg/L, BWC-2 at 4.5 mg/L, and BWC-3 at 3.3 mg/L. Due to low flow rates, later in the season, a fine layer of muck (silt and detritus) settles out and covers the substrate at the two lower stations (BWC-1 and BWC-2). This material is easily suspended within the water column when disturbed.

Phosphorus

A small portion of both Big Willow Creek and the Payette Slough enter the Payette River during irrigation season. The Payette River will require an approximate total phosphorus (TP) reduction of 34% to meet the Snake River Hells Canyon Total Maximum load concentration of 0.07 mg/L (IDEQ, 2002). Therefore 0.07 mg/L concentration is used to compare total phosphorus (P) levels in Big Willow Creek.

The majority of phosphorus found within Big Willow Creek consists of dissolved phosphorus (DP) which is the most readily available form of P for aquatic plant uptake. (Figure 2). Research indicates that maintaining DP levels at <0.047 mg/L (McGarrigle, 1993) or <0.060 mg/L (Miltner and Rankin, 1998) was necessary to prevent nuisance algae growth and negative effects on fish communities. Only BWC-3 is below these recommended levels.

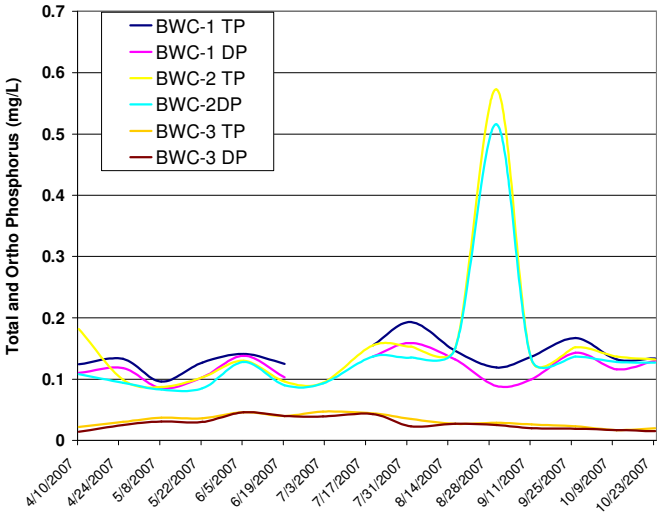

Figure 2. Total and dissolved phosphorus concentrations.

The percentages of DP to TP are comparatively consistent throughout the watershed (Table 1). The reason for the dominance of dissolved P throughout the watershed is not thoroughly understood at this time.

The soils in the lower section of Big Willow, along the river corridor, are nearly level to moderately sloping deep well drained loams and sandy loams on stream bottoms and alluvial fans. There is a shallow water table in the lower section which requires careful irrigation to avoid excessive runoff from fields. This shallow water table along with well drained soils may also be a transport mechanism for DP during stream base flow conditions.

Table 1. TP and DP concentrations and percentages.

Site	Average TP (mg/L)	Average DP (mg/L)	% DP
BWC-1	0.138	0.123	88
BWC-2	0.158	0.151	96
BWC-3	0.032	0.028	89

Overall phosphorus reductions to meet the goal of 0.07 mg/L would require a 56% reduction at station BWC-2 and a 49% reduction at BWC-1. The upper station (BWC-3) would not require any reduction in phosphorus.

Dissolved Oxygen

The two lower stations (BWC-1 and BWC-2) on Big Willow Creek showed depressed dissolved oxygen (DO) levels starting in early June through October (Figure 3). The state of Idaho water quality standards require systems designated as cold water biota maintain a DO level of 6.0 mg/L or higher.

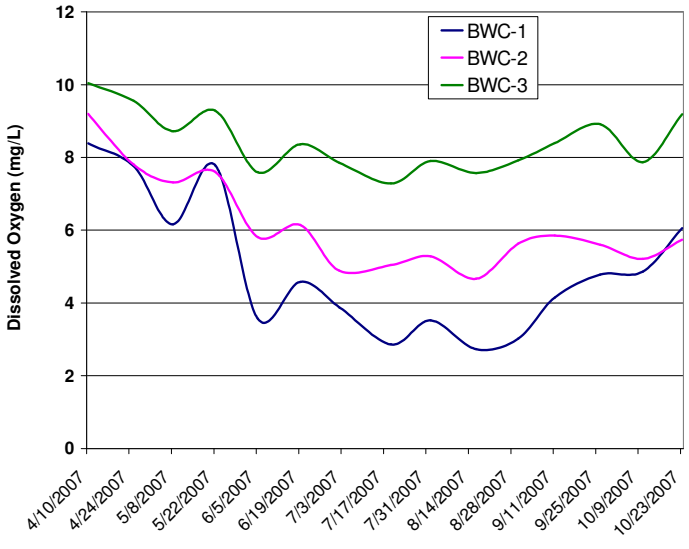

Figure 3. Dissolved Oxygen levels.

Possible reasons for the distressed DO levels at the lower stations on Big Willow Creek could be lower discharge and sluggish water velocity during the summer months caused by water diversions for irrigation and numerous beaver complexes (Figure 4).

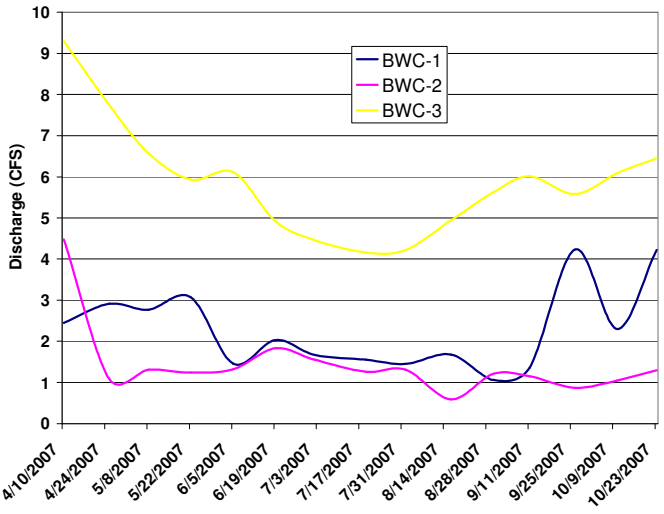

Figure 4. Discharge rates for Big Willow Creek stations.

Another potential cause of low DO could be the excessive algal and aquatic vegetation growth that occurs at both of the lower stations (Figure 5). This excessive growth may be a direct result of the high dissolved phosphorus concentrations along with low discharge and warm water temperatures.

Figure 5. Site BWC-1 with excessive aquatic vegetation.

The large algae blooms that plague Big Willow Creek can be viewed in Figure 6 which is at Succor Creek road bridge just upstream of BWC-2 sampling site.

Figure 6. Algae blooms at station BWC-2

Temperature

Temperature concerns are being addressed by the IDEQ in the Big Willow Creek Potential Natural Vegetation temperature TMDL. A communiqué (Schwarz 2007) with one of the major property owners within the Big Willow Creek watershed expressed his concern with PNV temperature TMDL. He stated that Big Willow Creek will never reach its potential natural vegetation due to the large beaver population and the damage they are doing to the riparian vegetation.

Bacteria (Escherichia Coli)

Bacteria levels were evaluated in 2007 using the state water quality standard for *E-coli*. There were several exceedances of the one time 406 colony forming units (CFUs) but the spatiality of the exceedances do not indicate a consistent problem with *E-coli* (Table 2).

Table 2. *E-coli* (CFUs) results Big Willow Creek.

DATE	BWC-1	BWC-2	BWC-3
4/10/2007	68	390	4
4/25/2007	520	260	10
5/8/2007	370	520	17
5/22/2007	440	220	14
6/5/2007	870	410	120
6/19/2007	68	290	55
7/2/2007	No data	690	110
7/19/2007	240	240	40
8/1/2007	240	130	18
8/16/2007	310	65	21
8/30/2007	280	2400	25
9/11/2007	490	160	1

Conclusion

At this time, it does not appear that suspended sediment concentrations exceed levels that are protective of quality fish habitat. There is an accumulation of detrital material mixed with fine silts that tend to accumulate in the lower reaches of Big Willow. The organic mixture enriches the bed sediment and increases the growth of algae and macrophytes. The decomposition of this material may also be a contributor to the low dissolved oxygen recorded in the lower segments (BWC-1 and BWC-2).

Phosphorus concentrations, especially the dissolved portion, will need to be addressed to reduce excessive nuisance aquatic growth. The vegetative decay (oxygen depleting) along with night time respiration are contributing to the mid-summer dissolved oxygen sags.

E-coli results indicate some periodic excess levels (≥406 CFU), but overall does not appear to be a problem. Further long term monitoring would be needed to determine if bacteria was a major concern in Big Willow Creek.

Recommendations

Big Willow Creek needs to store and discharge additional water during the summer months. Being a low gradient stream, more water needs to be kept within the channel to help with normal flushing of pollutants and aeration of the water column. Grants and loans need to be pursued within the watershed to improve diversion structures and improve irrigation efficiency. Irrigation efficiency would not only lower dissolved phosphorus concentrations but it would keep more water in Big Willow Creek. Improved diversions would help manage water at a higher efficiency and help maintain additional water in the river channel.

In addition to diversion improvement, it may be necessary to further control the beaver population within the watershed. Over population may be causing irreparable damage to the riparian area that has been designated as the overall solution (shade) for Big Willow Creek to meet its cold water aquatic designation. Excessive beaver dams also tend to stagnate waterways and cause damage due to low discharge and excessive heating of the beaver ponds.

References

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