Elkhorn Creek Diesel Spill Study Design

Background

Large trout such as the one above are common in many streams throughout the Elkhorn Creek watershed.

Elkhorn Creek starts near the Mercer-McDowell County line on Rt. 52 and follows Rt. 52 through many villages such as Maybeury, Switchback, Elkhorn, Upland, Kyle, Northfork, Keystone, Eckman, Landgraff, Vivian, Kimball, Big Four, Superior and Maitland before entering the Tug in Welch. The Norfolk Southern railroad follows the stream from Maybeury to Welch. There are two big springs at the upper end of the stream and many other springs add to the flow as you go downstream. These are not natural springs but water flowing out of the underground reservoirs of water that have collected in the old deep coal mines that are no longer active. This water is cool and the chemistry is good with an alkalinity of 120 parts per million or higher and a high pH. Elkhorn Creek has not been flowing in a truly natural stream channel since serious coal mining got underway in the region. The stream was moved in many stretches to accommodate roads, railroads, houses, towns, and coal mines. In several stretches one or both banks of the stream is a rock wall, a concrete wall, a timber crib wall, or a railroad embankment consisting of rock, gravel and other materials. In many sections the stream bank is a gob pile and coal fines are everywhere.

Around 1970 rainbow trout fingerlings were dumped into the upper end of Elkhorn Creek because the truck broke down. The rainbows started reproducing and browns also started reproducing after DNR stocked a few brown fingerlings in 1993.

Flooding ravaged the area on July 8, 2001 that damaged or destroyed many houses and other structures along the stream. Another major flood hit Elkhorn Creek again on May 2, 2002 with a tragic loss of life and major damage to houses, schools, vehicles, bridges, roads and other structures. There were 7 flood related deaths in McDowell County including a woman from North Carolina and her baby who drowned on Rt. 52 in Landgraff and two people killed in Keystone when a tree slid off the mountainside. Immediately after both floods people from the Federal Emergency Management Agency (FEMA), Red Cross, WV National Guard, WVDOH, and many other WV agencies moved into the flooded areas to assist the residents with food, housing, cleaning supplies and other essentials. They worked to make basic repairs to the infrastructure and to clean up the mess.

After a major flood there is always a call from some of the residents and local politicians to dredge the stream or for other projects that they sincerely think will help to protect them against future floods. After the May 2, 2002 flood about $5,300,000 (WV 25%- US 75%) was secured for "stream cleaning", construction of gabion walls between the stream and a few houses, and some bank repair with large rocks. The dredging of segments of Elkhorn Creek started around July 1 and includes a 0.5-mile stretch in Kimball and segments at several highway and railroad bridges. The dredging work was completed around September 23, 2002 and I would estimate that about 2.5 miles of stream has been dredged or severely altered by heavy equipment. After dredging the stream banks usually consists of material dredged from the stream, which is sand, gravel, small rocks, mud and coal fines. These stream banks are very unstable and subject to severe erosion during the next major flood.

-- **Ernie Nester** of the Kanawha Valley of Trout Unlimited provided the above background information.

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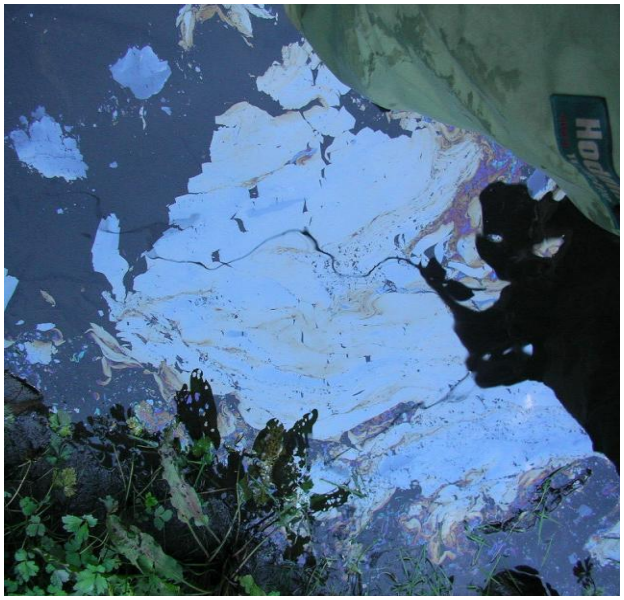
The next section is taken directly from the Bluefield Telegraph. The article provides information about the diesel fuel spill.

Spill kills fish across four miles of Elkhorn

By CHARLES OWENS
Bluefield Daily Telegraph

NORTHFORK — Health officials in McDowell County were still working Thursday to determine the extent of a fish kill in the Elkhorn River following a tractor-trailer crash and large diesel spill on U.S. Route 52.



Gasoline sheen still abundant at the impact site more than a week after the spill.

The tractor-trailer crashed early Wednesday morning after approaching a curve and overturning on its side. The tanker on the tractor-trailer was ruptured in several spots losing an estimated 7,400 to 7,500 gallons of diesel, Cpl. L.S. Noe, of the county sheriff's department, said.

Noe said officials with the Department of Natural Resources, the Department of Environmental Protection and the U.S. Fish and Wildlife Resources were still working Thursday to determine the extent of the fish and aquatic wildlife kill. "We can replace the dirt," Noe said. "It's hard to replace the stream and our fish. Some of the fish in there that I've seen that were destroyed I know for a fact was 10 years old."

The fish kill extended more than four miles from the Powhattan to Eckman communities, Mark Scott, a fishery biologist with the District 4 offices of the Department of Natural Resources in Beckley, said. "It wasn't a complete kill, but it did kill quite a few," Scott said. "I've found both rainbow and ground trout that were dead. They ranged in size from 4 inches to 24 inches. Where the kill started is where the impact is worse. The further you go down stream; I was finding more and more live fish. Toward the end down there you just find one or two dead fish."

Scott said fish may be returning to the area of the diesel spill in two or three weeks.

"They will move in and find those niches where those big fish are no longer there," Scott said. "They are territorial." Scott said the DNR would continue to monitor the fish kill.

"All kills are bad," Scott said. "We don't like fish kills because they have wiped out some nice fish. It may take time for the smaller fish to grow into bigger fish. No kill is good. But if this had been a total kill it would have been really, really bad. It started out as a total kill where the truck wrecked."

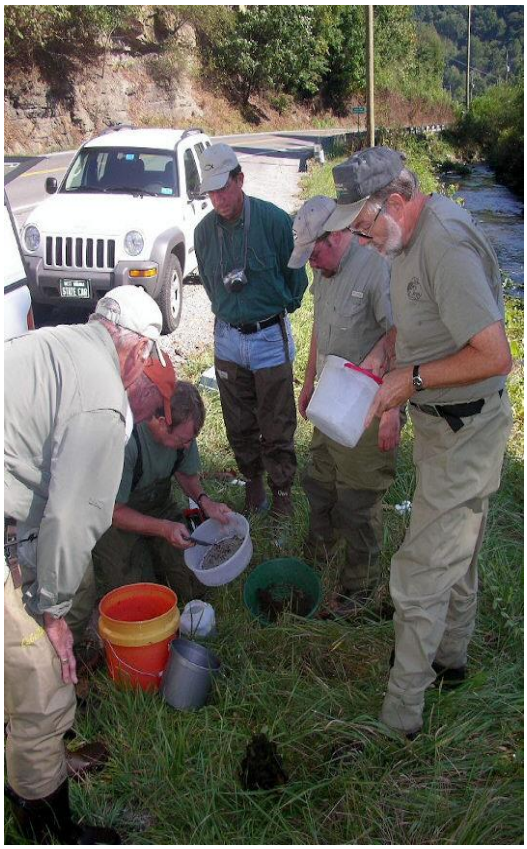
The diesel spill prompted officials to close a section of Route 52 for more than 12 hours Monday. Noe said additional closures might be necessary as the cleanup continues.

— Contact Charles Owens at cowens@bdtonline.com

Study Purpose

The purpose of the study is to examine the impacts of the diesel fuel spill on the benthic macroinvertebrate community in the effected area.

Study design



Project teams performs macroinvertebrate sorting and counting at the reference site

The sample design is a simple targeted approach consisting of a reference (control) upstream of the spill, an impact site just downstream from the spill and a recovery site about 1 ½ to 2-miles further downstream. A slice of the topographic map showing the sample stations is shown on the next page. A level three WV Save Our Streams bioassessment will be performed at each site which includes an assessment of 10 habitat conditions, observations of current physical conditions, and discharge measurements using a Global Flow Probe velocity meter. Additionally several chemical conditions will also be assessed using the WV Save Our Streams Field Kit (LaMotte Code: XX01245).

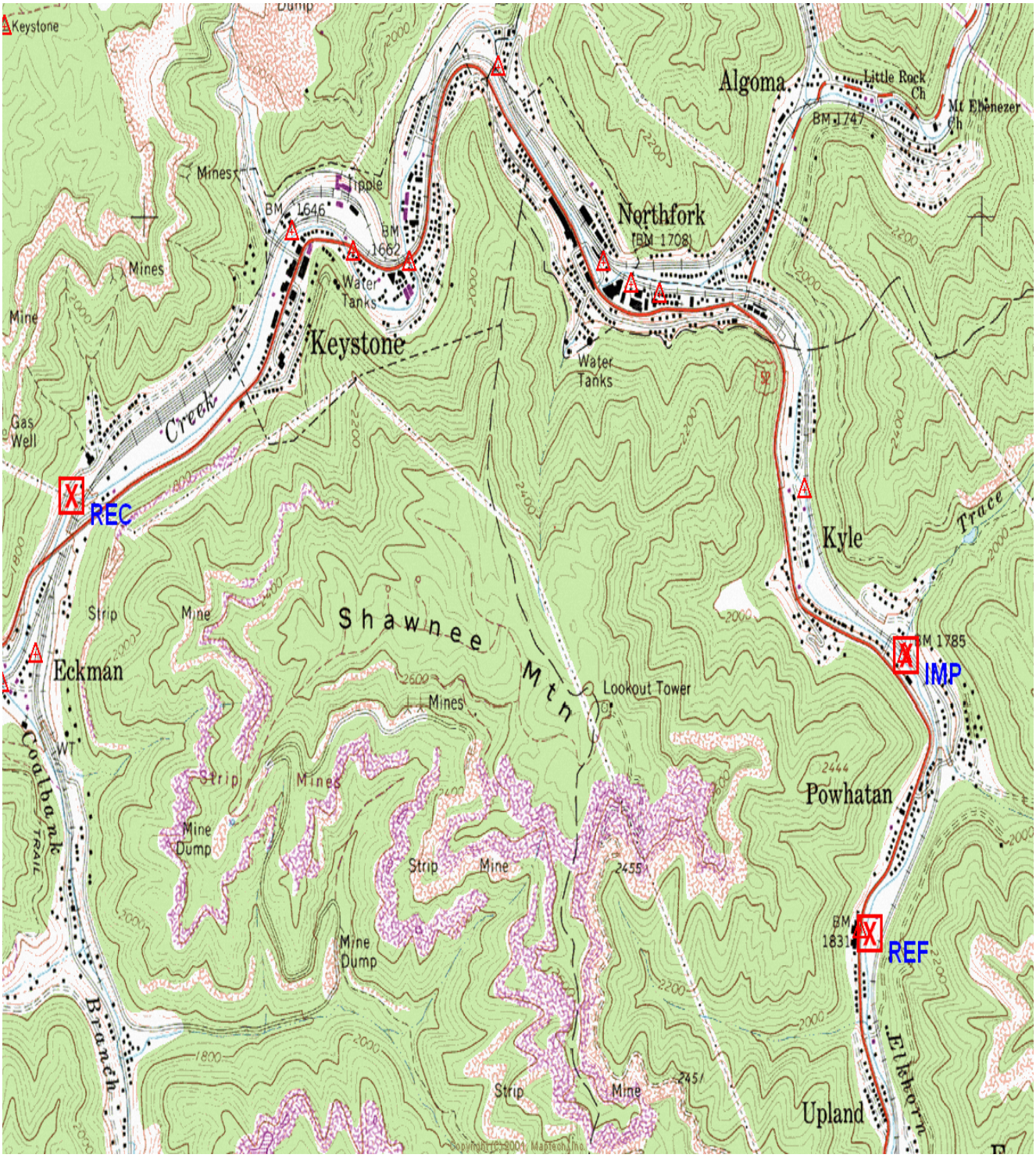
The water chemistry kit consists of the following: Dissolved Oxygen (LaMotte Code: 5860), Nitrate-Nitrogen (LaMotte Code: 3354), Alkalinity (LaMotte Code: 4491-DR), Acidity (LaMotte Code: 7182) and Iron (LaMotte Code: 3318). Additionally field attributes of pH, Conductivity, Temperature, and Total Dissolved Solids will be measured using a LaMotte Tracer Combination Meter (LaMotte Code: 1766). Turbidity will be estimate using a simple clarity tube.

Macroinvertebrate samples will be collected using a modified surber style kick-net, which is 18" high x 9" wide x 10" deep. The net's mesh is a 500-micron Nytex. Four kicks will be performed at each station in representative riffles. The macroinvertebrate samples are preserved on-site in 70% Ethanol and identified to family level after the composite sample is sub-sampled using a ½ sub-sample sort. WV Save Our Streams will identify the samples using facilities at DEP's Kanawha City Headquarters.

Study Period

The study period will extend from September 18, 2007 through the fall of 2008. Two more samplings will be performed at each site in the spring and fall of 2008. Local volunteers from the Elkhorn Creek Watershed Association and the McDowell County Wastewater Coalition will continue the study into the future. The final length of the study has not yet been determined.

Station map



REF (Reference station) located upstream of the spill near Powhatan; IMP (Impact station) located just downstream from the spill at the Kyle church; REC (Recovery station) located downstream from Keystone approximately 1 ½ stream miles from the spill site.

Physical and chemical conditions

LOCATION

	Reference	Impact	Recovery
LATITUDE	37-23-53	37-24-16	37-24-33
LONGITUDE	81-25-21	81-25-13	81-27-45
NEAREST TOWN	POWATAN	KYLE	KEYSTONE
COUNTY	MCDOWELL	MCDOWELL	MCDOWELL
PHYSICAL CONDITIONS			
OIL SHEEN	NONE	HEAVY	SLIGHT
WATER CLARITY	CLEAR	CLEAR	CLEAR
WATER COLOR	NONE	NONE	NONE
WATER ODOR	NONE	CHEMICAL	MUSKY
BED COLOR	BROWN/BLACK	BROWN/BLACK	BROWN/BLACK
ALGAE COLOR	DARK GREEN	DARK GREEN	DARK GREEN
ALGAE ABUNDANCE	MODERATE	MODERATE	MODERATE
ALGAE HABIT	HAIRY	HAIRY	HAIRY
FOAM	NONE	NONE	NONE
SHADE	POOR	GOOD	MODERATE
WATER LEVEL	NORMAL	NORMAL	NORMAL
VELOCITY	2.6	2.0	2.1
AVERAGE DEPTH (FT)	0.58	0.56	0.75
WIDTH (FT)	17.2	18.0	23.4
CROSS SECTIONAL AREA (FT^2)	10.0	10.1	17.6
DISCHARGE (CFS)	25.5	20.0	36.3
HABITAT CONDITIONS			
SEDIMENT DEPOSITION	18	15	12
EMBEDDEDNESS	9	9	13
RIFFLE FREQUENCY	18	18	15
ATTACHMENT SITES	14	16	16
VELOCITY/DEPTH	10	10	14
CHANNEL FLOW STATUS	19	15	10
CHANNEL ALTERATIONS	14	15	13
BANK PROTECTION	19	15	12
BANK STABILITY	20	17	11
BUFFER WIDTH	13	8	13
TOTAL HABITAT SCORE	154	138	129
HABITAT INDEX	77.0	69.0	64.5
WATER CHEMISTRY			
TEMPERATURE	16.5 C	16.9 C	18.7 C
PH	8.2	8.4	8.8
CONDUCTIVITY	557	534	555
TOTAL DISSOLVED SOLIDS	279	376	299
NITRATE-NITROGEN	ND	ND	ND
IRON	ND	ND	ND
ACIDITY	< 1	< 1	< 1
ALKALINITY	160	240	224
TURBIDITY (JTU)	100	100	100
DISSOLVED OXYGEN	9.2	9.0	9.4

Fish were observed again at the impact site about one month after the spill.

Biological conditions

A simple analysis of variance is used to analyze the macroinvertebrate community.

The variance and the closely related standard deviation are measures of how spread out a distribution is. In other words, they are measures of variability. The variance is computed as the average squared deviation of each number from its mean. For example, for the numbers 1, 2, and 3, the mean is 2 and the variance is:

$$\sigma^2 = \frac{(1-2)^2 + (2-2)^2 + (3-2)^2}{3} = 0.667$$

Table 1 compares several metrics used by WV Save Our Streams to assess stream conditions, Table 2 compares the percentages of the families collected at each site and Table 3 on the next page provides a list of the families collected.

Table 1. Metrics

Metrics				**Variance from Reference**	
	Reference	Impact	Recovery	Impact	Recovery
Count	301	29	60	36992.0	29040.5
Total Taxa	10	8	9	2.0	0.5
EPT Taxa	2	2	2	0.0	0.0
Biotic Index	6.65	6.31	5.70	0.1	0.5
% EPT	43.5	27.6	26.7	126.4	141.1
% Tolerant	47.2	41.4	38.3	16.8	39.6
% Dominant	47.2	41.4	38.3	16.8	39.6
IBI Score	47.4	46.0	49.2	1.0	1.6

Table 2. Percent differences of families collected at each station

% Comparison of groups common to all samples				**Variance from Reference**	
	Reference	Impact	Recovery	Impact	Recovery
Baetidae	10.0	20.7	6.3	57.2	6.8
Hydropsychidae	33.6	6.9	18.8	356.4	109.5
Elmidae	3.0	24.1	12.5	222.6	45.1
Oligochaeta	7.6	20.7	6.3	85.8	0.8
Hirudinea	12.3	10.3	6.3	2.0	18.0
Turbellaria	8.0	10.3	13.3	2.6	14.0

Table 3. Families identified from each station

Reference

Class/Order	Class/Order/Family	Count
Amphipoda	Gammaridae	4
Coleoptera	Elmidae	9
Diptera	Chironomidae	58
Diptera	Simuliidae	14
Diptera	Tipulidae	1
Ephemeroptera	Baetidae	30
Hirudinea	Hirudinea	37
Oligochaeta	Oligochaeta	23
Trichoptera	Hydropsychidae	101
Turbellaria	Turbellaria	24
	Total	301
	Total Taxa	10

Impact

Class/Order	Class/Order/Family	Count
Coleoptera	Elmidae	7
Decapoda	Cambaridae	1
Ephemeroptera	Baetidae	6
Hirudinea	Hirudinea	3
Odonata	Gomphidae	1
Oligochaeta	Oligochaeta	6
Trichoptera	Hydropsychidae	2
Turbellaria	Turbellaria	3
	Total	29
	Total Taxa	8

Recovery

Class/Order	Class/Order/Family	Count
Coleoptera	Elmidae	8
Decapoda	Cambaridae	1
Diptera	Athericidae	12
Diptera	Chironomidae	7
Ephemeroptera	Baetidae	4
Hirudinea	Hirudinea	4
Oligochaeta	Oligochaeta	4
Trichoptera	Hydropsychidae	12
Turbellaria	Turbellaria	8
	Total	60
	Total Taxa	9