Report on:

The Biological Integrity of the Deerfield River Below Harriman Dam, As Determined by an Assessment of the Macroinvertebrate Community.

Biomonitoring and Aquatic Studies Section

VT DEC

March 23, 2004

Background:

The assessed section of river is located below the Harriman Dam in the town of Whitingham, VT, representative of about 3.5 stream miles on the main stem of the Deerfield River. This section of the Deerfield River is designated as Class B water, cold water habitat by the VT Water Resources Board. Under the general water quality criteria "aquatic habitat" in-stream conditions shall be managed to achieve "no change from background conditions that would have an undue adverse effect on the composition of the aquatic biota, the physical or chemical nature of the substrate, or the species composition or propagation of fishes". The aquatic biota narrative water quality criteria guidance for Class B waters is "no undue adverse effect on the aquatic biota." Equivalent language from the current water quality standards (Vermont Water Quality Standards, effective July 2, 2000, 3-04B4) is: "change from the reference condition for aquatic macroinvertebrate and fish assemblages shall be limited to a moderate change in the relative proportion of tolerant, intolerant, taxonomic and functional components". The reference condition stream type for the Deerfield River within this reach applying the VTDEC guidance is a Medium High Gradient (MHG) macroinvertebrate community type (VTDEC 2002).

The Deerfield River flow within the assessed section of river (below Harriman Dam to the West Branch of the Deerfield River) is presently controlled by the PG&E Energy Group under a FERC license agreement and conditions specified in VTDEC 401 water quality certification issued January 1995. The specified flows for the Deerfield River within this "bypass" section of river below the Harriman Dam are 57cfs July1-Sept 30, 70cfs October 1-June 30. This flow is not significantly augmented until the confluence with the West Branch of the Deerfield River 3.5 miles downstream of the dam. Under the water quality standards section 2-02(B) Hydrology: Artificial flow conditions shall not "result in an undue adverse effect on any existing use, beneficial value or use or result in a level of water quality that does not comply with these rules." The water quality certification issued by the VTDEC determined the above flows and resulting water quality would comply with the VT Water Quality Standards, subject to among other conditions, a study(s) to determine the suitability of the anticipated cold temperature regime in the "bypass" (Condition H).

Condition H was because the deep profundal zone reservoir release, as agreed upon in the certification, provides a constant very cold temperature thru the summer that may be too cold to support a high quality recreational brook trout fishery or the designated aquatic life uses for Class "B" waters. The deep cold water release may suppress both primary and secondary production resulting in a depressed level of biological integrity and an "undue adverse effect on the aquatic biota". The very cold temperature may also not support the fishery management objective identified during the FERC relicensing process by VT Fish and Wildlife Department as: " to restore a wild brook trout population to the Harriman Bypass and implement a management strategy that supports a high quality recreational fishery…."(VFWD 2003).

Water temperature from the deep release was measured at 4.7 ^{O} C during the flow demonstration conducted in September 1993. The temperature only increased about 2-3 ^{O} C before reaching the Harriman powerhouse 4.5 miles below the Dam. This very cold temperature regime could potentially limit the growth rate of the desired fishery directly and indirectly by limiting the food base. The very cold temperature regime may also cause an undue adverse effect on the aquatic biota, resulting in a violation of the VT WQ standards for Class B waters. Due to the above concerns the VTDEC Water Quality 401 certification condition H states that if monitoring data collected after the implementation of the required flow regime show temperature is either limiting the growth rate of the fishery or resulting in an undue adverse effect on the aquatic biota, "… the applicant shall design and implement measures necessary to meet dissolved oxygen standards and or raise the water temperature in the Harriman bypass….". Condition X also states that the Depart may request, at any time, that FERC reopen the license to consider modifications to the liscense necessary to assure compliance with Vermont Water Quality Standards.

This report evaluates the biological integrity of the aquatic biota with an assessment of the macroinvertebrate community within the most affected "bypass" section of the Deerfield River. The assessment will contribute to the VTDEC determination of compliance with the VT WQS Class B aquatic habitat standard "no undue adverse effect on the aquatic biota". The data may also contribute to an evaluation of the condition of the fishery resource within the same reach of stream.

Methods

The macroinvertebrate community was sampled in the late summer - early fall index period at two locations within the bypass reach at approximately river mile 52.4 and 51.3. The sampling locations are shown in **Figure 1**, and the site location descriptors in **Table 1**. The two locations coincide with fishery monitoring reaches 1 and 4, respectively. The upper station 52.4 is about 1/2 mile and the lower site 51.3 is about 1.6 miles below the Harriman Dam.

Figure 1: Map showing the location of the macroinvertebrate sampling stations

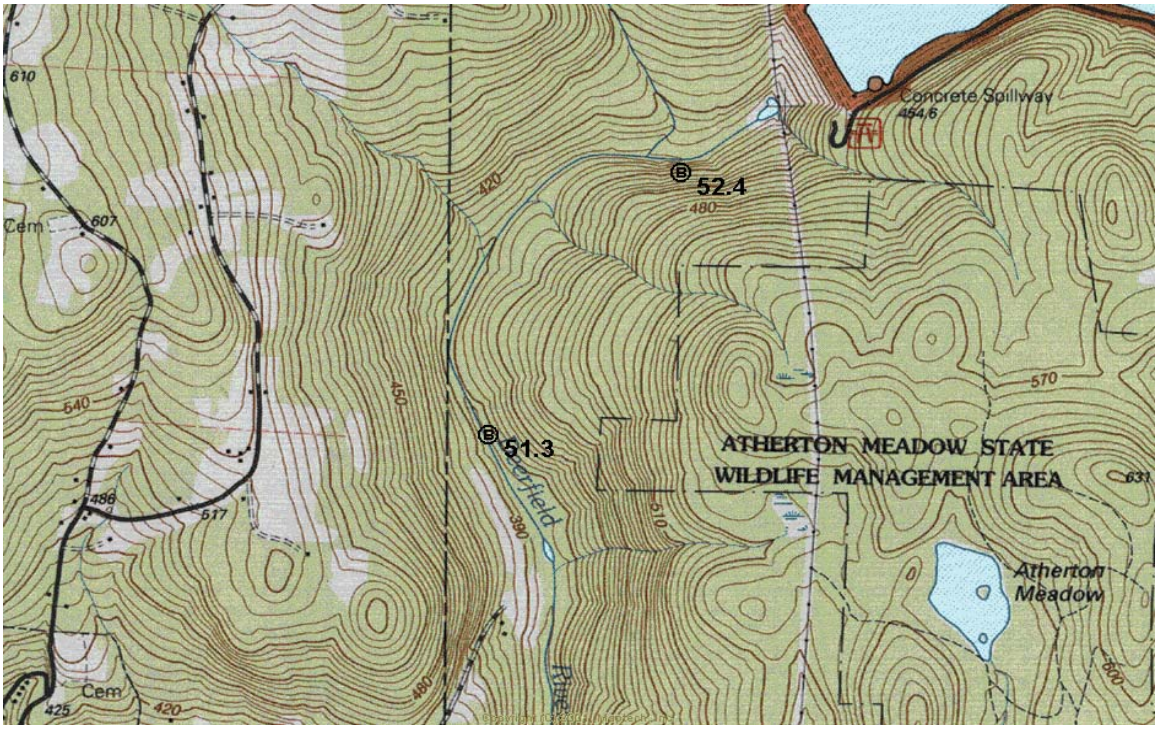

Table 1: Site location descriptors of the 2 macroinvertebrate sampling stations.

Station (RM)	D.A km2	Elev.ft	Lat.	Long	Dist from Dam mi.
52.4	478	1300	42 74 24	72 55 13	0.5
51.3	486	1255	42 46 51	72 55 39	1.6

Replicate macroinvertebrate samples were collected at each station following the Kick Net (KN) method outlined in the VTDEC standard operating procedures and protocols. Samples were processed in the VTDEC Laboratory in Waterbury VT, following standard VTDEC subsampling methods. These methods are described in detail in the VTDEC Biocriteria Guidance Document (2002). All samples are preserved in the field with 75%

Ethyl Alcohol (ETOH). Animals are identified to a specified level of taxonomy, usually genus or species, enumerated and then archived at the VTDEC laboratory in 75% ETOH. The taxa data is then entered into the VTDEC Biomonitoring Access© database, and community metrics are then computed and stored in the database.

Results and Discussion

The VT DEC examines the level of biological integrity of the macroinvertebrate community at an assessment stream reach by comparing eight community metrics from a reach to that of the expected condition for the appropriate stream reference type. The reference stream type for the Deerfield River below the Harriman Dam is a Medium High Gradient stream (MHG). The eight community metrics are measures of the functional and structural integrity of the macroinvertebrate community and are presented in **Table 2** below.

Table 2: Macroinvertebrate community metrics from two stations on the "bypass" reach of the Deerfield River below Harriman Dam, and one reach at RM 67.5 above regulated flows. Values in bold are below Class B expectation for a Medium High Gradient stream (MHG) type. VTDEC Biocriteria Guidance Document (2002).

Station RM (dist bl dam)	Date	Density	Richness	EPT	PMA-o	Bio Index	%Olig	EPT/ EPT&c	PPCS-f
#1 52.4 (0.5)	9/2003	1145	**25.5**	**8.5**	**34**	**5.25**	1.3	**0.16**	**0.29**
#4 51.3 (1.6)	9/2003	1732	31	**13.5**	47	3.79	1.2	0.45	**0.33**
67.5 (ab reg fl)	9/1990	642	48	27	81	2.94	0.9	0.67	0.71
Class "B"		>300	>30	>18	>45	<5.00	<12	>0.45	>0.40
Median Reference Streams		1797	45.8	27	83	3.20	0.1	0.9	0.64

The macroinvertebrate community from neither reache of stream meet the VTDEC biocriteria guidance for several metrics. The upper station RM 52.4 (0.5 mi from dam) is rated as poor and the lower station RM 51.3 as fair in biological integrity. Both reaches are relatively low in both richness and EPT richness (25.5, 31 and 8.5, 13.5 respectively). The

median richness for this stream type is 45.8, and the sensitive EPT taxa median is 27. The Bio Index value for station RM 52.4 is also elevated indicating that the stream reach is dominated by species, that are moderately tolerant of enrichment. Normally this level of Bio Index value is associated with increased community density and richness, neither of which was apparent at station RM 52.4.

The overall community structural (PMA-o, and EPT/EPT&c) as well as functional integrity (PPCS-f) is below expectations at the upper Station RM 52.4, while at the lower station RM51.3 only the functional integrity remains altered. Table 3 shows the order level structural and guild functional composition of the macroinvertebrate community at both reaches. Station RM 52.4 was dominated by the Diptera Chironomidae (>80% composition), with the taxa *Micropsectra sp* and *Cricotopus sp* making up over 50% of the community. As a result the PMA-o metric, which measures the order level similarity of the community to that of reference streams (**Appendix 1**), and the ratio of intolerant EPT to tolerant Chironomidae, EPT/EPT&c, are both below expectations (34 and 0.16, respectively) (**Table 2)**. The median value of these two metrics among reference streams is 83 and 0.90, respectively.

Table 3: The structural and guild functional composition of the macroinvertebrate community from two stations on the Deerfield River below the Harriman Dam.

Station (RM)	**52.4**	**51.3**		**52.4**	**51.3**
Orders	**% Composition**		**Functional Grps**	**% Composition**	
Coleoptera	0.0	0.4	**Col.Gatherer**	61.9	59.8
Diptera	83.2	54.3	**Col.Filterer**	3.8	4.0
Ephemeroptera	5.2	14.3	**Predator**	6.0	10.9
Plecoptera	4.6	23.8	**Shred.Det.**	2.3	16.5
Trichoptera	5.3	4.9	**Shred. Herb.**	25.2	4.5
Oligochaeta	1.3	1.2	**Scrapper**	0.0	0.4

At station RM 51.3 the normally dominant orders Ephemeroptera and Plecoptera recover to a degree, and the Diptera decrease in composition. These shifts result in the EPT/EPT&c and PMA-o rebounding to an acceptable level of structural integrity - 0.45 EPT/EPT&c, and 47% PMA-o similarity to reference – at RM 51.3. It is interesting to note that the structural integrity at this station is more similar to that of a Small High Gradient (SHG) macroinvertebrate community stream type (PMA-o, SHG = 66%). The increase in composition of the Plecoptera is due to an abundance of the *Leuctridae* and *Chloroperlidae* families at RM 51.3. These two Plecoptera families as well as the Ephemeroptera, *Epeorus sp*, and the Trichoptera, *Parapsyche apicalis*, *Rhycophila carolina* and *R. acutiloba* are more typically dominate in cold SHG streams. To a lesser degree the functional integrity (PPCS-f) of the community also improves at RM 51.3, but remains below acceptable levels at 0.33. To a large extent the recovery is due to an increase in the shredder-detritus guild, and a decrease in the shredder-herbivore functional guild. This may also in part be due to a lessening of the enrichment effect (resulting in a decrease in the Chironomidae) found closer to the dam. As a result of these shifts in taxa the Bio Index metric recovers to a very good rating of 3.79.

A number of standardized physical habitat observations and water quality measures were taken at the time of macroinvertebrate sampling of both stations. These data are presented in **Table 4** and **Table 5**. The substrate was dominated by boulder and cobble at both stations. Sand and substrate embeddedness were low at both stations indicating that sedimentation and embeddedness are not likely stressors on the community.

The macro and micro algae percent cover was observed to be greater at the upper station 52.4. The Total Phosphorus (TP) was also higher at this upper station at 32ug/l compared to 14ug/l at the lower station, indicating uptake by the periphyton. Total Nitrogen (TN) levels were slightly higher at the upper station and Nitrate levels were the same at both stations. The greater periphyton productivity at the upper site is in part responsible for the elevated Bio Index value and dominance by herbivore shredders at station 52.4

Table 4: Substrate composition, embeddedness and silt rating, and percent algae cover at two stations on the Deerfield River below Harriman dam. Observations taken at time of macroinvertebrate sampling on Sept 10,2003.

Station (RM)	**52.4**	**51.3**
Substrate Size	%	%
Boulder	38	46
Cobble	37	23
Course Gravel	11	21
Gravel	12	10
Sand	2	0
Embeddedness	5-25%	5-25%
Silt rating (1 low-5 high)	1	1
Macro Algae % cover	**%** composition	**%** composition
None	31	60
<5	57	39
5-25	12	1
Micro Algae (thickness rating)	**%** composition	**%** composition
None	17	8
slimy	73	91
(<0.5mm)	10	1

None of the metals tested with the exception of Iron and Manganese, were above detection limits. Iron and Manganese were elevated above natural background levels, but well below any concern for aquatic life (Iron chronic criteria 1000 ug/l). The elevated levels are likely due to redox activity in the profundal zone of Harriman Reservoir.

Table 5: Water Quality data collected from two stations on the Deerfield River below Harriman Dam on Sept. 10, 2003. In addition the following parameters were tested for but found to be below detection limits. Ammonia <0.05mg/l, Copper <10.0ug/l, Lead <5.0ug/l, Nickel <10.0ug/l, Antimony <10.0 ug/l, Selenium <5.0 ug/l, Thallium <5.0ug/l, Zinc <25 ug/l.

	Station 52.4	**Station 51.3**
Chemical Parameter		
Time	0900	1030
Temperature °C	6.9	8.5
D.O. mg/l	11.41	10.7
D.O. % saturation	94.8	92.8
pH std units	6.54	6.35
Alkalinity mg/l	3.4	3.5
Conductivity uohms	41.8	41.1
Chloride mg/l	6.7	6.5
Sulfate mg/l	4.00	4.01
Nitrate mg/l	0.27	0.27
Total Nitrogen mg/l	0.43	0.38
Total Phosphorus ug/l	32	14
Iron ug/l	294	291
Sodium mg/l	3.81	3.77
Potassium mg/l	0.57	0.57
Manganese ug/l	93.1	87.3
Turbidity NTU	1.0	1.0

The pH was in the low to mid 6's and the alkalinity was 3.5 mg/l at both stations. These values indicate the Deerfield River may be sensitive to pH depressions during high runoff periods of snow pack in the early spring. If persistent enough, the resulting low pH could suppress the number of pH sensitive taxa found. The most sensitive insect group to low pH is the Ephemeroptera. While low pH may be a threat to the biological integrity, data on file with the VTDEC from a reach of the Deerfield River at RM 67.5 show the biological

integrity to be excellent **Table 2**. RM 67.5 is located upstream of the confluence with the Somerset Reservoir outlet in an equally poorly buffered reach, and well above the influence of regulated hydro-flows. The number of Ephemeroptera taxa recorded at this reach was 7, the EPT 28, and the overall richness 42. The pH, and alkalinity in this section of river measured 6.42 and 1.7 mg/l, respectively. These values are lower than those reported here from the Harriman "bypass" reaches, and due to the unregulated flows in the section spring snow melt pH stress would likely be greater. It is therefore concluded that low pH is not likely the dominant stressor in the Harriman "bypass" section of the Deerfield River.

Normandeau Associates monitored the dissolved oxygen (D.O.), and temperature in 1998 and 1999 as required in the FERC operating license and the VANR 401 permit (Normandeau 1998,1999). The dual - D.O. criteria of 6.0 and 70% saturation were exceeded in both the upper and lower reaches of the bypass section on all occasions from June thru October in both years. The composition of the macroinvertebrate community is not dominated by low D.O. tolerant taxa, supporting the above findings that DO is not a stress on the aquatic biota in the "bypass" section.

Temperatures reported by Normandeau (1998,1999) in the above monitoring project most often measured between 7 and 9 ^{o} C in 1998, and ranged from 6-9.5 ^{o} C in 1999. Temperatures increased from about 2 to 4 ^{o} C over the approximately three-mile "bypass" reach of the Deerfield River from the Dam to the Route 100 Bridge in the village of Readsboro, VT.

The VTF&W Dept. also monitored temperature in 2002 using an in-stream datalogger at about the midpoint of the "bypass" reach (VTF&W 2003). Temperature was recorded hourly from May 22 to September 30,2002. The average recorded temperature was 9.16 ^{o} C. Temperatures exceeding 10 ^{o} C occurred 26.8 percent of the time, and 14 ^{o} C only 0.9 percent of the time. These data also show daily temperature fluctuations averaged only 2.73 ^{o} C over a 24 hr period. The highest temperature recorded was 14.55 ^{o} C, on June 6th, and was associated with a surface water release from Harriman Reservoir due to a prolonged rain event. The temperature measured during the macroinvertebrate sampling visit in September 2003 was 6.9 and 8.5 ^{o} C at RM 52.4 and 51.3, at 0900 and 1030, respectively. These

temperatures are substantially lower by 7-9 ^{o} C than similar sized rivers sampled during the same week, which were all measured in the mid-teens.

The temperature regime of a stream depends upon many factors including amount of canopy, stream channel orientation, air temperature, flow, distance from lentic areas and groundwater springs. Temperature, as discussed in "The Ecology of Aquatic Insects" is known to have both a direct (bioenergetics), and indirect (due to quality and quantity of food base) effect on insect life history parameters of egg development, larval growth rate, adult size, and fecundity (Sweeney 1984). In the embryonic stage, increased or decreased temperature triggers a diapause or quiescent period in egg development. Egg and larval development period generally decrease with increased temperatures until an upper limit has negative effects on survival. In general, a species needs a certain accumulation of degree-days over a given growth period, which is often triggered by a threshold temperature and or photoperiod, to mature. The larval development period can often be predicted using the summation of degree-days needed for a particular species. The degree-day accumulation often used in these predictions is the difference between the average mean daily temperatures and the development threshold temperature for a given species.

Conclusions, and Recommendations

<u>The Deerfield River bypass section below Harriman Dam does not presently support the VT Class B Aquatic Life Use thresholds based on the macroinvertebrate community integrity.</u> Neither of the river stations sampled at 0.5 and 1.1 miles below the Harriman Dam supported Vermont DEC threshold biocriteria for a MHG stream type as determined by VTDEC Biocriteria Guidance 2002. The macroinvertebrate community at both stations sampled is low in taxa richness and EPT taxa. Enrichment tolerant collector gatherer and herbivore taxa dominate the upper reach, while the lower station's functional composition is closer to that of a cold water mountain brook than a medium sized high gradient river.

The likely stressors on the community based on an analysis of the macroinvertebrate community structure and function, available water quality data, and temperature monitoring are temperature, pH, and slight enrichment (particulates and nutrients). Of these, temperature is likely having the greatest effect on the number of macroinvertebrate taxa

present, which is the most severely effected community metric. The other two stressors likely play off each other with the low alkalinity, and potentially periodic low pH depressing overall productivity, while increases in organic particulates and nutrients are causing an increase in primary productivity and altering the secondary (macroinvertebrate) functional composition for a short reach immediately below the dam.

It is recommended that a modified temperature regime be explored for the river, defined in terms of biologically based degree-days, and threshold temperatures. **The targeted temperature regime must allow for both the fishery management objective (to restore a wild brook trout population that supports a high quality recreational fishery) and the Class B water quality criteria objective for aquatic habitat as applied by the VTDEC by measuring the in stream biological integrity of the aquatic biota for a MHG stream type to be met**.

This could be accomplished in two ways:
One: A target temperature regime could be based on both the number of degree-days, and the threshold temperature needed for several indicator macroinvertebrate species of a medium high gradient river type to complete their lifecycle, as well as the number of degree-days needed by brook trout to achieve a necessary growth rate to support a high quality recreational fishery.

Two: The temperature regime of several selected local "reference" MHG streams could be monitored with data-loggers and a temperature regime for the Deerfield be based on the results.

It should also be explored how mixing profundal water with that in the epi- or meta-limnion may effect the already slightly elevated nutrient levels recorded at the upper site.

Biological monitoring of the macroinvertebrate community should continue for another year at the present sites as well as at a site below Tobey Brook, and a site below the confluence with the West Branch of the Deerfield to allow for a more complete longitudinal biological assessment of the "bypass" reach impact.

References

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Appendix 1: Reference Stream macroinvertebrate composition of the Major orders and Functional Guild groups by stream type

	SHG	MHG	WWMG
Percent Composition Major orders			
Coleoptera	8	6	12
Diptera	19	18	13
Ephemeroptera	23	34	34
Plecoptera	21	8	8
Trichoptera	28	33	31
Oligocheata	0.5	0.5	1
Other	0.5	0.5	1
Percent Composition Functional Groups			
Col.Gath.	31	32	22
Col.Filt	18	30	36
Predator	19	13	7
Shred-Det	15	4	2
Shred-Herb	1	1	5
Scraper	12	13	22

Appendix 2: Macroinvertebrate taxa density and percent composition from two stations on the Deerfield River below Harriman Dam

Station 52.4,upper, 0.5 mi below Dam, Fish #1				
Order	Genus	species	Density/KN	Percent Composition
DIPTERA	CRICOTOPUS	spa	281	24.6
DIPTERA	EUKIEFFERIELLA	devonica	6	0.5
DIPTERA	EUKIEFFERIELLA	brehmi	2	0.1
DIPTERA	EUKIEFFERIELLA	claripennis	43	3.7
DIPTERA	NANOCLADIUS	sp	1	0.1
DIPTERA	NATARSIA	sp	2	0.1
DIPTERA	PAGASTIA	sp	172	15.0
DIPTERA	PARAMETRIOCNEMUS	sp	4	0.4
DIPTERA	SYNORTHOCLADIUS	sp	1	0.1
DIPTERA	THIENEMANNIELLA	sp	2	0.1
DIPTERA	THIENEMANNEMYIA	sp	2	0.1
DIPTERA	TVETENIA	bavarica	68	5.9
DIPTERA	MICROPSECTRA	sp	341	29.8
DIPTERA	MUSCIDAE	unid	1	0.1
DIPTERA	SIMULIUM	tubersom	2	0.1
DIPTERA	SIMULIUM	vittatum	12	1.1
DIPTERA	ANTOCHA	sp	1	0.1
DIPTERA	DICRANOTA	sp	3	0.3
DIPTERA	HEXATOMA	sp	2	0.1
EPHEMEROPTERA	BAETIDAE	imm	9	0.7
EPHEMEROPTERA	BAETIS	flavistriga	4	0.3
EPHEMEROPTERA	BAETIS	tricaudatus	44	3.9
EPHEMEROPTERA	EPEORUS	sp	3	0.3
EPHEMEROPTERA	PARALEPTOPHLEBIA	sp	2	0.1
TRICHOPTERA	HYDROPSYCHE	aerata	1	0.1
TRICHOPTERA	PARAPSYCHE	apicalis	27	2.4
TRICHOPTERA	HYDATOPHYLAX	sp	1	0.1
TRICHOPTERA	DOLOPHILODES	sp	4	0.4
TRICHOPTERA	RHYACOPHILA	minora	31	2.7
TRICHOPTERA	RHYACOPHILA	acutiloba	0	0.0
PLECOPTERA	CHLOROPERLIDAE	imm	29	2.6
PLECOPTERA	LEUCTRIDAE	unid	27	2.4
OLIGOCHAETA	NAIDIDAE	unid	8	0.7
OLIGOCHAETA	LUMBRICULIDAE	unid	4	0.3
OLIGOCHAETA	ENCHYTRAEIDAE	unid	3	0.3
HYDRACHNIDIA	LEBERTIA	sp	4	0.3

Station 51.3,lower, 1.6 mi bl Dam, Fish #4				
Order	Genus	species	Desity/KN	Percent Composition
COLEOPTERA	OPTIOSERVUS	sp	2	0.1
COLEOPTERA	OULIMNIUS	latiusculus	4	0.2
DIPTERA	BRILLIA	sp	2	0.1
DIPTERA	CRICOTOPUS	spa	78	4.5
DIPTERA	EUKIEFFERIELLA	brehmi	4	0.2
DIPTERA	EUKIEFFERIELLA	claripennis	6	0.3
DIPTERA	PAGASTIA	sp	44	2.5
DIPTERA	PARAMETRIOCNEMUS	sp	38	2.2
DIPTERA	POLYPEDILUM	aviceps	2	0.1
DIPTERA	PRODIAMESA	sp	2	0.1
DIPTERA	RHEOCRICOTOPUS	sp	28	1.6
DIPTERA	THIENEMANNEMYIA	sp	4	0.2
DIPTERA	TVETENIA	bavarica	12	0.7
DIPTERA	MICROPSECTRA	sp	706	40.8
DIPTERA	SIMULIUM	tubersom	14	0.8
DIPTERA	SIMULIUM	vittatum	2	0.1
DIPTERA	DICRANOTA	sp	6	0.3
EPHEMEROPTERA	BAETIDAE	imm	62	3.6
EPHEMEROPTERA	BAETIS	tricaudatus	88	5.1
EPHEMEROPTERA	EURYLOPHELLA	funeralis	2	0.1
EPHEMEROPTERA	HEPTAGENIIDAE	imm	2	0.1
EPHEMEROPTERA	EPEORUS	sp	84	4.8
EPHEMEROPTERA	LEPTOPHLEBIIDAE	unid	2	0.1
TRICHOPTERA	PARAPSYCHE	apicalis	36	2.1
TRICHOPTERA	SYMPHITOPSYCHE	slossonae	2	0.1
TRICHOPTERA	LEPIDOSTOMA	sp	4	0.2
TRICHOPTERA	PSYCHOGLYPHA	sp	2	0.1
TRICHOPTERA	DOLOPHILODES	sp	14	0.8
TRICHOPTERA	RHYACOPHILA	fuscula	2	0.1
TRICHOPTERA	RHYACOPHILA	carolina	6	0.3
TRICHOPTERA	RHYACOPHILA	minora	14	0.8
TRICHOPTERA	RHYACOPHILA	acutiloba	4	0.2
PLECOPTERA	CAPNIIDAE	unid	4	0.2
PLECOPTERA	CHLOROPERLIDAE	unid	120	6.9
PLECOPTERA	LEUCTRIDAE	unid	278	16.1
PLECOPTERA	AGNETINA	capitata	0	0.0
PLECOPTERA	ISOPERLA	sp	2	0.1
PLECOPTERA	MALIREKUS	sp	8	0.5
PLECOPTERA	PTERONARCYS	sp	2	0.1
TRICLADIDA	PHAGOCATA	sp	6	0.3
OLIGOCHAETA	NAIDIDAE	unid	12	0.7
OLIGOCHAETA	ENCHYTRAEIDAE	unid	6	0.3
OLIGOCHAETA	LUMBRICINA	unid	2	0.1
HYDRACHNIDIA	LEBERTIA	sp	14	0.8