Memorandum

To: Brown's Creek Watershed District

Date: April 9, 2008
From: Mike Majeski, Cecilio Olivier

Re: THPP Infiltration Improvement – Project Update

The objective of this memorandum is to report on the performance of the Trout Habitat Preservation Project (THPP) since the installation of improvements designed to restore the infiltration capacity of this project. This memorandum uses the infiltration rates calculated by Christa Bren for her Master's Thesis titled "Trout Habitat Preservation Project: Infiltration Basin Evaluation" (December 21, 2005). As the Managers may recall, Ms. Bren reported the infiltration rates calculated from 2000 to 2004, concluding that there was a decrease in performance towards the end of this monitoring period. As a result of this conclusion, the BCWD Board of Managers agreed that improvements to the system needed to be made. These improvements were designed and constructed over the 2005-2006 time period. The first monitoring season since the construction of these improvements was 2007 which is reported in this memorandum.

Background

In the winter of 2006, improvements were made to Basin 1 with the installation of an infiltration trench near the bottom of the basin and modifications to the drop outlet structure. The drop outlet structure was modified with the installation a pipe at the bottom of the structure that allows water from Basin 3 to flow into Basin 1. Refer to Figure 1 for a map of THPP.

During the 2007 monitoring season, surface water elevations in Basin 1 and Basin 3 did not reach their respective outlet elevations; therefore, no water discharged from the THPP project site. The drawdowns measured in Basin 3 in late March and early April were the result of the improvement made to the drop structure of Basin 1. Above the water elevation of 966.5 in Basin 3, water in Basin 3 flows into Basin 1 via the modified drop outlet structure. The additional water flowing from Basin 3 contributes to the increase in the volume of runoff infiltrated in Basin 1. Once water levels in Basin 3 fall below 966.5, water can no longer flow from Basin 3 into Basin 1. With the addition of the improvements, surface water infiltration monitoring was needed to evaluate the performance of the trench. In order to compare the infiltration performance of Basin 1, Basin 3, and the combined Basin 1 and 3 complex to previous analyses, previously established methodologies needed to be followed. The analyses performed for this report and previous reports used a slope evaluation method for computing basin infiltration rates.

Methodology

The slope evaluation method used to determine the volumetric infiltration rates in Basin 1, Basin 3, and the Basin 1 and 3 complex were computed by determining the

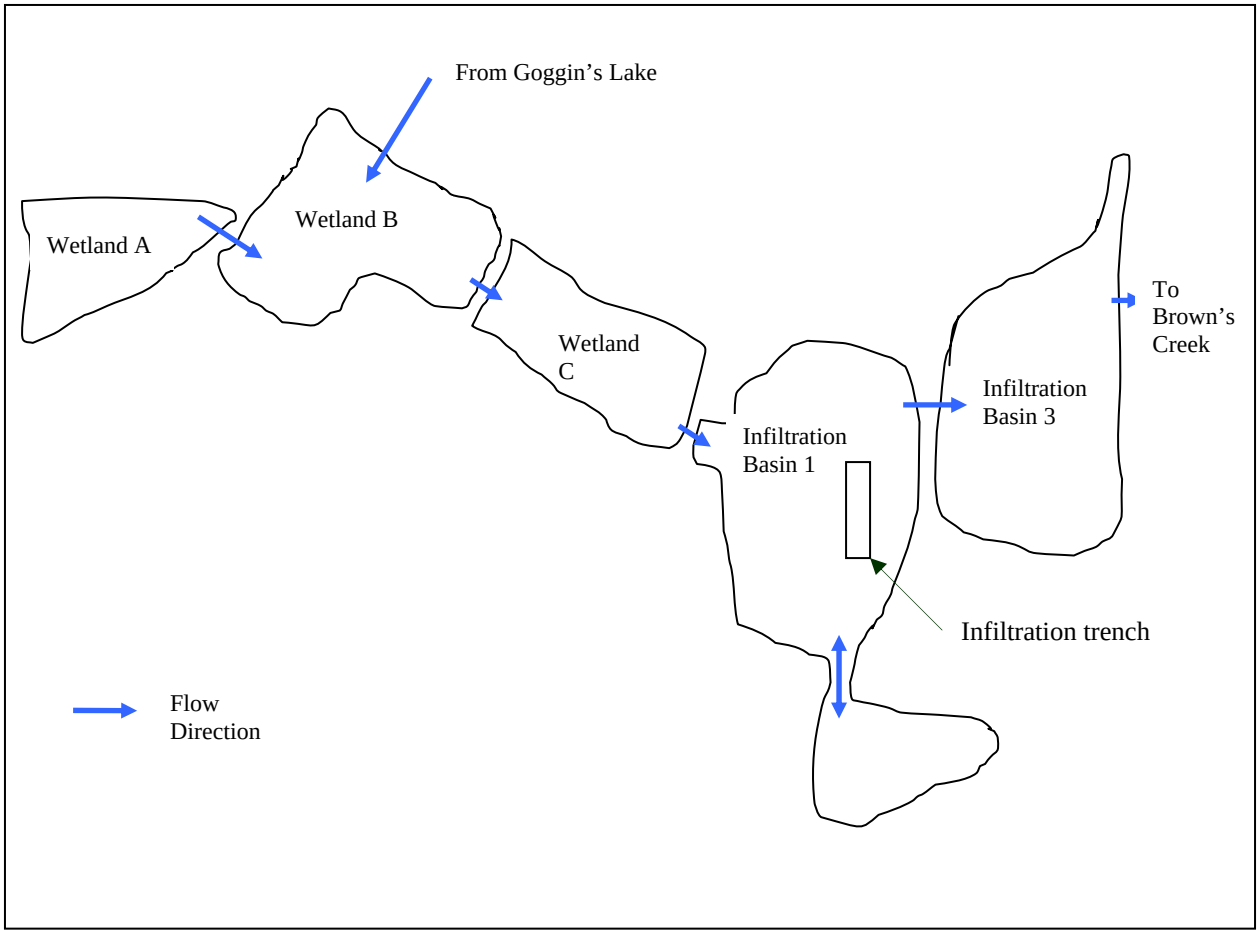

Figure 1. THPP wetland and infiltration basin layout.

rate of water leaving the basins and multiplying this rate by the average surface water area (sq.ft.) in the basins. The rate of water loss (infiltration) was derived from plotting the surface water elevation (ft.) versus time (min.). To isolate the infiltration component from the other hydrological processes working on the system, timeframes of data were chosen where no precipitation and inflow and outflow discharges occurred within the basins. This methodology has been used in previous infiltration analyses and was used to evaluate the 2007 data as well. Figure 2 shows the surface water elevations in Basin 1 and Figure 3 shows the surface water elevations in Basin 3. Tables 1-3 identify the timeframes selected for calculating volumetric infiltration rates as well as the starting and ending surface water elevations and surface areas.

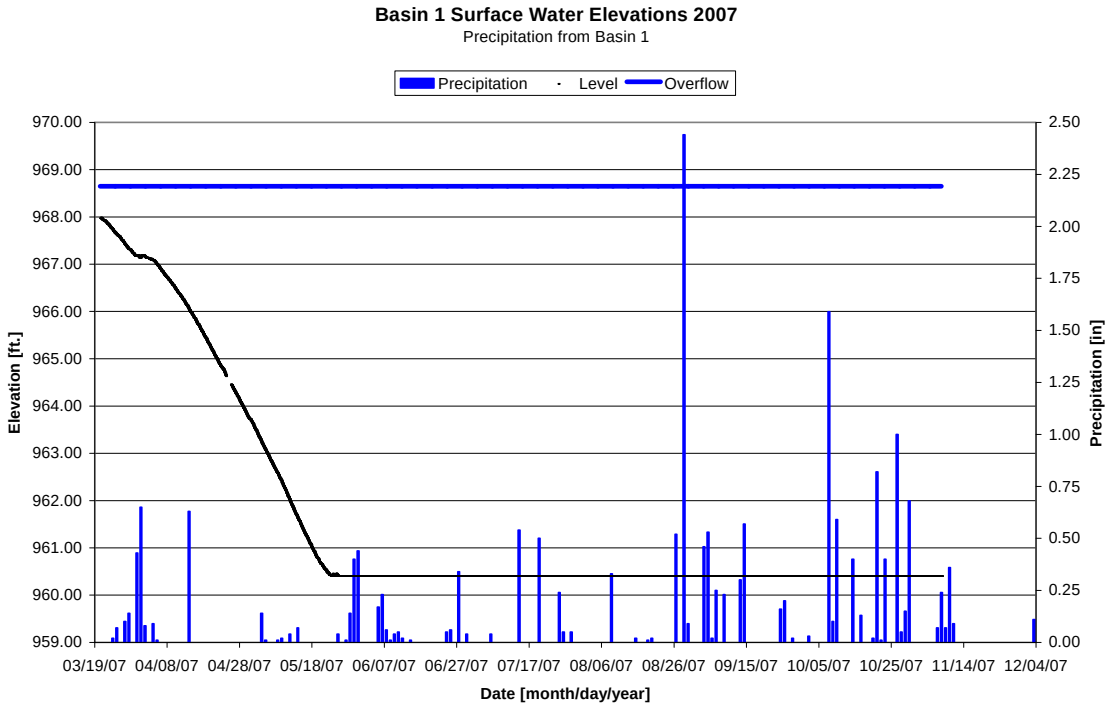

Figure 2. Surface water elevations of Basin 1.

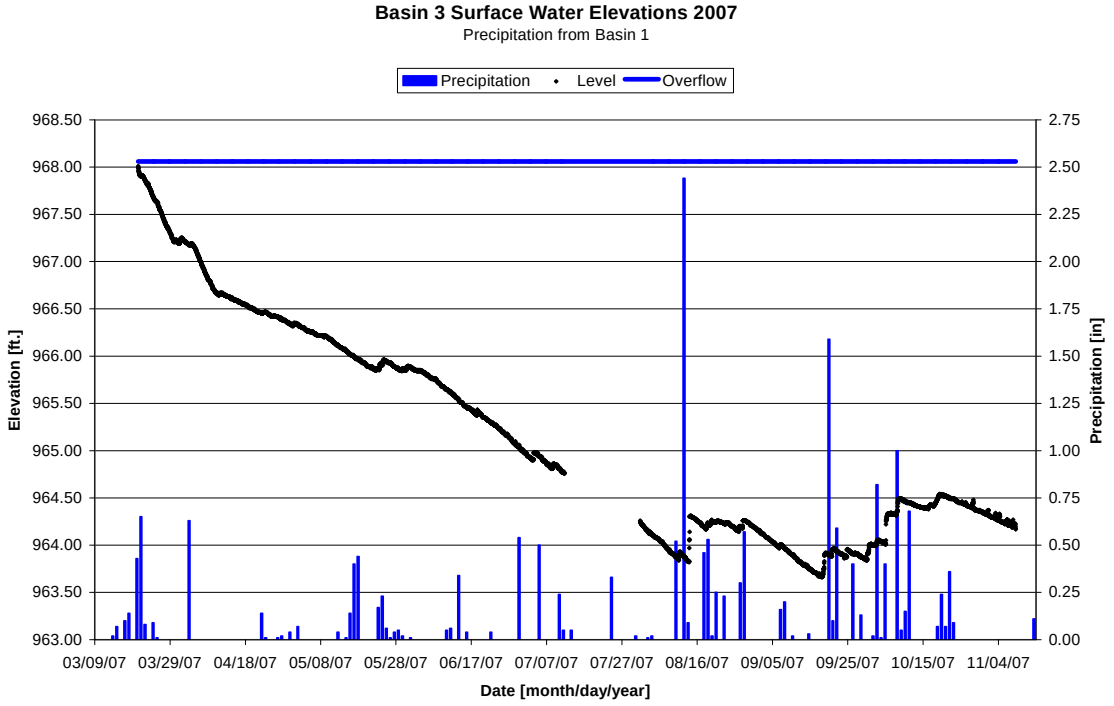

Figure 3. Surface water elevations of Basin 3.

Table 1. Basin 1 Elevation and Areas

Timeframe 1	**Elevation [ft.]**	**Surface Area [sq. ft.]**
04/13/07 (0:12) to	966.16	40,886.2
04/30/07 (18:14)	963.72	17,318.7
Timeframe 2		
05/09/07 (4:41) to	962.45	13,381.7
05/19/07 (23:41)	960.71	4,955.1

Table 2. Basin 3 (Final basin before Brown's Creek) Elevation and Areas.

Timeframe 1	**Elevation [ft.]**	**Surface Area [sq. ft.]**
04/13/07 (0:12) to	966.63	38,339.3
04/30/07 (18:14)	966.32	36,177.1
Timeframe 2		
05/09/07 (4:41) to	966.21	35,409.8
05/19/07 (23:41)	965.91	33,440.6

Table 3. Combined Basins 1 and 3 Elevation and Areas.

Timeframe 1	**Elevation [ft.]**	**Surface Area [sq. ft.]**
03/20/07 (12:14) to	967.97	130,416.3
03/24/07 (23:44)	967.64	122,402.6
Timeframe 2		
04/04/07 (0:14)	967.08	108,803.7
04/10/07 (0:41)	966.67	98,847.4

Results

Analyses performed in 2000-2004 focused on the infiltration rates measured in the combined Basin 1 and 3 complex. The analysis for the Basin 1 and 3 complex assumed equal surface water elevations and infiltration rates in Basins 1 and 3 combined. Table 4 displays the previous volumetric infiltration rates calculated for the combined Basin 1 and 3 complex with the addition of the 2007 data.

Table 4. Infiltration Rate by the Slope Evaluation 2000-2004, 2007.

Year	Basin 1 and 3 Infiltration Rate [cfs]
2000	0.018
2001	0.032
2002	0.081
2003	0.028
2004	0.017
2007 Timeframe 1	**0.107**
2007 Timeframe 2	**0.082**

Conclusions

Based on previous analyses, the infiltration rate in the combined Basin 1 and 3 complex has significantly increased following the installation of the infiltration trench improvement in 2006.

The infiltration timeframes chosen for the 2007 analyses were limited due to a lack of basin inundation following spring snowmelt. The presence of precipitation events occurring during the infiltration period from late March into early May also limited suitable infiltration timeframes. Once the snowmelt water infiltrated in Basin 1, very little water inundated the basin for the remainder of the monitoring season due to the performance of the trench and lack of significant rainfall events in the late spring and summer of 2007.

Following completion of the THPP construction project in 2000, infiltration rates increased until 2002 as vegetation established in the basins. Following the 2002 season, infiltration rates decreased as erosion from the surrounding watershed caused sedimentation within the basins and clogged pore spaces created by the established vegetation. After the installation of the infiltration trench in 2007, the infiltration rates in Basin 1 have been restored back to the target rates observed in 2002.

Given the maximum capacity of the combined Basin 1 and 3 system at the elevation of 968, it is expected that the infiltration rates would increase with the increase in head within the system. The overall conclusion of this study is that we achieved the goal to restore the optimum infiltration rates observed in 2002.

Recommendations

Heavy rains in the fall of 2007 caused erosion to occur along the dirt road between Basin 1 and Wetland C, near the east end of Wetland C. The topography in this area slopes down toward the culvert under the dirt road. Some sedimentation did occur in Wetland C and although no water outletted from Wetland C into Basin 1 during this period, future events may flush these sediments into Basin 1 and affect the infiltration performance of the basin and trench.

Repairing the buffer zone through seeding at the east end of Wetland C would reduce the amount of sediment reaching Wetland C by slowing the rate of runoff and trapping sediment within the buffer zone. A permanent retaining wall or similar structure that would support the road base would better alleviate the erosion potential in this area. There is also erosion occurring at the southeast corner of Wetland B. A wider buffer zone in this area would slow the erosive forces of the runoff and also help trap sediment.

Monitoring of the THPP should continue in order to evaluate the long term performance of the trench and infiltration basins and the interaction between the wetlands and the infiltration basins. It is expected that without further sedimentation in Basin 1, infiltration rates should remain similar to the rates observed in 2007.