THE RESPONSE OF FISH POPULATIONS TO AMD REMEDIATION IN THE LITTLE SANDY WATERSHED

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Background

The Little Sandy Watershed is part of the Big Sandy Watershed of the Cheat River. It lies in Northeast Preston County of West Virginia. Little Sandy drains 33,679 acres and Beaver Creek, the longest tributary, drains 7,232 acres. Historically the Little Sandy watershed was likely populated with Native Brook Trout. After the area was settled and cleared and the water temperature increased, the Brook Trout would have retreated to all suitable cold feeder streams. Smallmouth Bass and other fish in the Little Sandy and Hatchery Trout were annually released to maintain a fishery. Extensive mining throughout the watershed during the middle of the 20th century caused degradation of the water quality from Acid Mine Drainage (AMD). Most of the tributaries of Little Sandy were impacted, including the Little Sandy main stem and Beaver Creek, the longest tributary.

Little Sandy in the 1980s

Around 1985 the local Trout Unlimited Chapter began to get interested in the Little Sandy Watershed as a potential trout fishery. Many people thought it was a waste of time because the stream would be dead forever. A few of us were not convinced that it would never live because it had so much potential and no new degradation was occurring. We knew the worst was in the past and things could only get better. Where others saw a dead stream, I saw a stream in recovery.

Little Sandy is a fairly large stream that contains boulders, riffles and other structure throughout most of it length, and it also has fairly good forest canopy. The stream did not have the look of many impaired streams that are armored with iron or other metals. It actually looked like many of the good trout streams in the area. Unfortunately, my idea about the stream was not supported by water quality and aquatic life.

Aquatic insect life in Little Sandy was nonexistent except for a few acid tolerant species. Water quality in the mid 1980s could not support any game fish as shown in Table 1. Major problems were believed to be AMD from Cherry Run, Beaver Creek and Webster Run. Storm runoff from active and inactive strip mines may have been contributing to the overall degradation. Fish population data from a Department of Natural Resources (DNR) Survey in 1989 is shown in Table 2.

Table 1. Water quality in the Little Sandy Watershed in 1982 & 1983.

	Little Sandy below Webster			Webster Run mouth			Little Sandy above Webster			Beaver Creek mouth			Little Sandy above Beaver		
Date	pH	Acid	alk	pH	acid	alk	pH	acid	Alk	pH	Acid	alk	pH	acid	alk
12-82	5.8	7	7	4.5	58	2	6.0	8	7	4.4	14	3	5.8	6	7
1-83	-	-	-	-	-	-	6.3	0	9	5.0	10	3	6.3	<1	19
1-83	5.6	15	4	4.3	40	3	6.2	3	8	-	-	-	-	-	-
2-83	4.9	11	4	4.4	37	2	5.6	7	6	5.1	15	2	5.8	7	8
4-83	4.9	21	2	4.6	60	1	5.3	10	2	4.9	17	2	5.4	10	4

Data is from WVDEP records. Acidity and Alkalinity recorded in mg/l.

Table 2. 1989 Little Sandy Fish Data.

Rotenone survey .8 above mouth, 8/12/89

Fish Species found 0

Aquatic life found 1 Caddisfly

Total lbs per acre 0

Early Reclamation

Change to the Little Sandy Watershed would come very slowly, but soon others became interested in the stream's water quality.

The West Virginia Department of Environmental Protection Abandoned Mine Lands (WVDEP/AML) started reclamation in the Little Sandy Watershed on Webster Run. The Webster Refuse Anoxic Limestone Drain (ALD) was completed in 1988. This successful ALD is the earliest AMD project on Little Sandy and is still working well. No other reclamation work was completed in the watershed until 1996.

The DEP/AML then addressed the AMD flowing into Cherry Run near its confluence with Little Sandy near its head at Hazelton. This project included the installation of a Successive Alkaline Producing Systems (SAPS) and an (ALD). This project was completed in 1996 and the systems are still in place and working well today. With this reclamation, the water quality was improved downstream to Beaver Creek and Trout

Unlimited (TU) began stocking Fingerling Brown Trout in that section on an experimental basis.

In 1997 the DEP/AML completed another project on Webster Run called the Sugar Valley Portal. The project closed reclaimed portal areas and created some OLCs and significantly improved Webster Run's water quality to what it is today. Although Webster does not have great water quality, it does not significantly degrade Little Sandy, as in the past.

There were several remaining AMD sites around the Little Sandy Watershed, but the major contributing stream was Beaver Creek. TU members had done some anecdotal sampling on Beaver and knew it was a major contributor to the problems of Little Sandy. It was also seen as a potential Native Brook Trout Stream because it had lower water temperature.

Beaver Creek Reclamation

The Friends of the Cheat (FOC) were organized in 1995 with the restoration of the lower Cheat as their goal and TU gained a dynamic partner in their efforts to get Little Sandy restored. Through the efforts of FOC, the River of Promise (ROP) was started. The ROP brought together State and Federal Agencies, Researchers, Academia, Industry and Conservation groups all working to solve the AMD problem on the Cheat. The ROP decided to focus on the Big Sandy Watershed with their clean-up efforts. The reasoning for this decision was a chance to bring a significant fishery back to the Big Sandy Watershed. Soon the technical committee of ROP was planning reclamation on Beaver Creek AMD sites.

Known problem sites were identified throughout the stream and resulted in three projects being planned for reclamation.

1. The first was at Big Bear Lake to mitigate poor water quality in the lakes and into Beaver Creek. The design was a Limestone Leachbed and Limestone Channel (OLC), as shown in Figure1.The project was funded by the Friends of the Cheat, through a grant from the United States Environmental Protection Agency. The work was performed by Groundbreakers, Inc., of Bridgeport, WV. Project design was by Triad Engineering, Inc., and Paul Ziemkiewicz of the National Mine Land Reclamation Center at WVU. The work was completed in 1998. This project was successful and the upper Beaver Creek water quality was improved.

Figure 1. Diagram of Big Bear lake Limestone Leachbed.

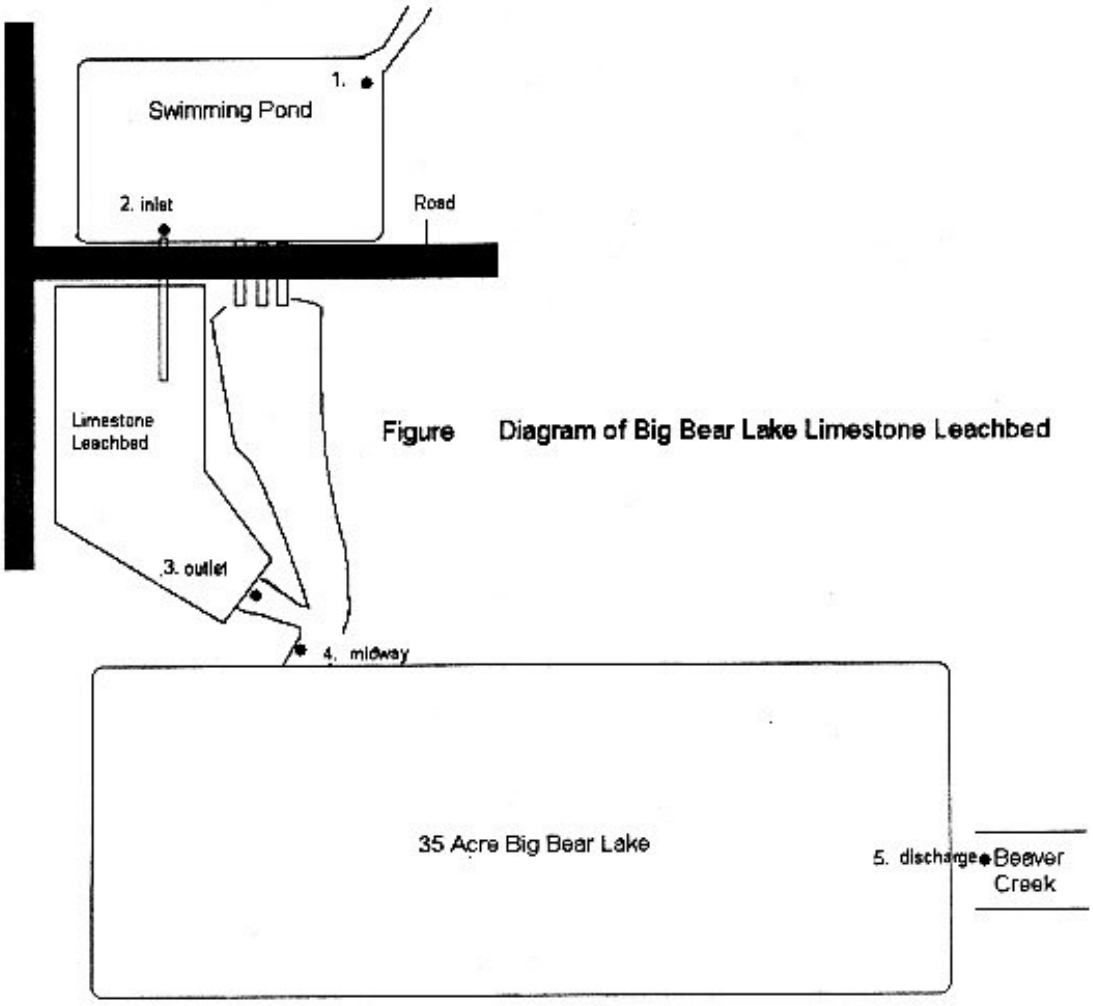

Figure Diagram of Big Bear Lake Limestone Leachbed

2. The Friends of the Cheat also received a grant to address another AMD problem at the McCarty site on Beaver Creek. The US Office of Surface Mining's Clean Stream Initiative supplied the grant and Grafton Coal Co., Inc., performed the work. The engineering design was by Triad Engineering, Inc., and the National Mine Land Reclamation Center at WVU. The project was completed in 2000. The innovative design, using Steel Slag Check Dams along with OLCs, was very successful and greatly improved lower Beaver Creek. A concept drawing is shown in Figure 2.

Fig 2. Diagram of the Limestone Leachbed and OLCs at McCarty Highwall.

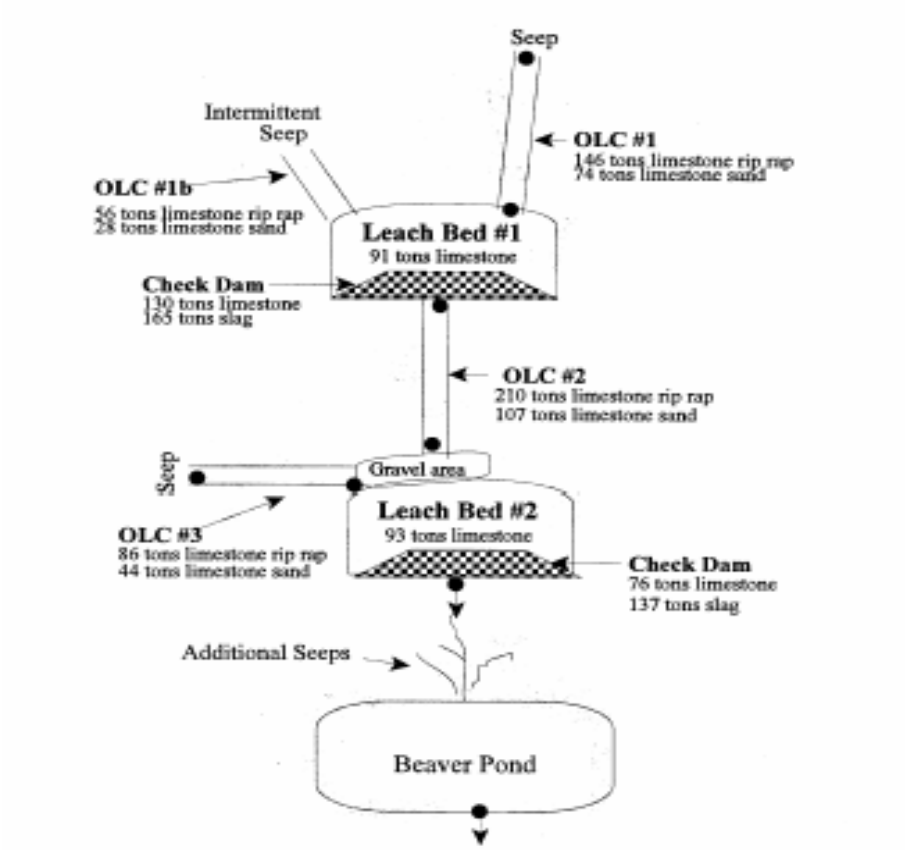

Figure 3: McCarty Highwall Treatment area.
Black dots mark the sample stations.

3. The third project planned for the Beaver Creek Drainage was the Livengood Site by the DEP/AML. The project was completed in 2001.Unfortunately the water quality was not addressed during construction as expected and the site must be revisited to address this problem. This was an obvious disappointment and a setback in the plans to transfer Native Brook Trout into all of Beaver Creek.

Temperature studies were done in Beaver Creek with "Hobo Temps" for two years during 1999 and 2000 after the Big Bear reclamation was completed to determine if the stream was cold enough to support Native Brook Trout, the preferred species in all cold streams. The water proved to be under the upper threshold limit for Brookies and the planning for the trout transfer from another stream was started. Our tests verified the water quality could also support the Natives.

With the disappointment of the Livengood project, we knew we could not put Brook Trout into lower Beaver Creek. Having no firm date when the Livengood Site water would be abated and not wanting to set the project back further, we made the decision to put them in the upper three or four miles.

On 7 September 2001, the WVDNR along with TU and FOC volunteers electrofished and transferred approximately 70 adults and several Young of the Year (YOY) from a nearby stream. They were distributed about evenly at two access points into good habitat. There was some concern about their ability to pair up and spawn because of the short time between the transfer and spawning time in October. Now we would need to wait for the survey one year later to find out if our efforts were successful.

Little Sandy Watershed Today

We were apprehensive when the time came to find out if the trout transfer from the previous year had yielded offspring in Beaver Creek. There were still some who thought we were foolish to even try such an experiment. On August 23, 2002, DNR Biologist Tom Oldham along with TU and FOC volunteers surveyed two sites by electrofishing to see if our efforts to restore this Brook Trout fishery were successful. Soon after we started shocking we were assured we had at least moderate success when a Young of the Year (YOY) was picked up.

The downstream site of 100 yards yielded 41 total fish but only 5 trout with 1 being YOY. The standing crop for this site was 19.2 lbs/acre as shown in Table 3. The DNR indicated that competition and predation could have contributed to fewer YOY at this site. The upstream site of 100 yards yielded only 11 fish with all of them being trout and 9 of them being YOY. The total standing crop was 6.5 lbs/acre as shown in Table 4. The DNR was satisfied with the reproduction and no additional transfers were needed. The project is successful at this time. Follow up surveys in two or three years will be made to monitor age class distribution and population levels.

Table 3. Species and sizes of fish in Beaver Creek at Station One.

Beaver Creek of Little Sandy Station One August 23, 2002 6. Fish Species		Abund.	Size Range (inches)	Wt/Lbs.	% Total No.	% Total Wt.
Suckers						
Catostomus commersoni (white sucker)		4	3.2 - 5.7	0.13	9.8	12.3
	Total	4		0	10	12
Minnows:						
Rhinichthys atratulus (blacknose dace)		5	2.2 - 3.1	0.04	12.2	3.8
Semotilus atromaculatus (creek chub)		19	1.3 - 5.0	0.32	46.3	30.2
	Total	24		0.36	58.5	34.0
Game Fishes:						
Salvelinus fontinalis (brook trout)						
Adults		4	5.3 - 9.0	0.47	9.8	44.3
YOYs		1	3.1	0.01	2.4	0.9
	Total	5		0.48	12.2	45.3
Darters and Others:						
Cottus bairdi (mottled sculpin)		8	2.2 - 3.7	0.09	19.5	8.5
	Total	8		0.09	19.5	8.5
TOTAL ALL SPECIES		41		1.06	100.0	100.0
Standing Crop (collected)		19.2	lbs/acre	*(Wt. Collected x 43,560 ÷ Area Sampled (Lgth. x Ave. Width)*		

Table 4. Species and size of fish in Beaver Creek at Station Two.

Beaver Creek of Little Sandy Station Two August 23, 2002 6. Species	Abund.	Size Range (inches)	Wt/Lbs.	% Total No.	% Total Wt.
Suckers					
Total	0		0	0	0
Minnows:					
Total	0		0	0	0
Game Fishes:					
Salvelinus fontinalis (brook trout)					
Adults	2	5.1 - 7.4	0.18	18.18	66.67
YOYs	9	2.4 - 3.9	0.09	81.82	33.33
Total	11		0.27	100	100
Darters and Others:					
TOTAL ALL FISH	11		0.27	100.0	100.0
Standing Crop (collected)	6.5	*lbs/acre (Wt. Collected x 43,560 ÷ Area Sampled (Lgth. x Ave. Width)*			

With the successful reclamation projects on Beaver Creek, the water quality was improving below Beaver all the way to the mouth as shown in Table 5. The fingerling trout stocked by the TU Chapter seemed to be faring somewhat better and now were being stocked below Beaver Creek. The aquatic life was improving, albeit at a slower pace than the water quality would indicate. A fish survey in 2001 in Little Sandy Canyon near the mouth by the DNR showed significant increase in fish populations compared to the 1989 survey, as shown in Table 6.

Table 5. Little Sandy water quality in 2002 and 2003.

	Little Sandy below Webster			Webster Run mouth			Little Sandy above Webster			Beaver Creek mouth			Little Sandy above Beaver		
Date	pH	acid	alk	pH	acid	alk	pH	acid	alk	pH	acid	alk	pH	acid	alk
12/31/02	6.6	7	14	6.5	8	11	6.7	7	15	6.4	8	11	6.8	7	16
1/31/03	6.6	7	15	6.5	8	10	6.6	8	17	6.4	6	10	6.7	8	19

Tests made by Bill Thorne with titration kit and Fisher pH color card.
Acidity and Alkalinity recorded in ml/l.

Table 6. 2001 Little Sandy Fish Data.

Rotenone survey .8 miles above mouth, 8/23/01
Fish Species found 14
Sensitive Species found 3, Hog Sucker, Trout, Smallmouth Bass
Aquatic insects were readily found.
Total lbs per acre 13.8

Remaining AMD Sites

The gains in aquatic life in both project streams give us reason to be happy about the accomplishments in the Little Sandy Watershed. Unfortunately, we have a long way to go to meet the goal of a healthy river system. With the aquatic insect life at less than 50% of what it should be in a healthy stream and the standing crop of fish at 35% of optima, it makes that picture very clear. The challenge for the near future is to get the remaining known AMD sites reclaimed and the problem water abated.

Three sites are known to be causing serious water quality problems. Friends of the Cheat have applied for a Clean Streams Initiative Grant from the Office of Surface Mining to address the before mentioned problem areas at the Livengood site. If the water treatment is successful as planned, the Beaver Creek Drainage will be free of all known AMD and will be a source of good water into Little Sandy. Brook Trout can then be transferred throughout Beaver Creek.

The two other sources of AMD are entering Little Sandy at its headwaters near Hazelton. One is near I68 highway and appears to be an old refuse pile from abandoned mines. Runoff from this site is a problem in all but the very driest periods. The other is on an unnamed tributary of Cherry Run and apparently comes from an old strip mine. The water in the stream has low pH, but does not appear to have a significant amount of metal and should be relatively easy to address.

Along with abating the known problems sites, an extensive review of all mine sites in the watershed should be done to ferret out any sources of AMD entering the Little Sandy Watershed. It is quite possible that there are sites unknown at this time and causing the problems we are realizing with aquatic life populations.

Another concern is the reliability of existing passive systems. Failure of existing treatments systems in the watershed sometime in the future could be a real possibility and is imperative that a maintenance system be developed. It should include monitoring along with an action plan to immediately address any water quality problem. Funds should be readily available to cover costs for treatment or repairs. With the restoration of fish populations goes the responsibility of their protection. Good water quality is a must for their survival and occasional slugs of AMD will be disastrous. A program to handle this potential problem should be put in place immediately by the ROP.

Overall the water quality data in the Little Sandy seems to indicate more aquatic life than is present. Historically aquatic insects repopulate at a very slow rate when water quality is restored, particularly when there is not a good adjoining recruitment source. The lack of bugs is very likely retarding total fish recovery.

Conclusion.

There has been great work by many people to restore the Little Sandy Fishery from the condition of the 1980s to what it is today. The stream is still in recovery and it likely will be for a few more years. I continue to believe that we can return the stream and the entire watershed into a good recreational fishery, instead of fair system we have today and maintain that condition. It is also obvious it will take longer than I originally thought, but for a project of this importance it will be worth the effort. We must continue to keep our focus on all AMD sources in the watershed if total recovery is to be realized. If we achieve the goal of a Little Sandy with no degradation, the local citizens will have great recreational opportunities and area will have a major economical asset. More importantly, we will have shown that a major watershed with many problems can be restored and maintained as a productive aquatic system.

Hopefully in a few years someone can update this report with a story of complete restoration and a Little Sandy Watershed with abundant aquatic life.

Thanks to the River of Promise, who spearheaded the restoration of the Little Sandy Watershed, with special thanks to Paul Ziemkiewicz at the National Mine Land Reclamation Center, Jeff Skousen at WVU, Rick Buckley at the Federal Office of Surface Mining, DNR personnel and the Friends of the Cheat. Also very important was the WVDEP/AML early restoration of Cherry and Webster Runs.