Cessna Run Abandoned Mine Drainage Treatment System Project
Technical Report

By:

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Introduction

Cessna Run (AKA The North Branch of Little Mahoning Creek), a 14.23 square mile sub watershed, is not only the largest tributary of Little Mahoning Creek, it is also the tributary with the greatest pollution impact, the tributary with the greatest potential in terms of a sustainable trout fishery in the entire Little Mahoning Creek drainage (approximately 115 square miles) and the tributary that forms the 4.1 mile Delayed Harvest Fly Fishing Only (DHFFO) stretch of Little Mahoning Creek.

The North Branch, the second largest of the three main tributaries that form Cessna Run, contains two areas of major abandoned mine drainage pollution impacts (Figure 1). The Phase I area consist of several surface mine discharges that contribute a majority of the acidity and aluminum loading input to the North Branch. The Phase II area consists of several alkaline deep and surface mining discharges that contribute a majority of the iron loading input to the North Branch.

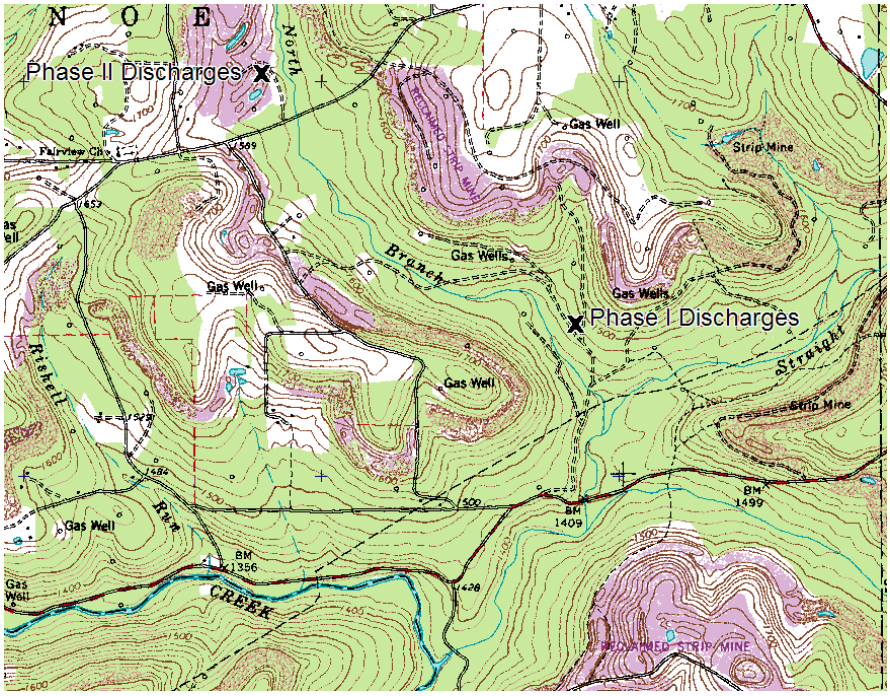

Figure 1. Phase I and Phase II project locations in the Cessna Run sub watershed of Little Mahoning Creek in Canoe Township, Indiana County.

In 2003, the Indiana County Conservation District, in partnership with the Little Mahoning Creek Watershed Association, the Ken Sink Chapter of Trout Unlimited, the Indiana County Chapter of the Pennsylvania Senior Environmental Corp and the Pennsylvania Game Commission, obtained grant funding from the Pennsylvania Department of Environmental Protection Growing Greener Initiative and the Federal Office of Surface Mining and a monetary donation from TJS Mining Company to design and construct two passive abandoned mine drainage treatment systems for three surface mining discharges (Phase I) that contribute a majority of the acidity and aluminum loading to Cessna Run (Figure 2).

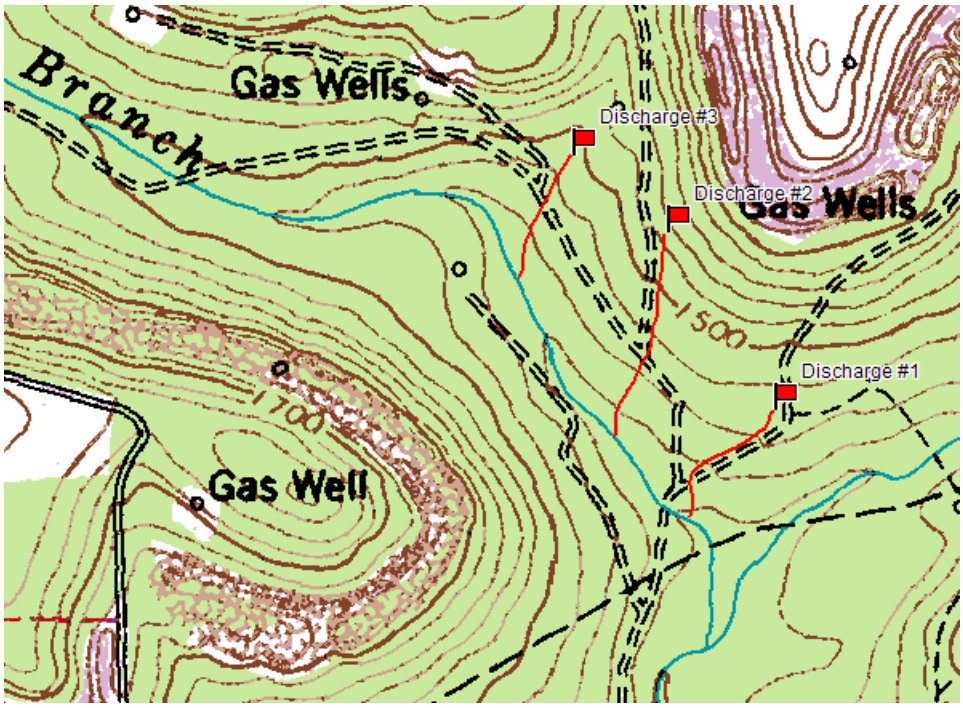

Figure 2. The three discharge locations of Cessna Run Phase I.

The construction of these two systems were completed in November 2005 and have been successfully treating an average of 175 gallon per minute (GPM) of AMD water since installation. The following is a compilation of studies completed post-construction

documenting the success of the treatment systems, and the water quality and biological improvements of the Cessna Run Watershed.

AMD Treatment System Water Quality

Discharge #1, the smaller flow of the three discharges, was treated with an oxic limestone channel (OLC). The effluent of the OLC was then allowed to precipitate its metal loading into a large forested area before it enters Cessna Run. Discharge #2 and #3 were captured and transported to the same treatment system, an oxic limestone drain (OLD) with two accompanying sedimentation ponds for metal precipitation.

The three Phase I discharges contribute on average a total of 134 lbs/day of acidity, 9.18 lbs/day of aluminum and 39.19 lbs/day of manganese loading to Cessna Run. After treatment, the acidity concentration of the discharge water was totally eliminated and 50.98 lbs/day of alkalinity were added. In addition, aluminum and manganese loadings have been reduced 65% and 52% respectively (Table 1 and Figure 3, 4 and 5). Metal concentration reductions are great, but not ideal because of the amount of land available for sedimentation due to stream and wetland constraints.

Table 1. The water quality improvements of the two Cessna Run Phase I treatment systems.

Location	Flow	Lab	Cond	Alk.	Acid.	Fe	Mn	Al	SO4	Alk Load	Acid Load	Fe Load	Mn Load	Al Load
	gpm	pH	uS	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	lb/day	lb/day	lb/day	lb/day	lb/day
D3	87.50	3.90	1335.00	0.00	72.75	0.17	21.35	5.28	799.75	0.00	74.40	0.17	21.78	5.47
D2	52.39	3.68	1215.00	0.00	60.00	0.83	18.13	3.46	667.50	0.00	37.33	0.49	11.06	2.14
OLD Effluent	139.39	6.75	1202.50	26.75	-8.25	0.32	9.91	1.47	666.50	41.24	-9.09	0.50	16.43	2.59
									Improvement	41.24	-120.82	-0.17	-16.40	-5.02
D1	37.40	3.97	1017.00	0.00	48.67	0.49	14.60	3.56	550.67	0.00	21.79	0.22	6.35	1.57
OLC Effluent	37.40	6.77	787.00	22.00	-5.67	0.14	5.50	1.26	400.67	9.74	-2.30	0.07	2.46	0.58
									Improvement	9.74	-24.08	-0.15	-3.89	-0.98
									Total Improvement	50.98	-144.91	-0.32	-20.29	-6.01

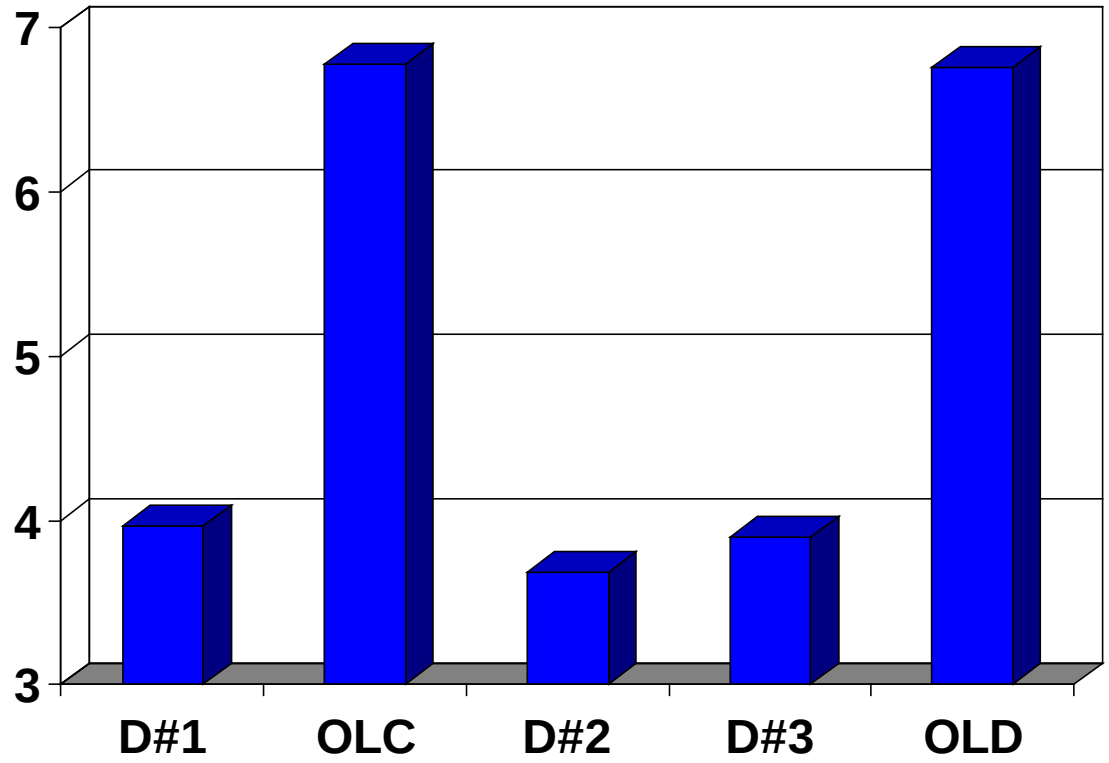

Figure 2. The influent and effluent pH values of the two Phase I Cessna Run treatment systems.

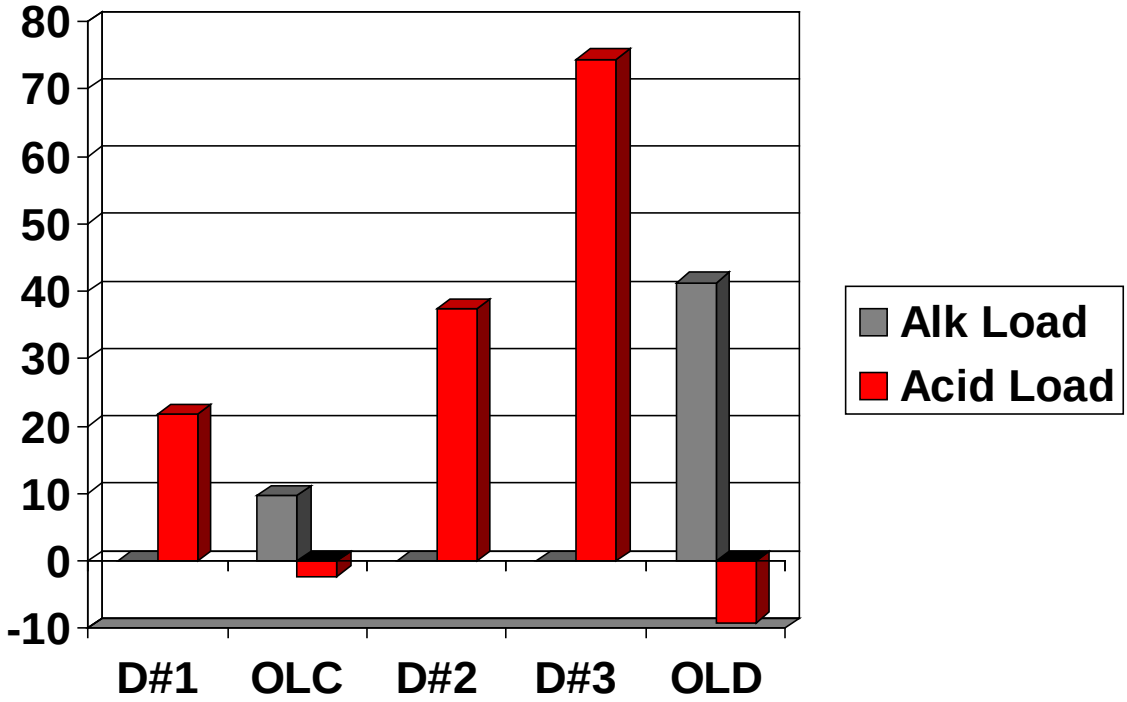

Figure 3. The influent and effluent alkalinity and acidity loadings of the two Phase I Cessna Run treatment systems.

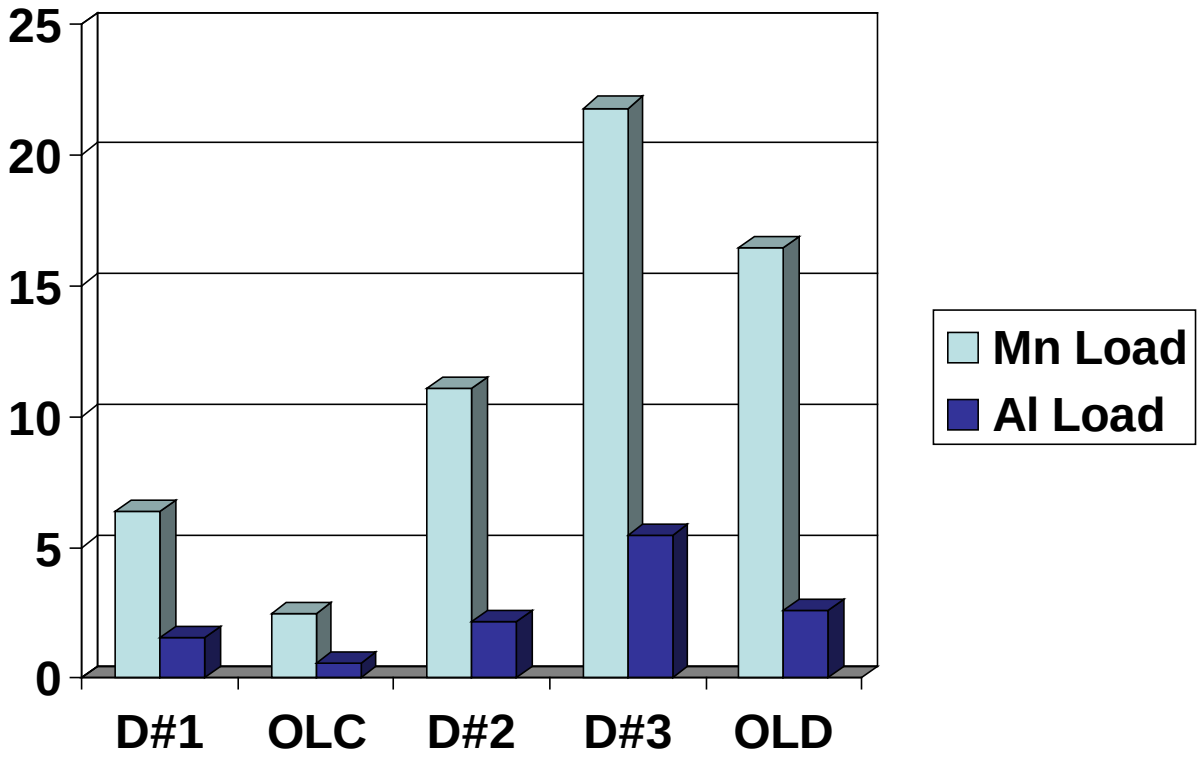

Figure 4. The influent and effluent aluminum and manganese loadings of the two Phase I Cessna Run treatment systems.

Cessna Run Water Quality

The water quality of Cessna Run improved throughout its length post construction of the Phase I system. This improvement was obviously most noticeable on the North Branch just before its confluence with Straight Run (Figure 5 and 6). The alkalinity concentration was increased 34% while the acidity concentration was reduced 251%. Similar improvements were documented for aluminum and manganese concentrations which were reduced 66% and 27% respectively.

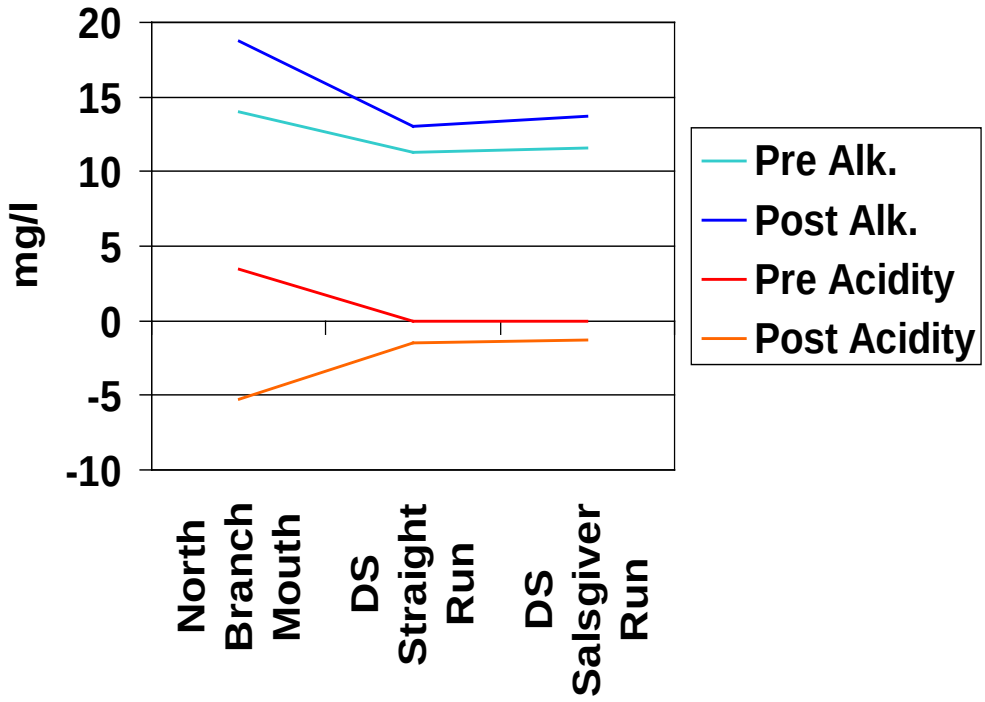

Figure 5. The alkalinity and acidity concentrations at selected sites in the Cessna Run watershed pre and post Phase I AMD treatment system construction.

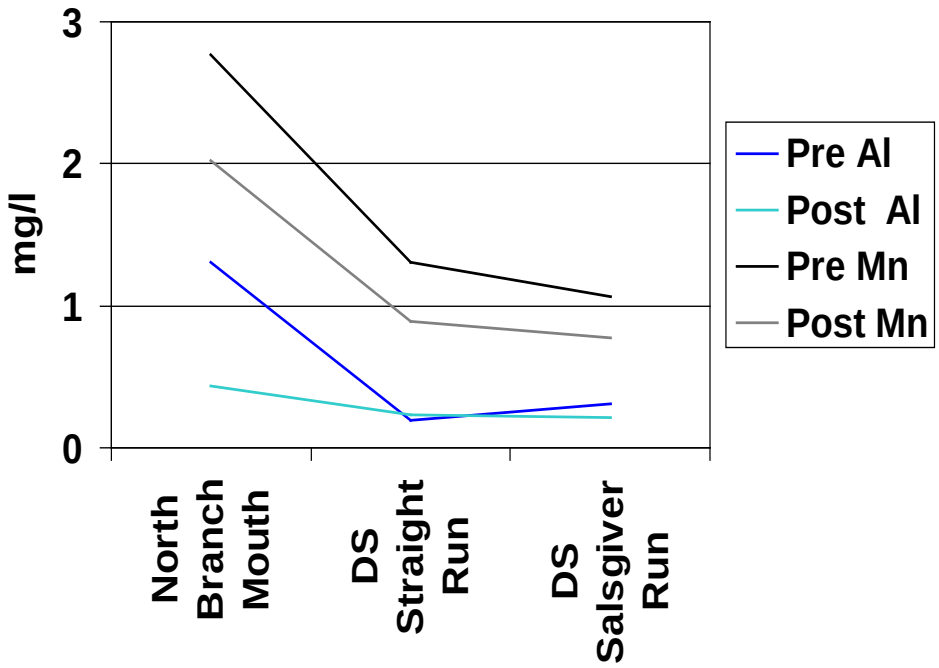

Figure 6. The aluminum and manganese concentrations at selected sites in the Cessna Run watershed pre and post Phase I AMD treatment system construction.

Cessna Run Macroinvertebrate Community

The macroinvertebrate community of Cessna Run has been the greatest responder to the construction of the Phase I systems. Every May, starting in 2003, the Ken Sink Chapter of Trout Unlimited completes a macroinvertebrate sample at Cessna Run before its confluence with Little Mahoning Creek, approximately 1.5 miles downstream of the Phase I systems. The 2006 sample, collected six months after the Phase I systems were placed online, shows great improvement in the EPT (Ephemeroptera (mayflies), Plecoptera (stoneflies) and Tricoptera (caddisflies)) Taxa, generally considered the three most pollution sensitive Orders of stream macroinvertebrates. Those improvements are illustrated in Figure 7 and 8.

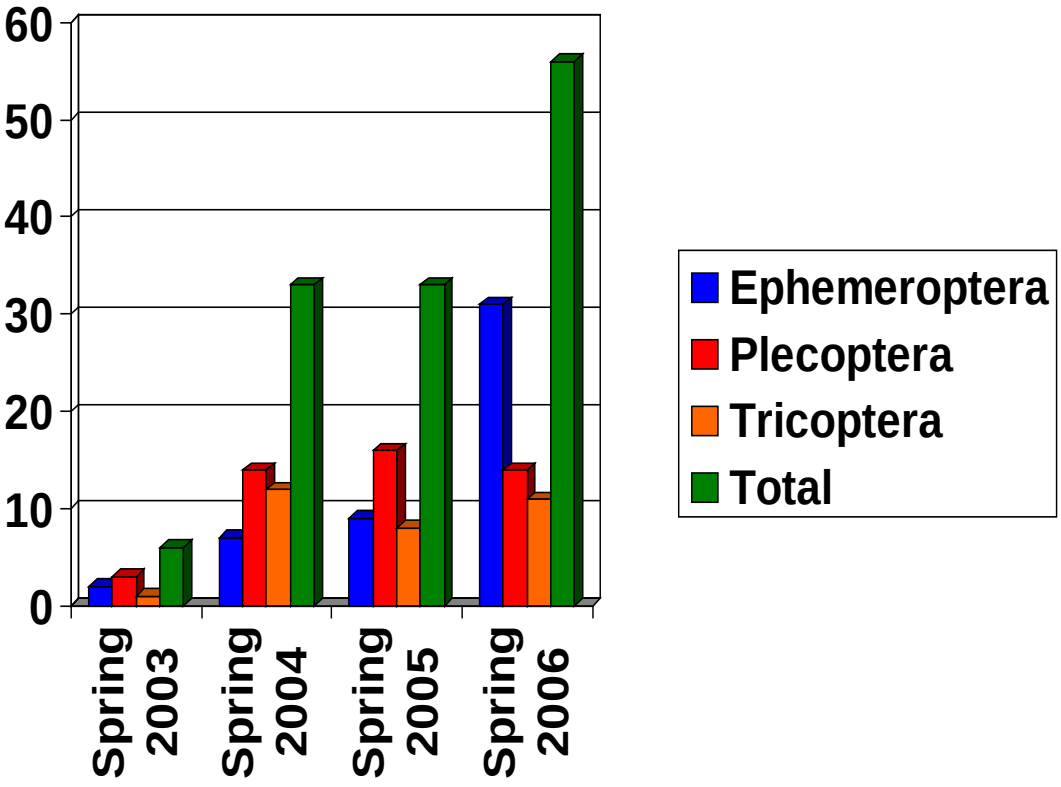

Figure 7. The EPT Taxa numbers at the mouth of Cessna Run. Notice the great improvement in the 2006 sample, post Phase I construction.

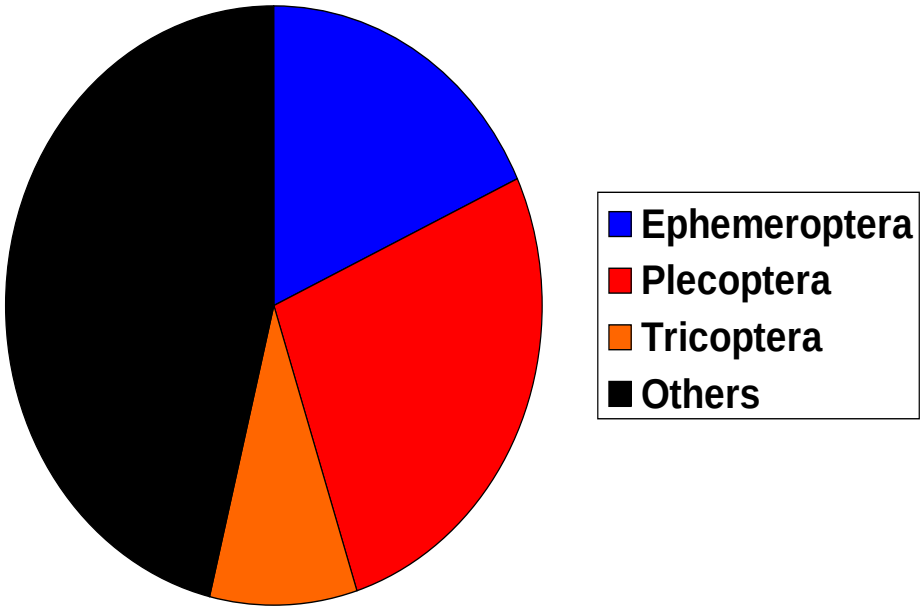

Figure 7. The composition of the macroinvertebrate community at the mouth of Cessna Run in spring 2003. The EPT Taxa constitute 54% of the sample. Ephemeropetera (mayflies) constitute 18% of the sample.

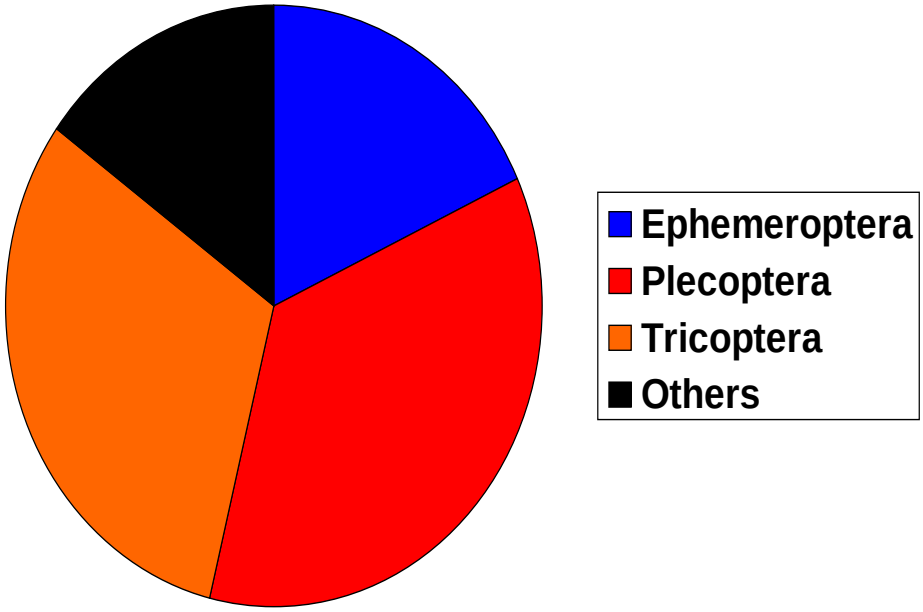

Figure 8. The composition of the macroinvertebrate community at the mouth of Cessna Run in spring 2004. The EPT Taxa constitute 85% of the sample. Ephemeropetera (mayflies) constitute 18% of the sample.

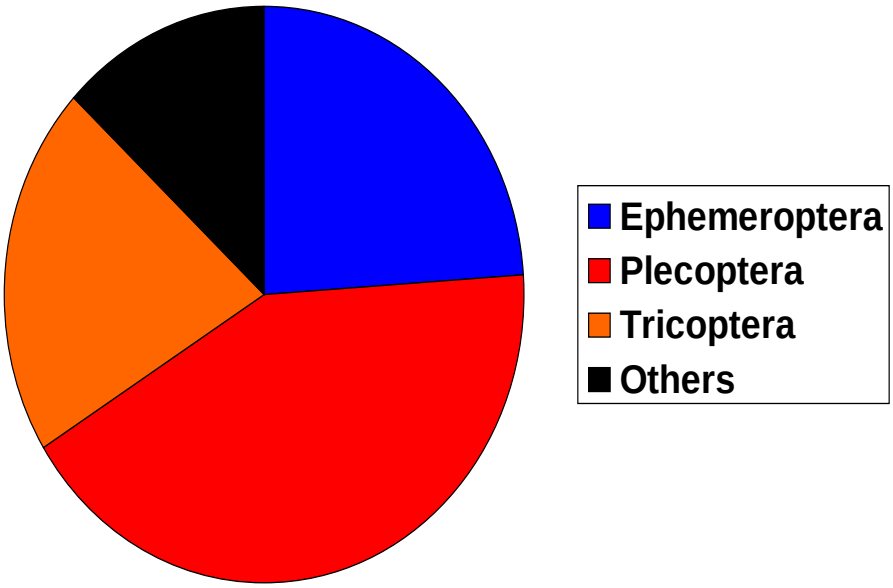

Figure 9. The composition of the macroinvertebrate community at the mouth of Cessna Run in spring 2005. The EPT Taxa constitute 87% of the sample. Ephemeropetera (mayflies) constitute 24% of the sample.

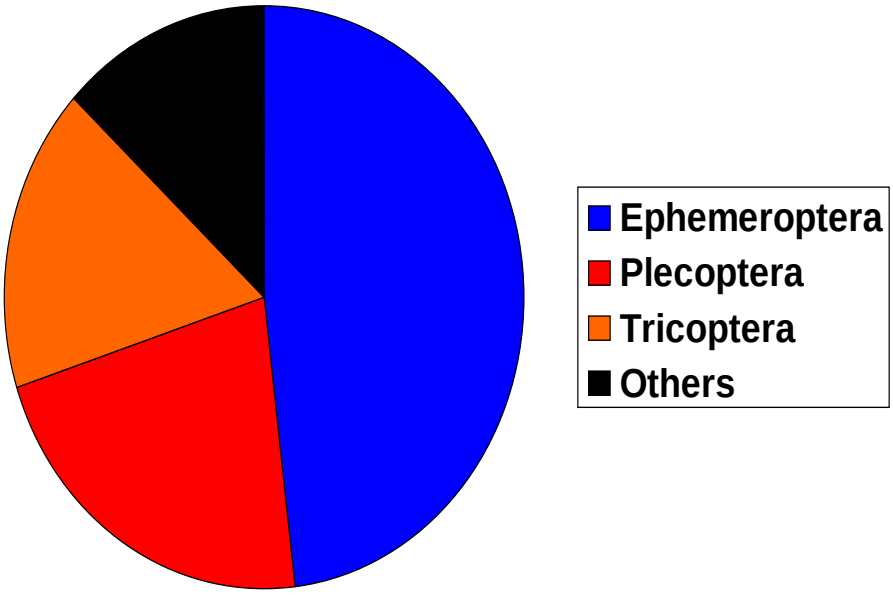

Figure 9. The composition of the macroinvertebrate community at the mouth of Cessna Run in spring 2005. The EPT Taxa constitute 87% of the sample. Ephemeropetera (mayflies) constitute 48% of the sample.

Cessna Run Fish Community

On April 19, 2006 the Western Pennsylvania Conservancy assisted the Indiana County Conservation District with a fish electroshocking study of Cessna Run between the entries of Straight Run and Salsgiver Run (Figure 10). One hundred fourteen total fish comprising seven different fish species were collected. A majority (70%) of those were blacknose dace (28%), creek chub (25%) and a field unidentifiable shiner species (17%). Other species collected were white sucker (9%) and smallmouth bass (3%).

Figure 10. Nick Pinizzotto and Ben Wright of the WPC electroshocking Cessna Run near its confluence with Salsgiver Run.

The two most important species collected were both native and stocked brook trout (13%) and mottled sculpin (5%) (Figure 11, 12 and 13) The stocked brook trout moved into Cessna Run from stockings that occurred in Little Mahoning Creek just previous to the shocking. One of those were collected just over one mile up Cessna Run from its confluence with Little Mahoning Creek, demonstrating that water quality in Cessna Run is adequate for trout survival and hopefully propagation.

The native brook trout were all collected just downstream of Straight Run, which has a small population of native brook trout. We hope that this migration into the main stem of Cessna Run continues from recolonizers located in Straight Run and Salsgiver Run.

Mottled sculpin, just as brook trout, are very sensitive to water quality degradation. Finding them in Cessna Run is very much like finding a mayfly. In addition, mottled sculpin have no swim bladders and feed exclusively at the substrate level. This demonstrates that the macroinvertebrate population is large enough to support these types of species.

Figure 11. A stocked Little Mahoning Creek brook trout collected in Cessna Run.

Figure 12. A native brook trout collected in Cessna Run just downstream of the entry of Straight Run.

Figure 13. One of the mottled sculpin collected in Cessna Run.