

Daniels, Stacy L., and Murphy, Paul C., (Crystal Lake Watershed Fund, Inc.), Biomonitoring of the Cold Creek Watershed, Three Subwatersheds of the Crystal Lake Watershed, Benzie County, Michigan, Supported by the Michigan Department of Environmental Quality, Volunteer Monitoring Program, Clean Water Fund, Clean Michigan Initiative, July 15, 2003.

Appendix B.	Physical Monitoring. Single Site Watershed Survey Data Sheets.	38pp	
Appendix C.	Biological Monitoring. Instream Survey Data Sheets.		22pp
Appendix D.	Chemical Monitoring. Hydrolab® multiprobe and Other Analyses.		6pp
Appendix E.	Quarterly Progress Reports.		6pp
Appendix F.	Quality Assurance Project Plan (QAPP).	10pp	

Table B1. Physical, Biological, and Chemical Monitoring Sites & Dates.

BRANCH	SMPL	NO.	SINGLE SITE	DATE	INSTREAM	DATE	HYDROLAB OTHERS	DATE
			PHYSICAL		BIOLOGICAL		CHEMICAL	
CC		1	X	11/12/02	X	11/12/02	--, S	11/12/02
CC		1		04/28/03	X	04/28/03		
NB		8		04/30/02		04/30/02	W, S	04/30/02
NB		8		11/11/02		11/11/02	W, S	11/12/02
NB		8A		04/30/02		04/30/02	W	04/30/02
NB		8A		11/11/02		11/11/02	W, S	11/12/02
NB		8D		04/30/02		04/30/02	W	04/30/02
NB		9A	X	04/30/02	X	04/30/02	W	04/30/02
NB		9A	X	11/11/02	X	11/11/02	W, S	11/12/02
NB		9B	X	04/30/02	X	04/30/02	W	04/30/02
NB		9B	X	11/11/02	X	11/11/02	W, S	11/12/02
NB		9B		04/28/03	X	04/28/03	W	04/28/03
NB		9D	X	04/30/02	X	04/30/02		04/30/02
NB		9D	X	11/11/02		11/11/02	W, S	11/12/02
NB		9D		04/28/03		04/28/03	W	04/28/03
NB		10A	X	04/30/02	X	04/30/02		04/30/02
NB		10A	X	11/11/02	X	11/11/02	--, S	11/12/02
NB		10B	X	04/30/02	X	04/30/02		04/30/02
NB		10B	X	11/11/02	X	11/11/02	--, S	11/12/02
MB		7	X	04/30/02	X	04/30/02	W	04/30/02
MB		7	X	11/11/02	X	11/11/02	W, S	11/11/02
MB		7C		04/30/02		04/30/02	W	04/30/02
MB		7C		11/11/02		11/11/02	W, S	11/11/02
SB		6	X	11/11/02	X	11/11/02	W, S	11/12/02
SB		6		04/28/03	X	04/28/03	W	04/28/03
SB		6A	X	11/12/02	X	11/12/02	W	11/12/02
SB		6B		11/12/02	X	11/12/02	W	11/12/02
SB		6D	X	11/12/02	X	11/12/02	W, S	11/12/02
SB		6E	X	11/11/02	X	11/11/02	W	11/11/02
Totals			16		20		22,13	

Table C1. Substrate Composition.

BRANCH	SMPL NO.	PLOT	PLOT	GRAVEL	SAND	SILT
		SYMBOL	SYMBOL	%	%	%
CC	1	1	1	5	75	20
NB	9A	9A	9A	0	90	10
NB	9A	9A	9A	0	90	120
NB	9B	9B	9B	0	30	70
NB	9D	9D	9D	0	90	10
NB	10A	10A	10A	0	0	100
NB	10B	10B	10B	0	0	100
MB	7	7	7	0	0	100
SB	6	6	6	25	75	0
SB	6A	6A	6A	10	80	10
SB	6D	6D	6D	10	70	20
SB	6E	6E	6D	10	85	5

Single Site Watershed Survey Data Sheet

Date: _____ Time: _____
 Water body Name: _____ County: _____ Station #: _____
 Location: _____ Township: _____ Sec T R ¼ ¼
 Investigator: _____ Lat: _____ Long: _____
 Coordinate Determination Method (check the one that applies):
 GPS GPS w/ DBR Digital mapping software Topographic map Other (_____)
 Map Scale (if known _____) Upstream Side/Downstream Side

PHYSICAL HABITAT																	
BACKGROUND INFORMATION - pg. 18						PHYSICAL APPEARANCE - pg. 20 (Check all that apply)											
Event Conditions noted at site	None		Light		Moderate		Heavy		Aquatic Plants	Present	Abundant						
	= 1		2		3		Unknown		Floating Algae	Present	Abundant						
Days since Rain									Filamentous Algae	Present	Abundant						
Water Temp./D.O./pH *									Bacterial Sheen/Slimes	Present	Abundant						
Water Color	Clear	Gray	Brown	Black	Green				Turbidity	Present	Abundant						
	Stream		Lake		Impound		Wetland		Oil Sheen	Present	Abundant						
	Stream		Lake		Impound		Wetland		Foam	Present	Abundant						
Stream Width (ft.)	<10	10-25	25-50	>50				Trash	Present	Abundant							
Avg. Stream Depth (ft.)	<1	1-3	>3		Unknown												
Water Velocity (ft./sec) *																	
Stream Flow Type	Dry	Stagnant	L	M	H												
SUBSTRATE (%) – pg. 22 (add to 100%)						INSTREAM COVER – pg. 23 (check all that apply)											
Boulder – 10 in. diam. Cobble/Gravel –10 to .08 in. diam. Sand – coarse grain Silt/Detritus/Muck - fine grain/organic matter Hardpan/Bedrock – solid clay/rock surface Artificial – manmade Unknown																	
RIVER MORPHOLOGY – pg. 23						STREAM CORRIDOR – pg. 26											
Riffle	Present			Abundant			Riparian Veg. Width ft.(L)	<10	10-30	30-100	>100						
Pool	Present			Abundant			Riparian Veg. Width ft.(R)	<10	10-30	30-100	>100						
Channel	Natural		Recovering		Maintained		Bank Erosion	0	L	M	H						
Designated Drain	?		Y		N		Streamside Land Cover	Bare	Grass	Shr	Trees						
Highest Water Mark (ft.)	?	<1	1-3	3-5	5-10	>10	Stream Canopy %	<25	25-50		>50						
Stream Cross Section						Adjacent Land Uses											
						Wetlands	L	R									
						Shrub or Old Field	L	R									
						Forest	L	R									
						Pasture	L	R									
						Crop Residue	L	R									
						Rowcrop	L	R									
						Residential Lawns, Parks	L	R									
						Impervious Surfaces	L	R									
Disturbed Ground	L	R															
No Vegetation	L	R															

* Optional Data Item

Data Sheet Version 4/27/00

Single Site Watershed Survey Data Sheet (page 2)

Date: _____ Time: _____
 Upstream Side/Downstream Side

Station #:

POTENTIAL SOURCES (Severity: S – slight; M – moderate; H – high) – pg. 28									
	Crop Related Sources	S	M	H	Land Disposal	S	M	H	
	Grazing Related Sources	S	M	H	On-site Wastewater Systems	S	M	H	
	Intensive Animal Feeding Operations	S	M	H	Silviculture (Forestry NPS)	S	M	H	
	Highway/Road/Bridge Maintenance and Runoff (Transportation NPS)	S	M	H	Resource Extraction (Mining NPS)	S	M	H	
	Channelization	S	M	H	Recreational/Tourism Activities (general)	S	M	H	
	Dredging	S	M	H	Golf Courses	S	M	H	
	Removal of Riparian Vegetation	S	M	H	Marinas/Recr. Boating (water releases)	S	M	H	
	Bank and Shoreline Erosion/Modification/Destruction	S	M	H	Marinas/Recr. Boating (bank or shoreline erosion)	S	M	H	
	Flow Regulation/ Modification (Hydrology)	S	M	H	Debris in Water	S	M	H	
	Upstream Impoundment	S	M	H	Industrial Point Source	S	M	H	
	<u>Construction:</u> Highway/Road /Bridge/Culvert	S	M	H	Municipal Point Source	S	M	H	
	<u>Construction:</u> Land Development	S	M	H	Natural Sources	S	M	H	
	Urban Runoff (Residential/ Urban NPS)	S	M	H	Source(s) Unknown	S	M	H	

SITE SUMMARY INFORMATION – pg. 33			
SURVEY DIRECTION	N/A	U/S	D/S
SITE SIMILARITY	?	Y	N
OVERALL SITE RANKING	L	M	H
SITE FOLLOW-UP RANK	L	M	H

COMMENTS:

Single Site Watershed Survey Data Sheet

Date: **11/12/02** Time: **13:41**

Water body Name: **Cold Creek**

County: **Benzie**

Station #: **Adventure Sports CC-1**

Location: **Main Branch**

Township: **Benzonia**

Sec **T R 1/4 1/4**

Investigator: **Paul Murphy & Abby Mahan**

Lat: **44°37.373'N**

Long: **086°05.675'W**

Coordinate Determination Method (check the one that applies):

GPS GPS w/ DBR Digital mapping software Topographic map Other (_____)

Map Scale (if known _____)

Upstream Side

PHYSICAL HABITAT											
BACKGROUND INFORMATION - pg. 18						PHYSICAL APPEARANCE - pg. 20 (Check all that apply)					
Event Conditions noted at site	None		Light		Moderate		Heavy		Aquatic Plants	Present	Abundant
	= 1		2		=3		Unknown		Floating Algae	Present	Abundant
Days since Rain	6.08		10.73		7.59				Filamentous Algae	Present	Abundant
Water Temp./D.O./pH *	Clear		Gray	Brown	Black	Green			Bacterial Sheen/Slimes	Present	Abundant
Water Color	Stream		Lake	Impound	Wetland				Turbidity	Present	Abundant
	Stream		Lake	Impound	Wetland				Oil Sheen	Present	Abundant
Stream Width (ft.)	<10	10-25		25-50		>50		Foam	Present	Abundant	
Avg. Stream Depth (ft.)	<1	1-3		>3		Unknown		Trash	Present	Abundant	
Water Velocity (ft./sec) *	Dry		Stagnant	L	M	H					
Stream Flow Type											
SUBSTRATE (%) – pg. 22 (add to 100%)						INSTREAM COVER – pg. 23 (check all that apply)					
Boulder – 10 in. diam.						Undercut Banks					
Cobble/Gravel –10 to .08 in. diam.						Overhanging Vegetation					
Sand – coarse grain						Deep Pools					
Silt/Detritus/Muck - fine grain/organic matter						Boulders					
Hardpan/Bedrock – solid clay/rock surface						Aquatic Plants					
Artificial – manmade						Logs or Woody Debris					
Unknown											
RIVER MORPHOLOGY – pg. 23						STREAM CORRIDOR – pg. 26					
Riffle	Present			Abundant			Riparian Veg. Width ft.(L)	<10	10-30	30-100	>100
Pool	Present			Abundant			Riparian Veg. Width ft.(R)	<10	10-30	30-100	>100
Channel	Natural		Recovering		Maintained		Bank Erosion	0	L	M	H
Designated Drain	?		Y		N		Streamside Land Cover	Bare	Grass	Shrub	Trees
Highest Water Mark (ft.)	?	<1	1-3	3-5	5-10	>10	Stream Canopy %	<25	25-50		>50
Stream Cross Section						Adjacent Land Uses					
						Wetlands	L	R			
						Shrub or Old Field	L	R			
						Forest	L	R			
						Pasture	L	R			
						Crop Residue	L	R			
						Rowcrop	L	R			
						Residential Lawns, Parks	L	R			
						Impervious Surface	L	R			
Disturbed Ground	L	R									
No Vegetation	L	R									

* Optional Data Item

Data Sheet Version 4/27/00

Single Site Watershed Survey Data Sheet (page 2)

Date: **11/12/02**
Upstream Side

Station #: **CC-1**

POTENTIAL SOURCES (Severity: S – slight; M – moderate; H – high) – pg. 28									
Crop Related Sources Grazing Related Sources Intensive Animal Feeding Operations Highway/Road/Bridge Maintenance and Runoff (Transportation NPS) Channelization Dredging Removal of Riparian Vegetation Bank and Shoreline Erosion/Modification/Destruction Flow Regulation/ Modification (Hydrology) Upstream Impoundment <u>Construction:</u> Highway/Road/Bridge/Culvert <u>Construction:</u> Land Development Urban Runoff (Residential/ Urban NPS)	S	M	H	Land Disposal	S	M	H		
	S	M	H	On-site Wastewater Systems	S	M	H		
	S	M	H	Silviculture (Forestry NPS)	S	M	H		
	S	M	H	Resource Extraction (Mining NPS)	S	M	H		
	S	M	H	Recreational/Tourism Activities (general)	S	M	H		
	S	M	H	Golf Courses	S	M	H		
	S	M	H	Marinas/Recr. Boating (water releases)	S	M	H		
	S	M	H	Marinas/Recr. Boating (bank or shoreline erosion)	S	M	H		
	S	M	H	Debris in Water	S	M	H		
	S	M	H	Industrial Pt. Source	S	M	H		
	S	M	H	Municipal Pt. Source	S	M	H		
	S	M	H	Natural Sources	S	M	H		
	S	M	H	Source(s) Unknown	S	M	H		

SITE SUMMARY INFORMATION – pg. 33			
SURVEY DIRECTION	N/A	U/S	D/S
SITE SIMILARITY	?	Y	N
OVERALL SITE RANKING	L	M	H
SITE FOLLOW-UP RANK	L	M	H

COMMENTS:

Single Site Watershed Survey Data Sheet

Date: **4/30/02** Time: **14:25**
 Waterbody Name: **Cold Creek** County: **Benzie** Station #: **MNB-UB NB-9A**
 Location: **North Branch** Township: **Benzonia** Sec **T** R **¼** **¼**
 Investigator: **Paul Murphy & Abby Mahan** Lat: **44°38.303'N** Long: **086°04.858'W**
 Coordinate Determination Method (check the one that applies):
 GPS GPS w/ DBR Digital mapping software Topographic map Other (____)
 Map Scale (if known _____) **Upstream Side**

PHYSICAL HABITAT												
BACKGROUND INFORMATION - pg. 18						PHYSICAL APPEARANCE - pg. 20 (Check all that apply)						
Event Conditions noted at site	None		Light		Moderate		Heavy		Aquatic Plants	Present	Abundant	
	= 1		2		=3		Unknown		Floating Algae	Present	Abundant	
Days since Rain									Filamentous Algae	Present	Abundant	
Water Temp./D.O./pH *	10.20		10.39		7.97				Bacterial Sheen/Slimes	Present	Abundant	
Water Color	Clear		Gray		Brown		Black Green		Turbidity	Present	Abundant	
	Stream		Lake		Impound		Wetland		Oil Sheen	Present	Abundant	
Stream Width (ft.)	<10		10-25		25-50		>50		Foam	Present	Abundant	
Avg. Stream Depth (ft.)	<1		1-3		>3		Unknown		Trash	Present	Abundant	
Water Velocity (ft./sec) *												
Stream Flow Type	Dry		Stagnant		L		M					
SUBSTRATE (%) – pg. 22 (add to 100%)						INSTREAM COVER – pg. 23 (check all that apply)						
Boulder – 10 in. diam.						Undercut Banks						X
Cobble/Gravel –10 to .08 in. diam.						Overhanging Vegetation						X
Sand – coarse grain						Deep Pools						
Silt/Detritus/Muck - fine grain/organic matter						Boulders						
Hardpan/Bedrock – solid clay/rock surface						Aquatic Plants						
Artificial – manmade						Logs or Woody Debris						X
Unknown												
RIVER MORPHOLOGY – pg. 23						STREAM CORRIDOR – pg. 26						
Riffle	Present			Abundant			Riparian Veg. Width ft.(L)	<10	10-30	30-100	>100	
Pool	Present			Abundant			Riparian Veg. Width ft.(R)	<10	10-30	30-100	>100	
Channel	Natural		Recovering		Maintained		Bank Erosion	0	L	M	H	
Designated Drain	?		Y		N		Streamside Land Cover	Bare	Grass	Shrub	Trees	
Highest Water Mark (ft.)	?	<1	1-3	3-5	5-10	>10	Stream Canopy %	<25	25-50	>50		
Stream Cross Section						Adjacent Land Uses						
						Wetlands	L	R				
						Shrub or Old Field	L	R				
						Forest	L	R				
						Pasture	L	R				
						Crop Residue	L	R				
						Rowcrop	L	R				
						Residential Lawns, Parks	L	R				
						Impervious Surface	L	R				
Disturbed Ground	L	R										
No Vegetation	L	R										

* Optional Data Item

Data Sheet Version 4/27/00

Single Site Watershed Survey Data Sheet (page 2)

Date: **04/30/02**
Upstream Side

Station #: **NB-9A**

POTENTIAL SOURCES (Severity: S – slight; M – moderate; H – high) – pg. 28									
Crop Related Sources	S	M	H	Land Disposal	S	M	H		
Grazing Related Sources	S	M	H	On-site Wastewater Systems	S	M	H		
Intensive Animal Feeding Operations	S	M	H	Silviculture (Forestry NPS)	S	M	H		
Highway/Road/Bridge Maintenance and Runoff (Transportation NPS)	S	M	H	Resource Extraction (Mining NPS)	S	M	H		
Channelization	S	M	H	Recreational/Tourism Activities (general) Nature Preserve	S	M	H		
Dredging	S	M	H	Golf Courses	S	M	H		
Removal of Riparian Vegetation	S	M	H	Marinas/Recr. Boating (water releases)	S	M	H		
Bank and Shoreline Erosion/Modification/Destruction	S	M	H	Marinas/Recr. Boating (bank or shoreline erosion)	S	M	H		
Flow Regulation/ Modification (Hydrology)	S	M	H	Debris in Water	S	M	H		
Upstream Impoundment	S	M	H	Industrial Pt. Source	S	M	H		
Construction: Highway/Road / Bridge/Culvert	S	M	H	Municipal Pt. Source	S	M	H		
Construction: Land Development	S	M	H	Natural Sources	S	M	H		
Urban Runoff (Residential/ Urban NPS)	S	M	H	Source(s) Unknown	S	M	H		

SITE SUMMARY INFORMATION – pg. 33			
SURVEY DIRECTION	N/A	U/ S	D/S
SITE SIMILARITY	?	Y	N
OVERALL SITE RANKING	L	M	H
SITE FOLLOW-UP RANK	L	M	H

COMMENTS:

Single Site Watershed Survey Data Sheet

Date: **11/11/02** Time: **14:25**
 Waterbody Name: **Cold Creek** County: **Benzie** Station #: **MNB-UB NB-9A**
 Location: **North Branch** Township: **Benzonia** Sec **T** R **¼** **¼**
 Investigator: **Paul Murphy & Abby Mahan** Lat: **44°38.303'N** Long: **086°04.858'W**
 Coordinate Determination Method (check the one that applies):
 GPS GPS w/ DBR Digital mapping software Topographic map Other (____)
 Map Scale (if known _____) **Upstream Side**

PHYSICAL HABITAT											
BACKGROUND INFORMATION - pg. 18						PHYSICAL APPEARANCE - pg. 20 (Check all that apply)					
Event Conditions noted at site	None		Light		Moderate		Heavy		Aquatic Plants	Present	Abundant
	= 1		2		=3		Unknown		Floating Algae	Present	Abundant
Days since Rain	7.45		10.48		7.66				Filamentous Algae	Present	Abundant
Water Temp./D.O./pH *	Clear		Gray	Brown	Black	Green			Bacterial Sheen/Slimes	Present	Abundant
Water Color	Stream		Lake	Impound	Wetland				Turbidity	Present	Abundant
	Stream		Lake	Impound	Wetland				Oil Sheen	Present	Abundant
Stream Width (ft.)	<10		10-25	25-50	>50				Foam	Present	Abundant
Avg. Stream Depth (ft.)	<1		1-3	>3	Unknown				Trash	Present	Abundant
Water Velocity (ft./sec) *											
Stream Flow Type	Dry	Stagnant	L	M	H						
SUBSTRATE (%) – pg. 22 (add to 100%)						INSTREAM COVER – pg. 23 (check all that apply)					
Boulder – 10 in. diam.						Undercut Banks			X		
Cobble/Gravel –10 to .08 in. diam.						Overhanging Vegetation			X		
Sand – coarse grain			90%			Deep Pools					
Silt/Detritus/Muck - fine grain/organic matter			10%			Boulders					
Hardpan/Bedrock – solid clay/rock surface						Aquatic Plants					
Artificial – manmade						Logs or Woody Debris			X		
Unknown											
RIVER MORPHOLOGY – pg. 23						STREAM CORRIDOR – pg. 26					
Riffle	Present			Abundant			Riparian Veg. Width ft.(L)	<10	10-30	30-100	>100
Pool	Present			Abundant			Riparian Veg. Width ft.(R)	<10	10-30	30-100	>100
Channel	Natural		Recovering		Maintained		Bank Erosion	0	L	M	H
Designated Drain	?		Y		N		Streamside Land Cover	Bare	Grass	Shrub	Trees
Highest Water Mark (ft.)	?	<1	1-3	3-5	5-10	>10	Stream Canopy %	<25	25-50	>50	
Stream Cross Section						Adjacent Land Uses					
						Wetlands	L			R	
						Shrub or Old Field	L			R	
						Forest	L			R	
						Pasture	L			R	
						Crop Residue	L			R	
						Rowcrop	L			R	
						Residential Lawns, Parks	L			R	
						Impervious Surface	L			R	
						Disturbed Ground	L			R	
						No Vegetation	L			R	

* Optional Data Item

Data Sheet Version 4/27/00

Single Site Watershed Survey Data Sheet (page 2)

Date: **11/11/02**
Upstream Side

Station #: **NB-9A**

POTENTIAL SOURCES (Severity: S – slight; M – moderate; H – high) – pg. 28								
Crop Related Sources	S	M	H	Land Disposal	S	M	H	
Grazing Related Sources	S	M	H	On-site Wastewater Systems	S	M	H	
Intensive Animal Feeding Operations	S	M	H	Silviculture (Forestry NPS)	S	M	H	
Highway/Road/Bridge Maintenance and Runoff (Transportation NPS)	S	M	H	Resource Extraction (Mining NPS)	S	M	H	
Channelization	S	M	H	Recreational/Tourism Activities (general) Nature Preserve	S	M	H	
Dredging	S	M	H	Golf Courses	S	M	H	
Removal of Riparian Vegetation	S	M	H	Marinas/Recr. Boating (water releases)	S	M	H	
Bank and Shoreline Erosion/Modification/Destruction	S	M	H	Marinas/Recr. Boating (bank or shoreline erosion)	S	M	H	
Flow Regulation/ Modification (Hydrology)	S	M	H	Debris in Water	S	M	H	
Upstream Impoundment	S	M	H	Industrial Pt. Source	S	M	H	
Construction: Highway/Road / Bridge/Culvert	S	M	H	Municipal Pt. Source	S	M	H	
Construction: Land Development	S	M	H	Natural Sources	S	M	H	
Urban Runoff (Residential/ Urban NPS)	S	M	H	Source(s) Unknown	S	M	H	

SITE SUMMARY INFORMATION – pg. 33			
SURVEY DIRECTION	N/A	U/ S	D/S
SITE SIMILARITY	?	Y	N
OVERALL SITE RANKING	L	M	H
SITE FOLLOW-UP RANK	L	M	H

COMMENTS:

Single Site Watershed Survey Data Sheet

Date: **4/30/02** Time: **14:53**
 Waterbody Name: **Cold Creek** County: **Benzie** Station #: **MNB-LB NB-9B**
 Location: **North Branch** Township: **Benzonia** Sec **T** R **¼** ¼ **¼**
 Investigator: **Paul Murphy & Abby Mahan** Lat: **44°38.196'N** Long: **086°05.037'W**
 Coordinate Determination Method (check the one that applies):
 GPS **GPS w/ DBR** **Digital mapping software** **Topographic map** **Other (_____)**
 Map Scale (if known _____) **Upstream Side**

PHYSICAL HABITAT												
BACKGROUND INFORMATION - pg. 18						PHYSICAL APPEARANCE - pg. 20 (Check all that apply)						
Event Conditions noted at site	None		Light		Moderate		Heavy		Aquatic Plants	Present	Abundant	
	= 1	2	=3		Unknown				Floating Algae	Present	Abundant	
Days since Rain									Filamentous Algae	Present	Abundant	
Water Temp./D.O./pH *	11.92		9.79		7.73				Bacterial Sheen/Slimes	Present	Abundant	
Water Color	Clear	Gray	Brown	Black	Green				Turbidity	Present	Abundant	
	Stream		Lake	Impound		Wetland				Oil Sheen	Present	Abundant
	Stream		Lake	Impound		Wetland				Foam	Present	Abundant
Stream Width (ft.)	<10	10-25	25-50		>50				Trash	Present	Abundant	
Avg. Stream Depth (ft.)	<1	1-3	>3		Unknown							
Water Velocity (ft./sec) *												
Stream Flow Type	Dry	Stagnant	L	M	H							
SUBSTRATE (%) – pg. 22 (add to 100%)						INSTREAM COVER – pg. 23 (check all that apply)						
Boulder – 10 in. diam.						Undercut Banks						
Cobble/Gravel –10 to .08 in. diam.						Overhanging Vegetation			X			
Sand – coarse grain			30			Deep Pools						
Silt/Detritus/Muck - fine grain/organic matter			70			Boulders						
Hardpan/Bedrock – solid clay/rock surface						Aquatic Plants			X			
Artificial – manmade						Logs or Woody Debris			X			
Unknown												
RIVER MORPHOLOGY – pg. 23						STREAM CORRIDOR – pg. 26						
Riffle	Present		Abundant				Riparian Veg. Width ft.(L)	<10	10-30	30-100	>100	
Pool	Present		Abundant				Riparian Veg. Width ft.(R)	<10	10-30	30-100	>100	
Channel	Natural	Recovering		Maintained		Bank Erosion	0	L	M	H		
Designated Drain	?	Y		N		Streamside Land Cover	Bare	Grass	Shrub	Trees		
Highest Water Mark (ft.)	?	<1	1-3	3-5	5-10	>10	Stream Canopy %	<25	25-50		>50	
Stream Cross Section						Adjacent Land Uses						
						Wetlands	L	R				
						Shrub or Old Field	L	R				
						Forest	L	R				
						Pasture	L	R				
						Crop Residue	L	R				
						Rowcrop	L	R				
						Residential Lawns, Parks	L	R				
						Impervious Surface	L	R				
Disturbed Ground	L	R										
No Vegetation	L	R										

* Optional Data Item

Data Sheet Version 4/27/00

Single Site Watershed Survey Data Sheet (page 2)

Date: **4/30/02**
Upstream Side

Station #: **NB-9B**

POTENTIAL SOURCES (Severity: S – slight; M – moderate; H – high) – pg. 28									
Crop Related Sources	S	M	H	Land Disposal	S	M	H		
Grazing Related Sources	S	M	H	On-site Wastewater Systems	S	M	H		
Intensive Animal Feeding Operations	S	M	H	Silviculture (Forestry NPS)	S	M	H		
Highway/Road/Bridge Maintenance and Runoff (Transportation NPS)	S	M	H	Resource Extraction (Mining NPS)	S	M	H		
Channelization	S	M	H	Recreational/Tourism Activities (general)	S	M	H		
Dredging	S	M	H	Golf Courses	S	M	H		
Removal of Riparian Vegetation	S	M	H	Marinas/Recr. Boating (water releases)	S	M	H		
Bank and Shoreline Erosion/Modification/Destruction	S	M	H	Marinas/Recr. Boating (bank or shoreline erosion)	S	M	H		
Flow Regulation/ Modification (Hydrology)	S	M	H	Debris in Water	S	M	H		
Upstream Impoundment	S	M	H	Industrial Pt. Source	S	M	H		
Construction: Highway/Road /Bridge/Culvert	S	M	H	Municipal Pt. Source	S	M	H		
Construction: Land Development	S	M	H	Natural Sources	S	M	H		
Urban Runoff (Residential/ Urban NPS)	S	M	H	Source(s) Unknown	S	M	H		

SITE SUMMARY INFORMATION – pg. 33			
SURVEY DIRECTION	N/A	U/ S	D/S
SITE SIMILARITY	?	Y	N
OVERALL SITE RANKING	L	M	H
SITE FOLLOW-UP RANK	L	M	H

COMMENTS:

Single Site Watershed Survey Data Sheet

Date: **11/11/02** Time: **15:06**
 Waterbody Name: **Cold Creek** County: **Benzie** Station #: **MNB-LB NB-9B**
 Location: **North Branch** Township: **Benzonia** Sec T R ¼ ¼
 Investigator: **Paul Murphy & Abby Mahan** Lat: **44°38.196'N** Long: **086°05.037'W**
 Coordinate Determination Method (check the one that applies):
 GPS GPS w/ DBR Digital mapping software Topographic map Other (____)
 Map Scale (if known _____) **Upstream Side**

PHYSICAL HABITAT											
BACKGROUND INFORMATION - pg. 18						PHYSICAL APPEARANCE - pg. 20 (Check all that apply)					
Event Conditions noted at site	None		Light		Moderate		Heavy		Aquatic Plants	Present	Abundant
	= 1	2	=3		Unknown			Floating Algae	Present	Abundant	
Days since Rain	7.30		10.10		7.67			Filamentous Algae	Present	Abundant	
Water Temp./D.O./pH *	Clear		Gray	Brown	Black	Green		Bacterial Sheen/Slimes	Present	Abundant	
Water Color	Stream		Lake	Impound	Wetland			Turbidity	Present	Abundant	
	Stream		Lake	Impound	Wetland			Oil Sheen	Present	Abundant	
Stream Width (ft.)	<10	10-25	25-50	>50				Foam	Present	Abundant	
Avg. Stream Depth (ft.)	<1	1-3	>3	Unknown				Trash	Present	Abundant	
Water Velocity (ft./sec) *	Dry		Stagnant	L	M	H					
Stream Flow Type											
SUBSTRATE (%) – pg. 22 (add to 100%)						INSTREAM COVER – pg. 23 (check all that apply)					
Boulder – 10 in. diam.						Undercut Banks					
Cobble/Gravel –10 to .08 in. diam.						Overhanging Vegetation					
Sand – coarse grain						Deep Pools					
Silt/Detritus/Muck - fine grain/organic matter						Boulders					
Hardpan/Bedrock – solid clay/rock surface						Aquatic Plants					
Artificial – manmade						Logs or Woody Debris					
Unknown											
RIVER MORPHOLOGY – pg. 23						STREAM CORRIDOR – pg. 26					
Riffle	Present		Abundant		Riparian Veg. Width ft.(L)		<10	10-30	30-100	>100	
Pool	Present		Abundant		Riparian Veg. Width ft.(R)		<10	10-30	30-100	>100	
Channel	Natural	Recovering		Maintained		Bank Erosion	0	L	M	H	
Designated Drain	?	Y		N		Streamside Land Cover	Bare	Grass	Shrub	Trees	
Highest Water Mark (ft.)	?	<1	1-3	3-5	5-10	>10	Stream Canopy %	<25	25-50	>50	
Stream Cross Section						Adjacent Land Uses					
						Wetlands	L	R			
						Shrub or Old Field	L	R			
						Forest	L	R			
						Pasture	L	R			
						Crop Residue	L	R			
						Rowcrop	L	R			
						Residential Lawns, Parks	L	R			
						Impervious Surface	L	R			
						Disturbed Ground	L	R			
No Vegetation	L	R									

* Optional Data Item

Data Sheet Version 4/27/00

Single Site Watershed Survey Data Sheet (page 2)

Date: 11/11/02
Upstream Side

Station #: NB-9B

POTENTIAL SOURCES (Severity: S – slight; M – moderate; H – high) – pg. 28									
Crop Related Sources	S	M	H	Land Disposal	S	M	H		
Grazing Related Sources	S	M	H	On-site Wastewater Systems	S	M	H		
Intensive Animal Feeding Operations	S	M	H	Silviculture (Forestry NPS)	S	M	H		
Highway/Road/Bridge Maintenance and Runoff (Transportation NPS)	S	M	H	Resource Extraction (Mining NPS)	S	M	H		
Channelization	S	M	H	Recreational/Tourism Activities (general)	S	M	H		
Dredging	S	M	H	Golf Courses	S	M	H		
Removal of Riparian Vegetation	S	M	H	Marinas/Recr. Boating (water releases)	S	M	H		
Bank and Shoreline Erosion/Modification/Destruction	S	M	H	Marinas/Recr. Boating (bank or shoreline erosion)	S	M	H		
Flow Regulation/ Modification (Hydrology)	S	M	H	Debris in Water	S	M	H		
Upstream Impoundment	S	M	H	Industrial Pt. Source	S	M	H		
Construction: Highway/Road /Bridge/Culvert	S	M	H	Municipal Pt. Source	S	M	H		
Construction: Land Development	S	M	H	Natural Sources	S	M	H		
Urban Runoff (Residential/ Urban NPS)	S	M	H	Source(s) Unknown	S	M	H		

SITE SUMMARY INFORMATION – pg. 33			
SURVEY DIRECTION	N/A	U/S	D/S
SITE SIMILARITY	?	Y	N
OVERALL SITE RANKING	L	M	H
SITE FOLLOW-UP RANK	L	M	H

COMMENTS:

Single Site Watershed Survey Data Sheet

Date: **4/30/02** Time: **14:30**
 Waterbody Name: **Cold Creek** County: **Benzie** Station #: **MNB-MB NB-9D**
 Location: **North Branch** Township: **Benzonia** Sec T R ¼ ¼
 Investigator: **Paul Murphy & Abby Mahan** Lat: **44°38.269'N** Long: **086°04.876'W**
 Coordinate Determination Method (check the one that applies):
 GPS GPS w/ DBR Digital mapping software Topographic map Other (____)
 Map Scale (if known _____) **Upstream Side**

PHYSICAL HABITAT												
BACKGROUND INFORMATION - pg. 18						PHYSICAL APPEARANCE - pg. 20 (Check all that apply)						
Event Conditions noted at site	None		Light		Moderate		Heavy		Aquatic Plants	Present	Abundant	
	= 1		2		=3		Unknown		Floating Algae	Present	Abundant	
Days since Rain									Filamentous Algae	Present	Abundant	
Water Temp./D.O./pH *	11.28		10.27		8.05				Bacterial Sheen/Slimes	Present	Abundant	
Water Color	Clear	Gray	Brown	Black	Green				Turbidity	Present	Abundant	
	Stream	Lake	Impound	Wetland						Oil Sheen	Present	Abundant
Stream Width (ft.)	<10	10-25	25-50	>50						Foam	Present	Abundant
Avg. Stream Depth (ft.)	<1	1-3	>3	Unknown						Trash	Present	Abundant
Water Velocity (ft./sec) *												
Stream Flow Type	Dry	Stagnant	L	M	H							
SUBSTRATE (%) – pg. 22 (add to 100%)						INSTREAM COVER – pg. 23 (check all that apply)						
Boulder – 10 in. diam.						Undercut Banks			X			
Cobble/Gravel –10 to .08 in. diam.						Overhanging Vegetation			X			
Sand – coarse grain			90%			Deep Pools						
Silt/Detritus/Muck - fine grain/organic matter			10%			Boulders						
Hardpan/Bedrock – solid clay/rock surface						Aquatic Plants						
Artificial – manmade						Logs or Woody Debris			X			
Unknown												
RIVER MORPHOLOGY – pg. 23						STREAM CORRIDOR – pg. 26						
Riffle	Present		Abundant				Riparian Veg. Width ft.(L)	<10	10-30	30-100	>100	
Pool	Present		Abundant				Riparian Veg. Width ft.(R)	<10	10-30	30-100	>100	
Channel	Natural		Recovering	Maintained		Bank Erosion		0	L	M	H	
Designated Drain	?		Y		N		Streamside Land Cover		Bare	Grass	Shrub	Trees
Highest Water Mark (ft.)	?	<1	1-3	3-5	5-10	>10	Stream Canopy %		<25	25-50	>50	
Stream Cross Section						Adjacent Land Uses						
						Wetlands	L	R				
						Shrub or Old Field	L	R				
						Forest	L	R				
						Pasture	L	R				
						Crop Residue	L	R				
						Rowcrop	L	R				
						Residential Lawns, Parks	L	R				
						Impervious Surface	L	R				
Disturbed Ground	L	R										
No Vegetation	L	R										

* Optional Data Item

Data Sheet Version 4/27/00

Single Site Watershed Survey Data Sheet (page 2)

Date: **04/30/02**
Upstream Side

Station #: **NB-9D**

POTENTIAL SOURCES (Severity: S – slight; M – moderate; H – high) – pg. 28									
Crop Related Sources Grazing Related Sources Intensive Animal Feeding Operations Highway/Road/Bridge Maintenance and Runoff (Transportation NPS) Channelization Dredging Removal of Riparian Vegetation Bank and Shoreline Erosion/Modification/Destruction Flow Regulation/ Modification (Hydrology) Upstream Impoundment <u>Construction:</u> Highway/Road/Bridge/Culvert <u>Construction:</u> Land Development Urban Runoff (Residential/ Urban NPS)	S	M	H	Land Disposal	S	M	H		
	S	M	H	On-site Wastewater Systems	S	M	H		
	S	M	H	Silviculture (Forestry NPS)	S	M	H		
	S	M	H	Resource Extraction (Mining NPS)	S	M	H		
	S	M	H	Recreational/Tourism Activities (general)	S	M	H		
	S	M	H	Golf Courses	S	M	H		
	S	M	H	Marinas/Recr. Boating (water releases)	S	M	H		
	S	M	H	Marinas/Recr. Boating (bank or shoreline erosion)	S	M	H		
	S	M	H	Debris in Water	S	M	H		
	S	M	H	Industrial Pt. Source	S	M	H		
	S	M	H	Municipal Pt. Source	S	M	H		
	S	M	H	Natural Sources	S	M	H		
	S	M	H	Source(s) Unknown	S	M	H		

SITE SUMMARY INFORMATION – pg. 33			
SURVEY DIRECTION	N/A	U/S	D/S
SITE SIMILARITY	?	Y	N
OVERALL SITE RANKING	L	M	H
SITE FOLLOW-UP RANK	L	M	H

COMMENTS:

Single Site Watershed Survey Data Sheet

Date: **11/11/02** Time: **14:46**
 Waterbody Name: **Cold Creek** County: **Benzie** Station #: **MNB-MB NB-9D**
 Location: **North Branch** Township: **Benzonia** Sec T R ¼ ¼
 Investigator: **Paul Murphy & Abby Mahan** Lat: **44°38.269'N** Long: **086°04.876'W**
 Coordinate Determination Method (check the one that applies):
 GPS GPS w/ DBR Digital mapping software Topographic map Other (____)
 Map Scale (if known _____) **Upstream Side**

PHYSICAL HABITAT												
BACKGROUND INFORMATION - pg. 18						PHYSICAL APPEARANCE - pg. 20 (Check all that apply)						
Event Conditions noted at site	None		Light		Moderate		Heavy		Aquatic Plants	Present	Abundant	
	= 1		2		=3		Unknown		Floating Algae	Present	Abundant	
Days since Rain	7.36		10.56		7.87				Filamentous Algae	Present	Abundant	
Water Temp./D.O./pH *	Clear		Gray	Brown	Black	Green			Bacterial Sheen/Slimes	Present	Abundant	
Water Color	Stream		Lake	Impound	Wetland				Turbidity	Present	Abundant	
	Stream		Lake	Impound	Wetland				Oil Sheen	Present	Abundant	
Stream Width (ft.)	<10		10-25	25-50	>50				Foam	Present	Abundant	
Avg. Stream Depth (ft.)	<1		1-3	>3	Unknown				Trash	Present	Abundant	
Water Velocity (ft./sec) *	Dry		Stagnant	L	M	H						
Stream Flow Type												
SUBSTRATE (%) – pg. 22 (add to 100%)						INSTREAM COVER – pg. 23 (check all that apply)						
Boulder – 10 in. diam.						Undercut Banks			X			
Cobble/Gravel –10 to .08 in. diam.						Overhanging Vegetation			X			
Sand – coarse grain			90%			Deep Pools						
Silt/Detritus/Muck - fine grain/organic matter			10%			Boulders						
Hardpan/Bedrock – solid clay/rock surface						Aquatic Plants						
Artificial – manmade						Logs or Woody Debris			X			
Unknown												
RIVER MORPHOLOGY – pg. 23						STREAM CORRIDOR – pg. 26						
Riffle	Present			Abundant			Riparian Veg. Width ft.(L)	<10	10-30	30-100	>100	
Pool	Present			Abundant			Riparian Veg. Width ft.(R)	<10	10-30	30-100	>100	
Channel	Natural		Recovering		Maintained		Bank Erosion	0	L	M	H	
Designated Drain	?		Y		N		Streamside Land Cover	Bare	Grass	Shrub	Trees	
Highest Water Mark (ft.)	?	<1	1-3	3-5	5-10	>10	Stream Canopy %	<25	25-50	>50		
Stream Cross Section						Adjacent Land Uses						
						Wetlands	L					R
						Shrub or Old Field	L					R
						Forest	L					R
						Pasture	L					R
						Crop Residue	L					R
						Rowcrop	L					R
						Residential Lawns, Parks	L					R
						Impervious Surface	L					R
						Disturbed Ground	L					R
						No Vegetation	L					R

* Optional Data Item

Data Sheet Version 4/27/00

Single Site Watershed Survey Data Sheet (page 2)

Date: **11/11/02**
Upstream Side

Station #: **NB-9D**

POTENTIAL SOURCES (Severity: S – slight; M – moderate; H – high) – pg. 28									
Crop Related Sources	S	M	H	Land Disposal	S	M	H		
Grazing Related Sources	S	M	H	On-site Wastewater Systems	S	M	H		
Intensive Animal Feeding Operations	S	M	H	Silviculture (Forestry NPS)	S	M	H		
Highway/Road/Bridge Maintenance and Runoff (Transportation NPS)	S	M	H	Resource Extraction (Mining NPS)	S	M	H		
Channelization	S	M	H	Recreational/Tourism Activities (general)	S	M	H		
Dredging	S	M	H	Golf Courses	S	M	H		
Removal of Riparian Vegetation	S	M	H	Marinas/Recr. Boating (water releases)	S	M	H		
Bank and Shoreline Erosion/Modification/Destruction	S	M	H	Marinas/Recr. Boating (bank or shoreline erosion)	S	M	H		
Flow Regulation/ Modification (Hydrology)	S	M	H	Debris in Water	S	M	H		
Upstream Impoundment	S	M	H	Industrial Pt. Source	S	M	H		
Construction: Highway/Road /Bridge/Culvert	S	M	H	Municipal Pt. Source	S	M	H		
Construction: Land Development	S	M	H	Natural Sources	S	M	H		
Urban Runoff (Residential/ Urban NPS)	S	M	H	Source(s) Unknown	S	M	H		

SITE SUMMARY INFORMATION – pg. 33			
SURVEY DIRECTION	N/A	U/ S	D/S
SITE SIMILARITY	?	Y	N
OVERALL SITE RANKING	L	M	H
SITE FOLLOW-UP RANK	L	M	H

COMMENTS:

Single Site Watershed Survey Data Sheet

Date: **4/30/02** Time: **15:30**
 Waterbody Name: **Cold Creek** County: **Benzie** Station #: **NB-10A**
 Location: **North Branch** Township: **Benzonia** Sec T R ¼ ¼
 Investigator: **Paul Murphy & Abby Mahan** Lat: **44°38.244'N** Long: **086°05.041'W**
 Coordinate Determination Method (check the one that applies):
 GPS GPS w/ DBR Digital mapping software Topographic map Other (____)
 Map Scale (if known _____) **Upstream Side**

PHYSICAL HABITAT												
BACKGROUND INFORMATION - pg. 18						PHYSICAL APPEARANCE - pg. 20 (Check all that apply)						
Event Conditions noted at site	None		Light		Moderate		Heavy		Aquatic Plants	Present	Abundant	
	= 1	2	=3	Unknown		Floating Algae	Present	Abundant				
Days since Rain									Filamentous Algae	Present	Abundant	
Water Temp./D.O./pH *	14.73		11.37		8.01				Bacterial Sheen/Slimes	Present	Abundant	
Water Color	Clear	Gray	Brown	Black	Green				Turbidity	Present	Abundant	
	Stream	Lake	Impound	Wetland						Oil Sheen	Present	Abundant
Stream Width (ft.)	<10	10-25	25-50	>50						Foam	Present	Abundant
Avg. Stream Depth (ft.)	<1	1-3	>3	Unknown						Trash	Present	Abundant
Water Velocity (ft./sec) *												
Stream Flow Type	Dry	Stagnant	L	M	H							
SUBSTRATE (%) – pg. 22 (add to 100%)						INSTREAM COVER – pg. 23 (check all that apply)						
Boulder – 10 in. diam.						Undercut Banks						
Cobble/Gravel –10 to .08 in. diam.						Overhanging Vegetation			X			
Sand – coarse grain						Deep Pools						
Silt/Detritus/Muck - fine grain/organic matter			100%			Boulders						
Hardpan/Bedrock – solid clay/rock surface						Aquatic Plants			X			
Artificial – manmade						Logs or Woody Debris			X			
Unknown												
RIVER MORPHOLOGY – pg. 23						STREAM CORRIDOR – pg. 26						
Riffle	Present		Abundant				Riparian Veg. Width ft.(L)	<10	10-30	30-100	>100	
Pool	Present		Abundant				Riparian Veg. Width ft.(R)	<10	10-30	30-100	>100	
Channel	Natural	Recovering		Maintained		Bank Erosion	0	L	M	H		
Designated Drain	?	Y		N		Streamside Land Cover	Bare	Grass	Shrub	Trees		
Highest Water Mark (ft.)	?	<1	1-3	3-5	5-10	>10	Stream Canopy %	<25	25-50	>50		
Stream Cross Section						Adjacent Land Uses						
						Wetlands	L	R				
						Shrub or Old Field	L	R				
						Forest	L	R				
						Pasture	L	R				
						Crop Residue	L	R				
						Rowcrop	L	R				
						Residential Lawns, Parks	L	R				
						Impervious Surface	L	R				
						Disturbed Ground	L	R				
No Vegetation	L	R										

* Optional Data Item

Data Sheet Version 4/27/00

Single Site Watershed Survey Data Sheet (page 2)

Date: **04/30/02**
Upstream Side

Station #: **NB-10A**

POTENTIAL SOURCES (Severity: S – slight; M – moderate; H – high) – pg. 28									
	Crop Related Sources	S	M	H	Land Disposal	S	M	H	
	Grazing Related Sources	S	M	H	On-site Wastewater Systems	S	M	H	
	Intensive Animal Feeding Operations	S	M	H	Silviculture (Forestry NPS)	S	M	H	
	Highway/Road/Bridge Maintenance and Runoff (Transportation NPS)	S	M	H	Resource Extraction (Mining NPS)	S	M	H	
	Channelization	S	M	H	Recreational/Tourism Activities (general)	S	M	H	
	Dredging	S	M	H	Golf Courses	S	M	H	
	Removal of Riparian Vegetation	S	M	H	Marinas/Recr. Boating (water releases)	S	M	H	
	Bank and Shoreline Erosion/Modification/Destruction	S	M	H	Marinas/Recr. Boating (bank or shoreline erosion)	S	M	H	
	Flow Regulation/ Modification (Hydrology)	S	M	H	Debris in Water	S	M	H	
	Upstream Impoundment	S	M	H	Industrial Pt. Source	S	M	H	
	<u>Construction:</u> Highway/Road /Bridge/Culvert	S	M	H	Municipal Pt. Source	S	M	H	
	<u>Construction:</u> Land Development	S	M	H	Natural Sources	S	M	H	
	Urban Runoff (Residential/ Urban NPS)	S	M	H	Source(s) Unknown	S	M	H	

SITE SUMMARY INFORMATION – pg. 33			
SURVEY DIRECTION	N/A	U/ S	D/S
SITE SIMILARITY	?	Y	N
OVERALL SITE RANKING	L	M	H
SITE FOLLOW-UP RANK	L	M	H

COMMENTS:

Single Site Watershed Survey Data Sheet

Date: **11/11/02** Time: **15:24**
 Waterbody Name: **Cold Creek** County: **Benzie** Station #: **NB-10A**
 Location: **North Branch** Township: **Benzonia** Sec T R ¼ ¼
 Investigator: **Paul Murphy & Abby Mahan** Lat: **44°38.244'N** Long: **086°05.041'W**
 Coordinate Determination Method (check the one that applies):
 GPS GPS w/ DBR Digital mapping software Topographic map Other (____)
 Map Scale (if known _____) **Upstream Side**

PHYSICAL HABITAT												
BACKGROUND INFORMATION - pg. 18						PHYSICAL APPEARANCE - pg. 20 (Check all that apply)						
Event Conditions noted at site	None		Light		Moderate		Heavy		Aquatic Plants	Present	Abundant	
	= 1		2		=3		Unknown		Floating Algae	Present	Abundant	
Days since Rain									Filamentous Algae	Present	Abundant	
Water Temp./D.O./pH *	7.31		10.57		7.73				Bacterial Sheen/Slimes	Present	Abundant	
Water Color	Clear	Gray	Brown	Black	Green				Turbidity	Present	Abundant	
	Stream		Lake		Impound		Wetland		Oil Sheen	Present	Abundant	
	Stream		Lake		Impound		Wetland		Foam	Present	Abundant	
Stream Width (ft.)	<10		10-25		25-50		>50		Trash	Present	Abundant	
Avg. Stream Depth (ft.)	<1		1-3		>3		Unknown					
Water Velocity (ft./sec) *												
Stream Flow Type	Dry	Stagnant		L	M	H						
SUBSTRATE (%) – pg. 22 (add to 100%)						INSTREAM COVER – pg. 23 (check all that apply)						
Boulder – 10 in. diam.						Undercut Banks						
Cobble/Gravel –10 to .08 in. diam.						Overhanging Vegetation			X			
Sand – coarse grain						Deep Pools						
Silt/Detritus/Muck - fine grain/organic matter			100%			Boulders						
Hardpan/Bedrock – solid clay/rock surface						Aquatic Plants			X			
Artificial – manmade						Logs or Woody Debris			X			
Unknown												
RIVER MORPHOLOGY – pg. 23						STREAM CORRIDOR – pg. 26						
Riffle	Present			Abundant			Riparian Veg. Width ft.(L)	<10	10-30	30-100	>100	
Pool	Present			Abundant			Riparian Veg. Width ft.(R)	<10	10-30	30-100	>100	
Channel	Natural		Recovering		Maintained		Bank Erosion	0	L	M	H	
Designated Drain	?		Y		N		Streamside Land Cover	Bare	Grass	Shrub	Trees	
Highest Water Mark (ft.)	?	<1	1-3	3-5	5-10	>10	Stream Canopy %	<25		25-50	>50	
Stream Cross Section						Adjacent Land Uses						
						Wetlands	L					R
						Shrub or Old Field	L					R
						Forest	L					R
						Pasture	L					R
						Crop Residue	L					R
						Rowcrop	L					R
						Residential Lawns, Parks	L					R
						Impervious Surface	L					R
						Disturbed Ground	L					R
No Vegetation	L					R						

* Optional Data Item

Data Sheet Version 4/27/00

Single Site Watershed Survey Data Sheet (page 2)

Date: **11/11/02**
Upstream Side

Station #: **NB-10A**

POTENTIAL SOURCES (Severity: S – slight; M – moderate; H – high) – pg. 28									
	Crop Related Sources	S	M	H	Land Disposal	S	M	H	
	Grazing Related Sources	S	M	H	On-site Wastewater Systems	S	M	H	
	Intensive Animal Feeding Operations	S	M	H	Silviculture (Forestry NPS)	S	M	H	
	Highway/Road/Bridge Maintenance and Runoff (Transportation NPS)	S	M	H	Resource Extraction (Mining NPS)	S	M	H	
	Channelization	S	M	H	Recreational/Tourism Activities (general)	S	M	H	
	Dredging	S	M	H	Golf Courses	S	M	H	
	Removal of Riparian Vegetation	S	M	H	Marinas/Recr. Boating (water releases)	S	M	H	
	Bank and Shoreline Erosion/Modification/Destruction	S	M	H	Marinas/Recr. Boating (bank or shoreline erosion)	S	M	H	
	Flow Regulation/ Modification (Hydrology)	S	M	H	Debris in Water	S	M	H	
	Upstream Impoundment	S	M	H	Industrial Pt. Source	S	M	H	
	<u>Construction:</u> Highway/Road /Bridge/Culvert	S	M	H	Municipal Pt. Source	S	M	H	
	<u>Construction:</u> Land Development	S	M	H	Natural Sources	S	M	H	
	Urban Runoff (Residential/ Urban NPS)	S	M	H	Source(s) Unknown	S	M	H	

SITE SUMMARY INFORMATION – pg. 33			
SURVEY DIRECTION	N/A	U/ S	D/S
SITE SIMILARITY	?	Y	N
OVERALL SITE RANKING	L	M	H
SITE FOLLOW-UP RANK	L	M	H

COMMENTS:

Single Site Watershed Survey Data Sheet

Date: **4/30/02** Time: **15:50**
 Waterbody Name: **Cold Creek** County: **Benzie** Station #: **NB-10B**
 Location: **North Branch** Township: **Benzonia** Sec T R ¼ ¼
 Investigator: **Paul Murphy & Abby Mahan** Lat: **44°38.338'N** Long: **086°05.037'W**
 Coordinate Determination Method (check the one that applies):
 GPS GPS w/ DBR Digital mapping software Topographic map Other (____)
 Map Scale (if known _____) **Downstream Side**

PHYSICAL HABITAT												
BACKGROUND INFORMATION - pg. 18						PHYSICAL APPEARANCE - pg. 20 (Check all that apply)						
Event Conditions noted at site	None		Light		Moderate		Heavy		Aquatic Plants	Present	Abundant	
	= 1		2		=3		Unknown		Floating Algae	Present	Abundant	
Days since Rain									Filamentous Algae	Present	Abundant	
Water Temp./D.O./pH *	13.37		10.71		7.93				Bacterial Sheen/Slimes	Present	Abundant	
Water Color	Clear	Gray	Brown	Black	Green				Turbidity	Present	Abundant	
	Stream		Lake		Impound		Wetland		Oil Sheen	Present	Abundant	
	Stream		Lake		Impound		Wetland		Foam	Present	Abundant	
Stream Width (ft.)	<10	10-25		25-50		>50		Trash	Present	Abundant		
Avg. Stream Depth (ft.)	<1	1-3		>3		Unknown						
Water Velocity (ft./sec) *												
Stream Flow Type	Dry	Stagnant		L	M	H						
SUBSTRATE (%) – pg. 22 (add to 100%)						INSTREAM COVER – pg. 23 (check all that apply)						
Boulder – 10 in. diam.						Undercut Banks						
Cobble/Gravel –10 to .08 in. diam.						Overhanging Vegetation			X			
Sand – coarse grain						Deep Pools						
Silt/Detritus/Muck - fine grain/organic matter			100%			Boulders						
Hardpan/Bedrock – solid clay/rock surface						Aquatic Plants			X			
Artificial – manmade						Logs or Woody Debris			X			
Unknown												
RIVER MORPHOLOGY – pg. 23						STREAM CORRIDOR – pg. 26						
Riffle	Present			Abundant			Riparian Veg. Width ft.(L)	<10	10-30	30-100	>100	
Pool	Present			Abundant			Riparian Veg. Width ft.(R)	<10	10-30	30-100	>100	
Channel	Natural		Recovering		Maintained		Bank Erosion	0	L	M	H	
Designated Drain	?		Y		N		Streamside Land Cover	Bare	Grass	Shrub	Trees	
Highest Water Mark (ft.)	?	<1	1-3	3-5	5-10	>10	Stream Canopy %	<25	25-50		>50	
Stream Cross Section						Adjacent Land Uses						
						Wetlands	L					R
						Shrub or Old Field	L					R
						Forest	L					R
						Pasture	L					R
						Crop Residue	L					R
						Rowcrop	L					R
						Residential Lawns, Parks	L					R
						Impervious Surface	L					R
						Disturbed Ground	L					R
No Vegetation	L					R						

* Optional Data Item

Data Sheet Version 4/27/00

Single Site Watershed Survey Data Sheet (page 2)

Date: **04/30/02**
Downstream Side

Station #: **NB-10B**

POTENTIAL SOURCES (Severity: S – slight; M – moderate; H – high) – pg. 28									
Crop Related Sources	S	M	H	Land Disposal	S	M	H		
Grazing Related Sources	S	M	H	On-site Wastewater Systems	S	M	H		
Intensive Animal Feeding Operations	S	M	H	Silviculture (Forestry NPS)	S	M	H		
Highway/Road/Bridge Maintenance and Runoff (Transportation NPS)	S	M	H	Resource Extraction (Mining NPS)	S	M	H		
Channelization	S	M	H	Recreational/Tourism Activities (general)	S	M	H		
Dredging	S	M	H	Golf Courses	S	M	H		
Removal of Riparian Vegetation	S	M	H	Marinas/Recr. Boating (water releases)	S	M	H		
Bank and Shoreline Erosion/Modification/Destruction	S	M	H	Marinas/Recr. Boating (bank or shoreline erosion)	S	M	H		
Flow Regulation/ Modification (Hydrology)	S	M	H	Debris in Water	S	M	H		
Upstream Impoundment	S	M	H	Industrial Pt. Source	S	M	H		
Construction: Highway/Road /Bridge/Culvert	S	M	H	Municipal Pt. Source	S	M	H		
Construction: Land Development	S	M	H	Natural Sources	S	M	H		
Urban Runoff (Residential/ Urban NPS)	S	M	H	Source(s) Unknown	S	M	H		

SITE SUMMARY INFORMATION – pg. 33			
SURVEY DIRECTION	N/A	U/S	D/S
SITE SIMILARITY	?	Y	N
OVERALL SITE RANKING	L	M	H
SITE FOLLOW-UP RANK	L	M	H

COMMENTS:

Single Site Watershed Survey Data Sheet

Date: **11/11/02** Time: **15:40**
 Waterbody Name: **Cold Creek** County: **Benzie** Station #: **NB-10B**
 Location: **North Branch** Township: **Benzonia** Sec T R ¼ ¼
 Investigator: **Paul Murphy & Abby Mahan** Lat: **44°38.338'N** Long: **086°05.037'W**
 Coordinate Determination Method (check the one that applies):
 GPS GPS w/ DBR Digital mapping software Topographic map Other (____)
 Map Scale (if known _____) **Downstream Side**

PHYSICAL HABITAT											
BACKGROUND INFORMATION - pg. 18						PHYSICAL APPEARANCE - pg. 20 (Check all that apply)					
Event Conditions noted at site	None		Light		Moderate		Heavy		Aquatic Plants	Present	Abundant
	= 1	2	=3		Unknown				Floating Algae	Present	Abundant
Days since Rain	7.36		10.50		8.15				Filamentous Algae	Present	Abundant
Water Temp./D.O./pH *	Clear		Gray	Brown	Black	Green			Bacterial Sheen/Slimes	Present	Abundant
Water Color	Stream		Lake	Impound	Wetland				Turbidity	Present	Abundant
	Stream		Lake	Impound	Wetland				Oil Sheen	Present	Abundant
Stream Width (ft.)	<10		10-25	25-50	>50				Foam	Present	Abundant
Avg. Stream Depth (ft.)	<1		1-3	>3	Unknown				Trash	Present	Abundant
Water Velocity (ft./sec) *	Dry		Stagnant	L	M	H					
Stream Flow Type											
SUBSTRATE (%) – pg. 22 (add to 100%)						INSTREAM COVER – pg. 23 (check all that apply)					
Boulder – 10 in. diam.						Undercut Banks					
Cobble/Gravel –10 to .08 in. diam.						Overhanging Vegetation			X		
Sand – coarse grain						Deep Pools					
Silt/Detritus/Muck - fine grain/organic matter			100%			Boulders					
Hardpan/Bedrock – solid clay/rock surface						Aquatic Plants			X		
Artificial – manmade						Logs or Woody Debris			X		
Unknown											
RIVER MORPHOLOGY – pg. 23						STREAM CORRIDOR – pg. 26					
Riffle	Present			Abundant			Riparian Veg. Width ft.(L)	<10	10-30	30-100	>100
Pool	Present			Abundant			Riparian Veg. Width ft.(R)	<10	10-30	30-100	>100
Channel	Natural		Recovering		Maintained		Bank Erosion	0	L	M	H
Designated Drain	?		Y		N		Streamside Land Cover	Bare	Grass	Shrub	Trees
Highest Water Mark (ft.)	?		<1	1-3	3-5	5-10	Stream Canopy %	<25	25-50		>50
Stream Cross Section						Adjacent Land Uses					
						Wetlands	L		R		
						Shrub or Old Field	L		R		
						Forest	L		R		
						Pasture	L		R		
						Crop Residue	L		R		
						Rowcrop	L		R		
						Residential Lawns, Parks	L		R		
						Impervious Surface	L		R		
						Disturbed Ground	L		R		
						No Vegetation	L		R		

* Optional Data Item

Data Sheet Version 4/27/00

Single Site Watershed Survey Data Sheet (page 2)

Date: **11/11/02**
Downstream Side

Station #: **NB-10B**

POTENTIAL SOURCES (Severity: S – slight; M – moderate; H – high) – pg. 28									
Crop Related Sources	S	M	H	Land Disposal	S	M	H		
Grazing Related Sources	S	M	H	On-site Wastewater Systems	S	M	H		
Intensive Animal Feeding Operations	S	M	H	Silviculture (Forestry NPS)	S	M	H		
Highway/Road/Bridge Maintenance and Runoff (Transportation NPS)	S	M	H	Resource Extraction (Mining NPS)	S	M	H		
Channelization	S	M	H	Recreational/Tourism Activities (general)	S	M	H		
Dredging	S	M	H	Golf Courses	S	M	H		
Removal of Riparian Vegetation	S	M	H	Marinas/Recr. Boating (water releases)	S	M	H		
Bank and Shoreline Erosion/Modification/Destruction	S	M	H	Marinas/Recr. Boating (bank or shoreline erosion)	S	M	H		
Flow Regulation/ Modification (Hydrology)	S	M	H	Debris in Water	S	M	H		
Upstream Impoundment	S	M	H	Industrial Pt. Source	S	M	H		
<u>Construction:</u> Highway/Road /Bridge/ Culvert	S	M	H	Municipal Pt. Source	S	M	H		
<u>Construction:</u> Land Development	S	M	H	Natural Sources	S	M	H		
Urban Runoff (Residential/ Urban NPS)	S	M	H	Source(s) Unknown	S	M	H		

SITE SUMMARY INFORMATION – pg. 33			
SURVEY DIRECTION	N/A	U/S	D/S
SITE SIMILARITY	?	Y	N
OVERALL SITE RANKING	L	M	H
SITE FOLLOW-UP RANK	L	M	H

COMMENTS:

Single Site Watershed Survey Data Sheet

Date: **04-30-02** Time: **16:30**
 Waterbody Name: **Cold Creek** County: **Benzie** Station #: **MB-NG MB-7**
 Location: **North Branch** Township: **Benzonia** Sec T R ¼ ¼
 Investigator: **Paul Murphy & Abby Mahan** Lat: **44°37.936'N** Long: **086°05.048'W**
 Coordinate Determination Method (check the one that applies):
 GPS GPS w/ DBR Digital mapping software Topographic map Other (____)
 Map Scale (if known _____) **Upstream Side**

PHYSICAL HABITAT												
BACKGROUND INFORMATION - pg. 18						PHYSICAL APPEARANCE - pg. 20 (Check all that apply)						
Event Conditions noted at site	None		Light		Moderate		Heavy		Aquatic Plants	Present	Abundant	
	= 1		2		=3		Unknown		Floating Algae	Present	Abundant	
Days since Rain									Filamentous Algae	Present	Abundant	
Water Temp./D.O./pH *	12.78		10.24		8.02				Bacterial Sheen/Slimes	Present	Abundant	
Water Color	Clear	Gray	Brown	Black	Green				Turbidity	Present	Abundant	
	Stream	Lake	Impound	Wetland						Oil Sheen	Present	Abundant
Stream Width (ft.)	<10	10-25	25-50	>50						Foam	Present	Abundant
Avg. Stream Depth (ft.)	<1	1-3	>3	Unknown						Trash	Present	Abundant
Water Velocity (ft./sec) *												
Stream Flow Type	Dry	Stagnant	L	M	H							
SUBSTRATE (%) – pg. 22 (add to 100%)						INSTREAM COVER – pg. 23 (check all that apply)						
Boulder – 10 in. diam.						Undercut Banks			X			
Cobble/Gravel –10 to .08 in. diam.						Overhanging Vegetation			X			
Sand – coarse grain						Deep Pools						
Silt/Detritus/Muck - fine grain/organic matter			100%			Boulders						
Hardpan/Bedrock – solid clay/rock surface						Aquatic Plants			X			
Artificial – manmade						Logs or Woody Debris			X			
Unknown												
RIVER MORPHOLOGY – pg. 23						STREAM CORRIDOR – pg. 26						
Riffle	Present			Abundant			Riparian Veg. Width ft.(L)	<10	10-30	30-100	>100	
Pool	Present			Abundant			Riparian Veg. Width ft.(R)	<10	10-30	30-100	>100	
Channel	Natural	Recovering		Maintained			Bank Erosion	0	L	M	H	
Designated Drain	?	Y		N			Streamside Land Cover	Bare	Grass	Shrub	Trees	
Highest Water Mark (ft.)	?	<1	1-3	3-5	5-10	>10	Stream Canopy %	<25	25-50	>50		
Stream Cross Section						Adjacent Land Uses						
						Wetlands	L	R				
						Shrub or Old Field	L	R				
						Forest	L	R				
						Pasture	L	R				
						Crop Residue	L	R				
						Rowcrop	L	R				
						Residential Lawns, Parks	L	R				
						Impervious Surface	L	R				
Disturbed Ground	L	R										
No Vegetation	L	R										

* Optional Data Item

Data Sheet Version 4/27/00

Single Site Watershed Survey Data Sheet (page 2)

Date: **04/30/02**

Station #: **MB-7**

Upstream Side/Downstream Side

POTENTIAL SOURCES (Severity: S – slight; M – moderate; H – high) – pg. 28									
Crop Related Sources	S	M	H	Land Disposal	S	M	H		
Grazing Related Sources	S	M	H	On-site Wastewater Systems	S	M	H		
Intensive Animal Feeding Operations	S	M	H	Silviculture (Forestry NPS)	S	M	H		
Highway/Road/Bridge Maintenance and Runoff (Transportation NPS)	S	M	H	Resource Extraction (Mining NPS)	S	M	H		
Channelization	S	M	H	Recreational/Tourism Activities (general)	S	M	H		
Dredging	S	M	H	Golf Courses	S	M	H		
Removal of Riparian Vegetation	S	M	H	Marinas/Recr. Boating (water releases)	S	M	H		
Bank and Shoreline Erosion/Modification/Destruction	S	M	H	Marinas/Recr. Boating (bank or shoreline erosion)	S	M	H		
Flow Regulation/ Modification (Hydrology)	S	M	H	Debris in Water	S	M	H		
Upstream Impoundment	S	M	H	Industrial Pt. Source	S	M	H		
Construction: Highway/Road /Bridge/Culvert	S	M	H	Municipal Pt. Source	S	M	H		
Construction: Land Development	S	M	H	Natural Sources	S	M	H		
Urban Runoff (Residential/ Urban NPS)	S	M	H	Source(s) Unknown	S	M	H		

SITE SUMMARY INFORMATION – pg. 33			
SURVEY DIRECTION	N/A	U/ S	D/S
SITE SIMILARITY	?	Y	N
OVERALL SITE RANKING	L	M	H
SITE FOLLOW-UP RANK	L	M	H

COMMENTS:

Single Site Watershed Survey Data Sheet

Date: **11-11-02** Time: **16:20**
 Waterbody Name: **Cold Creek** County: **Benzie** Station #: **MB-NG MB-7**
 Location: **North Branch** Township: **Benzonia** Sec T R ¼ ¼
 Investigator: **Paul Murphy & Abby Mahan** Lat: **44°37.936'N** Long: **086°05.048'W**
 Coordinate Determination Method (check the one that applies):
 GPS GPS w/ DBR Digital mapping software Topographic map Other (____)
 Map Scale (if known _____) **Upstream Side**

PHYSICAL HABITAT													
BACKGROUND INFORMATION - pg. 18						PHYSICAL APPEARANCE - pg. 20 (Check all that apply)							
Event Conditions noted at site	None		Light		Moderate		Heavy		Aquatic Plants	Present	Abundant		
	= 1		2		=3		Unknown		Floating Algae	Present	Abundant		
Days since Rain	7.24		10.59		7.82				Filamentous Algae	Present	Abundant		
Water Temp./D.O./pH *	Clear		Gray		Brown		Black		Green		Bacterial Sheen/Slimes	Present	Abundant
Water Color	Stream		Lake		Impound		Wetland				Turbidity	Present	Abundant
	Stream		Lake		Impound		Wetland				Oil Sheen	Present	Abundant
Stream Width (ft.)	<10		10-25		25-50		>50				Foam	Present	Abundant
Avg. Stream Depth (ft.)	<1		1-3		>3		Unknown				Trash	Present	Abundant
Water Velocity (ft./sec) *													
Stream Flow Type	Dry		Stagnant		L		M		H				
SUBSTRATE (%) – pg. 22 (add to 100%)						INSTREAM COVER – pg. 23 (check all that apply)							
Boulder – 10 in. diam.						Undercut Banks						X	
Cobble/Gravel –10 to .08 in. diam.						Overhanging Vegetation						X	
Sand – coarse grain						Deep Pools							
Silt/Detritus/Muck - fine grain/organic matter						Boulders							
Hardpan/Bedrock – solid clay/rock surface						Aquatic Plants						X	
Artificial – manmade						Logs or Woody Debris						X	
Unknown													
RIVER MORPHOLOGY – pg. 23						STREAM CORRIDOR – pg. 26							
Riffle	Present			Abundant			Riparian Veg. Width ft.(L)	<10	10-30	30-100	>100		
Pool	Present			Abundant			Riparian Veg. Width ft.(R)	<10	10-30	30-100	>100		
Channel	Natural		Recovering		Maintained		Bank Erosion	0	L	M	H		
Designated Drain	?		Y		N		Streamside Land Cover	Bare	Grass	Shrub	Trees		
Highest Water Mark (ft.)	?		<1		1-3		3-5		5-10		>10		
Stream Cross Section						Adjacent Land Uses							
						Wetlands						L	R
						Shrub or Old Field						L	R
						Forest						L	R
						Pasture						L	R
						Crop Residue						L	R
						Rowcrop						L	R
						Residential Lawns, Parks						L	R
						Impervious Surface						L	R
Disturbed Ground						L	R						
No Vegetation						L	R						

* Optional Data Item

Data Sheet Version 4/27/00

Single Site Watershed Survey Data Sheet (page 2)

Date: 11/11/02
Upstream Side

Station #: MB-7

POTENTIAL SOURCES (Severity: S – slight; M – moderate; H – high) – pg. 28									
Crop Related Sources	S	M	H	Land Disposal	S	M	H		
Grazing Related Sources	S	M	H	On-site Wastewater Systems	S	M	H		
Intensive Animal Feeding Operations	S	M	H	Silviculture (Forestry NPS)	S	M	H		
Highway/Road/Bridge Maintenance and Runoff (Transportation NPS)	S	M	H	Resource Extraction (Mining NPS)	S	M	H		
Channelization	S	M	H	Recreational/Tourism Activities (general)	S	M	H		
Dredging	S	M	H	Golf Courses	S	M	H		
Removal of Riparian Vegetation	S	M	H	Marinas/Recr. Boating (water releases)	S	M	H		
Bank and Shoreline Erosion/Modification/Destruction	S	M	H	Marinas/Recr. Boating (bank or shoreline erosion)	S	M	H		
Flow Regulation/ Modification (Hydrology)	S	M	H	Debris in Water	S	M	H		
Upstream Impoundment	S	M	H	Industrial Pt. Source	S	M	H		
Construction: Highway/Road /Bridge/Culvert	S	M	H	Municipal Pt. Source	S	M	H		
Construction: Land Development	S	M	H	Natural Sources	S	M	H		
Urban Runoff (Residential/ Urban NPS)	S	M	H	Source(s) Unknown	S	M	H		

SITE SUMMARY INFORMATION – pg. 33			
SURVEY DIRECTION	N/A	U/ S	D/S
SITE SIMILARITY	?	Y	N
OVERALL SITE RANKING	L	M	H
SITE FOLLOW-UP RANK	L	M	H

COMMENTS:

Single Site Watershed Survey Data Sheet

Date: **11/11/02** Time: **11:30**
 Waterbody Name: **Cold Creek** County: **Benzie** Station #: **SB-6**
 Location: **South Branch** Township: **Benzonia** Sec **T** R **¼** ¼
 Investigator: **Paul Murphy & Abby Mahan** Lat: **44°37.062'N** Long: **086°05.317'W**
 Coordinate Determination Method (check the one that applies):
 GPS GPS w/ DBR Digital mapping software Topographic map Other (____)
 Map Scale (if known _____) **Upstream Side**

PHYSICAL HABITAT												
BACKGROUND INFORMATION - pg. 18						PHYSICAL APPEARANCE - pg. 20 (Check all that apply)						
Event Conditions noted at site	None		Light		Moderate		Heavy		Aquatic Plants	Present	Abundant	
	= 1		2		=3		Unknown		Floating Algae	Present	Abundant	
Days since Rain									Filamentous Algae	Present	Abundant	
Water Temp./D.O./pH *	7.12		10.98		7.91				Bacterial Sheen/Slimes	Present	Abundant	
Water Color	Clear	Gray	Brown		Black		Green		Turbidity	Present	Abundant	
	Stream		Lake		Impound		Wetland		Oil Sheen	Present	Abundant	
Stream Width (ft.)	<10		10-25		25-50		>50		Foam	Present	Abundant	
Avg. Stream Depth (ft.)	<1		1-3		>3		Unknown		Trash	Present	Abundant	
Water Velocity (ft./sec) *												
Stream Flow Type	Dry	Stagnant		L	M	H						
SUBSTRATE (%) – pg. 22 (add to 100%)						INSTREAM COVER – pg. 23 (check all that apply)						
Boulder – 10 in. diam.						25%			Undercut Banks	X		
Cobble/Gravel –10 to .08 in. diam.						75%			Overhanging Vegetation	X		
Sand – coarse grain									Deep Pools			
Silt/Detritus/Muck - fine grain/organic matter									Boulders			
Hardpan/Bedrock – solid clay/rock surface									Aquatic Plants	X		
Artificial – manmade									Logs or Woody Debris	X		
Unknown												
RIVER MORPHOLOGY – pg. 23						STREAM CORRIDOR – pg. 26						
Riffle	Present			Abundant			Riparian Veg. Width ft.(L)	<10	10-30	30-100	>100	
Pool	Present			Abundant			Riparian Veg. Width ft.(R)	<10	10-30	30-100	>100	
Channel	Natural		Recovering		Maintained		Bank Erosion	0	L	M	H	
Designated Drain	?		Y		N		Streamside Land Cover	Bare	Grass	Shrub	Trees	
Highest Water Mark (ft.)	?	<1	1-3	3-5	5-10	>10	Stream Canopy %	<25	25-50		>50	
Stream Cross Section						Adjacent Land Uses						
						Wetlands	L					R
						Shrub or Old Field	L					R
						Forest	L					R
						Pasture	L					R
						Crop Residue	L					R
						Rowcrop	L					R
						Residential Lawns, Parks	L					R
						Impervious Surface	L					R
Disturbed Ground	L					R						
No Vegetation	L					R						

* Optional Data Item

Data Sheet Version 4/27/00

Single Site Watershed Survey Data Sheet (page 2)

Date: **11/11/02**
Upstream Side

Station #: **SB-6**

POTENTIAL SOURCES (Severity: S – slight; M – moderate; H – high) – pg. 28											
Crop Related Sources Grazing Related Sources Intensive Animal Feeding Operations Highway/Road/Bridge Maintenance and Runoff (Transportation NPS) Channelization Dredging Removal of Riparian Vegetation Bank and Shoreline Erosion/Modification/Destruction Flow Regulation/ Modification (Hydrology) Upstream Impoundment <u>Construction:</u> Highway/Road /Bridge/Culvert <u>Construction:</u> Land Development Urban Runoff (Residential/ Urban NPS)	S	M	H		S	M	H		S	M	H
	S	M	H	Land Disposal	S	M	H		S	M	H
	S	M	H	On-site Wastewater Systems	S	M	H		S	M	H
	S	M	H	Silviculture (Forestry NPS)	S	M	H		S	M	H
	S	M	H	Resource Extraction (Mining NPS)	S	M	H		S	M	H
	S	M	H	Recreational/Tourism Activities (general)	S	M	H		S	M	H
	S	M	H	Golf Courses	S	M	H		S	M	H
	S	M	H	Marinas/Recr. Boating (water releases)	S	M	H		S	M	H
	S	M	H	Marinas/Recr. Boating (bank or shoreline erosion)	S	M	H		S	M	H
	S	M	H	Debris in Water	S	M	H		S	M	H
	S	M	H	Industrial Pt. Source	S	M	H		S	M	H
	S	M	H	Municipal Pt. Source	S	M	H		S	M	H
	S	M	H	Natural Sources	S	M	H		S	M	H
S	M	H	Source(s) Unknown	S	M	H		S	M	H	

SITE SUMMARY INFORMATION – pg. 33			
SURVEY DIRECTION	N/A	U/ S	D/S
SITE SIMILARITY	?	Y	N
OVERALL SITE RANKING	L	M	H
SITE FOLLOW-UP RANK	L	M	H

COMMENTS:

Single Site Watershed Survey Data Sheet

Date: **11/12/02** Time: **12:40**

Waterbody Name: **Cold Creek**

County: **Benzie**

Station #: **SB-6A**

Location: **South Branch**

Township: **Benzon**

Sec T R ¼ ¼

Investigator: **Paul Murphy & Abby Mahan**

Lat: **44°36.767'N**

Long: **086°05.025W**

Coordinate Determination Method (check the one that applies):

GPS GPS w/ DBR Digital mapping software Topographic map Other (____)

Map Scale (if known _____)

Downstream Side

PHYSICAL HABITAT											
BACKGROUND INFORMATION - pg. 18						PHYSICAL APPEARANCE - pg. 20 (Check all that apply)					
Event Conditions noted at site	None		Light		Moderate		Heavy		Aquatic Plants	Present	Abundant
	= 1		2		=3		Unknown		Floating Algae	Present	Abundant
Days since Rain	7.67		11.13		7.84				Filamentous Algae	Present	Abundant
Water Temp./D.O./pH *	Clear		Gray	Brown	Black	Green			Bacterial Sheen/Slimes	Present	Abundant
Water Color	Stream		Lake	Impound	Wetland				Turbidity	Present	Abundant
	Stream		Lake	Impound	Wetland				Oil Sheen	Present	Abundant
Stream Width (ft.)	<10		10-25	25-50	>50				Foam	Present	Abundant
Avg. Stream Depth (ft.)	<1		1-3	>3	Unknown				Trash	Present	Abundant
Water Velocity (ft./sec) *											
Stream Flow Type	Dry	Stagnant	L	M	H						
SUBSTRATE (%) – pg. 22 (add to 100%)						INSTREAM COVER – pg. 23 (check all that apply)					
Boulder – 10 in. diam.						Undercut Banks			X		
Cobble/Gravel –10 to .08 in. diam.			10%			Overhanging Vegetation			X		
Sand – coarse grain			80%			Deep Pools					
Silt/Detritus/Muck - fine grain/organic matter			10%			Boulders					
Hardpan/Bedrock – solid clay/rock surface						Aquatic Plants					
Artificial – manmade						Logs or Woody Debris			X		
Unknown											
RIVER MORPHOLOGY – pg. 23						STREAM CORRIDOR – pg. 26					
Riffle	Present			Abundant			Riparian Veg. Width ft.(L)	<10	10-30	30-100	>100
Pool	Present			Abundant			Riparian Veg. Width ft.(R)	<10	10-30	30-100	>100
Channel	Natural		Recovering		Maintained		Bank Erosion	0	L	M	H
Designated Drain	?		Y		N		Streamside Land Cover	Bare	Grass	Shrub	Trees
Highest Water Mark (ft.)	?	<1	1-3	3-5	5-10	>10	Stream Canopy %	<25	25-50	>50	
Stream Cross Section						Adjacent Land Uses					
						Wetlands	L	R			
						Shrub or Old Field	L	R			
						Forest	L	R			
						Pasture	L	R			
						Crop Residue	L	R			
						Rowcrop	L	R			
						Residential Lawns, Parks	L	R			
						Impervious Surface	L	R			
						Disturbed Ground	L	R			
						No Vegetation	L	R			

* Optional Data Item

Data Sheet Version 4/27/00

Single Site Watershed Survey Data Sheet (page 2)

Date: **11/12/02**
Downstream Side

Station #: **SB-6A**

POTENTIAL SOURCES (Severity: S – slight; M – moderate; H – high) – pg. 28									
Crop Related Sources	S	M	H	Land Disposal	S	M	H		
Grazing Related Sources	S	M	H	On-site Wastewater Systems	S	M	H		
Intensive Animal Feeding Operations	S	M	H	Silviculture (Forestry NPS)	S	M	H		
Highway/Road/Bridge Maintenance and Runoff (Transportation NPS)	S	M	H	Resource Extraction (Mining NPS)	S	M	H		
Channelization	S	M	H	Recreational/Tourism Activities (general)	S	M	H		
Dredging	S	M	H	Golf Courses	S	M	H		
Removal of Riparian Vegetation	S	M	H	Marinas/Recr. Boating (water releases)	S	M	H		
Bank and Shoreline Erosion/Modification/Destruction	S	M	H	Marinas/Recr. Boating (bank or shoreline erosion)	S	M	H		
Flow Regulation/ Modification (Hydrology)	S	M	H	Debris in Water	S	M	H		
Upstream Impoundment	S	M	H	Industrial Pt. Source	S	M	H		
<u>Construction:</u> Highway/Road /Bridge/ Culvert	S	M	H	Municipal Pt. Source	S	M	H		
<u>Construction:</u> Land Development	S	M	H	Natural Sources	S	M	H		
Urban Runoff (Residential/ Urban NPS)	S	M	H	Source(s) Unknown	S	M	H		

SITE SUMMARY INFORMATION – pg. 33			
SURVEY DIRECTION	N/A	U/ S	D/S
SITE SIMILARITY	?	Y	N
OVERALL SITE RANKING	L	M	H
SITE FOLLOW-UP RANK	L	M	H

COMMENTS:

Single Site Watershed Survey Data Sheet

Date: **11/12/02** Time: **13:12**
 Water body Name: **Cold Creek** County: **Benzie** Station #: **SB-6D**
 Location: **South Branch** Township: **Benzonia** Sec **T** R **¼** **¼**
 Investigator: **Paul Murphy & Abby Mahan** Lat: **44°36.804'N** Long: **086°04.327'W**
 Coordinate Determination Method (check the one that applies):
 GPS ___ GPS w/ DBR ___ Digital mapping software ___ Topographic map ___ Other (____)
 Map Scale (if known _____) **Downstream Side**

PHYSICAL HABITAT											
BACKGROUND INFORMATION - pg. 18						PHYSICAL APPEARANCE - pg. 20 (Check all that apply)					
Event Conditions noted at site	None		Light		Moderate		Heavy		Aquatic Plants	Present	Abundant
	= 1		2		=3		Unknown		Floating Algae	Present	Abundant
Days since Rain	7.55		9.95		7.78				Filamentous Algae	Present	Abundant
Water Temp./D.O./pH *	Clear		Gray	Brown	Black	Green			Bacterial Sheen/Slimes	Present	Abundant
Water Color	Stream		Lake	Impound	Wetland				Turbidity	Present	Abundant
	Stream		Lake	Impound	Wetland				Oil Sheen	Present	Abundant
Stream Width (ft.)	<10	10-25		25-50		>50		Foam	Present	Abundant	
Avg. Stream Depth (ft.)	<1	1-3		>3		Unknown		Trash	Present	Abundant	
Water Velocity (ft./sec) *	Dry		Stagnant	L	M	H					
Stream Flow Type											
SUBSTRATE (%) – pg. 22 (add to 100%)						INSTREAM COVER – pg. 23 (check all that apply)					
Boulder – 10 in. diam.						Undercut Banks			X		
Cobble/Gravel –10 to .08 in. diam.			10%			Overhanging Vegetation			X		
Sand – coarse grain			70%			Deep Pools					
Silt/Detritus/Muck - fine grain/organic matter			20%			Boulders					
Hardpan/Bedrock – solid clay/rock surface						Aquatic Plants					
Artificial – manmade						Logs or Woody Debris			X		
Unknown											
RIVER MORPHOLOGY – pg. 23						STREAM CORRIDOR – pg. 26					
Riffle	Present			Abundant			Riparian Veg. Width ft.(L)	<10	10-30	30-100	>100
Pool	Present			Abundant			Riparian Veg. Width ft.(R)	<10	10-30	30-100	>100
Channel	Natural		Recovering		Maintained		Bank Erosion	0	L	M	H
Designated Drain	?		Y		N		Streamside Land Cover	Bare	Grass	Shrub	Trees
Highest Water Mark (ft.)	?	<1	1-3	3-5	5-10	>10	Stream Canopy %	<25	25-50		>50
Stream Cross Section						Adjacent Land Uses					
						Wetlands	L	R			
						Shrub or Old Field	L	R			
						Forest	L	R			
						Pasture	L	R			
						Crop Residue	L	R			
						Rowcrop	L	R			
						Residential Lawns, Parks	L	R			
						Impervious Surface	L	R			
						Disturbed Ground	L	R			
						No Vegetation	L	R			

* Optional Data Item

Data Sheet Version 4/27/00

Single Site Watershed Survey Data Sheet (page 2)

Date: **11/12/02**
Downstream Side

Station #: **SB-6D**

POTENTIAL SOURCES (Severity: S – slight; M – moderate; H – high) – pg. 28									
Crop Related Sources	S	M	H	Land Disposal	S	M	H		
Grazing Related Sources	S	M	H	On-site Wastewater Systems	S	M	H		
Intensive Animal Feeding Operations	S	M	H	Silviculture (Forestry NPS)	S	M	H		
Highway/Road/Bridge Maintenance and Runoff (Transportation NPS)	S	M	H	Resource Extraction (Mining NPS)	S	M	H		
Channelization	S	M	H	Recreational/Tourism Activities (general)	S	M	H		
Dredging	S	M	H	Golf Courses	S	M	H		
Removal of Riparian Vegetation	S	M	H	Marinas/Recr. Boating (water releases)	S	M	H		
Bank and Shoreline Erosion/Modification/Destruction	S	M	H	Marinas/Recr. Boating (bank or shoreline erosion)	S	M	H		
Flow Regulation/ Modification (Hydrology)	S	M	H	Debris in Water	S	M	H		
Upstream Impoundment	S	M	H	Industrial Pt. Source	S	M	H		
Construction: Highway/Road /Bridge/Culvert	S	M	H	Municipal Pt. Source	S	M	H		
Construction: Land Development	S	M	H	Natural Sources	S	M	H		
Urban Runoff (Residential/ Urban NPS)	S	M	H	Source(s) Unknown	S	M	H		

SITE SUMMARY INFORMATION – pg. 33			
SURVEY DIRECTION	N/A	U/ S	D/S
SITE SIMILARITY	?	Y	N
OVERALL SITE RANKING	L	M	H
SITE FOLLOW-UP RANK	L	M	H

COMMENTS:

Single Site Watershed Survey Data Sheet

Date: **11/11/02** Time: **13:14**

Waterbody Name: **Cold Creek** County: **Benzie** Station #: **Shields Dr. SB-6E**

Location: **South Branch** Township: **Benzonia** Sec **T** R **¼** **¼**

Investigator: **Paul Murphy & Abby Mahan** Lat: **44°37.545'N** Long: **086°05.305'W**

Coordinate Determination Method (check the one that applies):

GPS GPS w/ DBR Digital mapping software Topographic map Other (____)

Map Scale (if known _____)

Upstream Side

PHYSICAL HABITAT												
BACKGROUND INFORMATION - pg. 18						PHYSICAL APPEARANCE - pg. 20 (Check all that apply)						
Event Conditions noted at site	None		Light		Moderate		Heavy		Aquatic Plants	Present	Abundant	
	= 1		2		=3		Unknown		Floating Algae	Present	Abundant	
Days since Rain									Filamentous Algae	Present	Abundant	
Water Temp./D.O./pH *	7.24		10.68		7.87				Bacterial Sheen/Slimes	Present	Abundant	
Water Color	Clear	Gray	Brown	Black	Green				Turbidity	Present	Abundant	
	Stream	Lake	Impound	Wetland						Oil Sheen	Present	Abundant
Stream Width (ft.)	<10	10-25	25-50	>50						Foam	Present	Abundant
Avg. Stream Depth (ft.)	<1	1-3	>3	Unknown						Trash	Present	Abundant
Water Velocity (ft./sec) *												
Stream Flow Type	Dry	Stagnant	L	M	H							
SUBSTRATE (%) – pg. 22 (add to 100%)						INSTREAM COVER – pg. 23 (check all that apply)						
Boulder – 10 in. diam.						Undercut Banks			X			
Cobble/Gravel –10 to .08 in. diam.			10%			Overhanging Vegetation			X			
Sand – coarse grain			85%			Deep Pools						
Silt/Detritus/Muck - fine grain/organic matter			5%			Boulders						
Hardpan/Bedrock – solid clay/rock surface						Aquatic Plants			X			
Artificial – manmade						Logs or Woody Debris			X			
Unknown												
RIVER MORPHOLOGY – pg. 23						STREAM CORRIDOR – pg. 26						
Riffle	Present		Abundant				Riparian Veg. Width ft.(L)	<10	10-30	30-100	>100	
Pool	Present		Abundant				Riparian Veg. Width ft.(R)	<10	10-30	30-100	>100	
Channel	Natural	Recovering		Maintained		Bank Erosion	0	L	M	H		
Designated Drain	?	Y		N		Streamside Land Cover	Bare	Grass	Shrub	Trees		
Highest Water Mark (ft.)	?	<1	1-3	3-5	5-10	>10	Stream Canopy %	<25	25-50	>50		
Stream Cross Section						Adjacent Land Uses						
						Wetlands	L	R				
						Shrub or Old Field	L	R				
						Forest	L	R				
						Pasture	L	R				
						Crop Residue	L	R				
						Rowcrop	L	R				
						Residential Lawns, Parks	L	R				
						Impervious Surface	L	R				
Disturbed Ground	L	R										
No Vegetation	L	R										

* Optional Data Item

Data Sheet Version 4/27/00

Single Site Watershed Survey Data Sheet (page 2)

Date: **11/11/02**
Upstream Side/Downstream Side

Station #: **SB-6E**

POTENTIAL SOURCES (Severity: S – slight; M – moderate; H – high) – pg. 28									
Crop Related Sources Grazing Related Sources Intensive Animal Feeding Operations Highway/Road/Bridge Maintenance and Runoff (Transportation NPS) Channelization Dredging Removal of Riparian Vegetation Bank and Shoreline Erosion/Modification/Destruction Flow Regulation/ Modification (Hydrology) Upstream Impoundment <u>Construction:</u> Highway/Road/Bridge/Culvert <u>Construction:</u> Land Development Urban Runoff (Residential/ Urban NPS)	S	M	H	Land Disposal	S	M	H		
	S	M	H	On-site Wastewater Systems	S	M	H		
	S	M	H	Silviculture (Forestry NPS)	S	M	H		
	S	M	H	Resource Extraction (Mining NPS)	S	M	H		
	S	M	H	Recreational/Tourism Activities (general)	S	M	H		
	S	M	H	Golf Courses	S	M	H		
	S	M	H	Marinas/Recr. Boating (water releases)	S	M	H		
	S	M	H	Marinas/Recr. Boating (bank or shoreline erosion)	S	M	H		
	S	M	H	Debris in Water	S	M	H		
	S	M	H	Industrial Pt. Source	S	M	H		
	S	M	H	Municipal Pt. Source	S	M	H		
	S	M	H	Natural Sources	S	M	H		
	S	M	H	Source(s) Unknown	S	M	H		

SITE SUMMARY INFORMATION – pg. 33			
SURVEY DIRECTION	N/A	U/S	D/S
SITE SIMILARITY	?	Y	N
OVERALL SITE RANKING	L	M	H
SITE FOLLOW-UP RANK	L	M	H

COMMENTS:

Table C2. Group and Total Stream Quality Scores.

BRANCH	SMPLNO.	PLOT	DATE	Time	GROUP 1	GROUP 2	GROUP 3	TSQS
		SYMBOL			SCORE	SCORE	SCORE	
CC	1	1	11/12/02		15.60	6.2	4.0	25.8
CC	1	1	04/28/03		15.60	9.2	3.0	27.8
NB	9A	9A	04/30/02		10.60	9.2	3.1	22.9
NB	9A	9A	11/11/02		5.00	3.2	2.2	10.4
NB	9B	9B	04/30/02		5.00	6.2	4.2	15.4
NB	9B	9B	11/11/02		5.00	3.2	2.3	10.3
NB	9B	9B	04/28/03		5.00	6.2	3.0	14.2
NB	9D	9D	04/28/03		10.60	9.2	4.2	24.0
NB	10A	10A	04/30/02		5.00	6.2	3.1	14.3
NB	10A	10A	11/11/02		5.00	3.2	3.1	11.3
NB	10B	10B	04/30/02		0.00	3.0	2.0	5.0
NB	10B	10B	11/11/02		5.00	3.0	2.1	10.1
MB	7	7	04/30/02		20.00	12.2	4.1	36.3
MB	7	7	11/11/02		5.00	6.2	4.4	15.6
SB	6	6	11/11/02		15.30	6.4	4.0	28.7
SB	6	6	04/28/03		15.90	6.2	3.1	25.2
SB	6A	6A	11/12/02		15.30	6.2	2.1	23.6
SB	6B	6B	11/12/02		15.90	6.4	2.0	24.3
SB	6D	6D	11/12/02		15.90	6.4	0.0	22.1
SB	6E	6E	11/11/02		20.00	9.2	3.3	32.5

Instream Survey Data Sheet

Station #:

Date:

Average Water Depth (ft.):

Is the substrate covered with excessive silt? Yes No
 Substrate Embeddedness: 0-25% 25-50% > 50%

Benthic Macroinvertebrates

Describe the types of habitats and substrates from which invertebrates were collected:

Use letter codes (R = 1-10, C = 11 or more) to record the approximate numbers of organisms in each taxa found in the stream reach.

Group 1 Sensitive	Group 2 Somewhat-Sensitive	Group 3 Tolerant
_____ Beetle adults (Coleoptera)	_____ Beetle larvae (Coleoptera)	_____ Aquatic worms (Oligochaeta)
_____ Caddisfly larvae (Trichoptera)	_____ Clams (Pelecypoda)	_____ Leeches (Hirudina)
_____ Hellgrammites (Megaloptera)	_____ Crane fly larvae (Diptera)	_____ Midge larvae (Diptera)
_____ Mayfly nymphs (Ephemeroptera)	_____ Crayfish (Decapoda)	_____ Pouch snails (Gastropoda)
_____ Gilled Snails (Gastropoda)	_____ Damselfly nymphs (Odonata)	_____ Sowbugs (Isopoda)
_____ Stonefly nymphs (Plecoptera)	_____ Dragonfly nymphs (Odonata)	_____ True Bugs (Hemiptera)
_____ Water penny (Coleoptera)	_____ Scuds (Amphipoda)	_____ Other Diptera
_____ Blackfly larvae (Diptera)	_____ Alderfly larvae (Megaloptera)	

Group 1	Group 2	Group 3
_____ # of R's * 5.0 = _____	_____ # of R's * 3.0 = _____	_____ # of R's * 1.1 = _____
_____ # of C's * 5.3 = _____	_____ # of C's * 3.2 = _____	_____ # of C's * 1.0 = _____
Group 1 Total = _____	Group 2 Total = _____	Group 3 Total = _____

Total Stream Quality Score (sum of totals for Groups 1-3) = _____

_____ Excellent (>48) _____ Good (34-48) _____ Fair (19-33) _____ Poor (<19)

During the sampling and evaluation, did you observe any fish or wildlife? Yes No

If yes, please describe (if possible):

(Data Sheet Version 4/27/00)

Instream Survey Data Sheet

Station #: **Cold Creek Adventure Sports**

CC-1

Date: **11/12/02**

Average Water Depth (ft.):

Is the substrate covered with excessive silt? Yes No
 Substrate Embeddedness: 0-25% 25-50% > 50%

Benthic Macroinvertebrates

Describe the types of habitats and substrates from which invertebrates were collected:

Sand, Gravel, and Cobble bottom. Planarians were present (Saved in Bottle).

Use letter codes (R = 1-10, C = 11 or more) to record the approximate numbers of organisms in each taxa found in the stream reach.

Group 1 Sensitive	Group 2 Somewhat-Sensitive	Group 3 Tolerant
_____ Beetle adults (Coleoptera)	_____ Beetle larvae (Coleoptera)	___ C _____ Aquatic worms (Oligochaeta)
___ C _____ Caddisfly larvae (Trichoptera)	_____ Clams (Pelecypoda)	_____ Leeches (Hirudina)
_____ Hellgrammites (Megaloptera)	___ R _____ Crane fly larvae (Diptera)	___ C _____ Midge larvae (Diptera)
___ R _____ Mayfly nymphs (Ephemeroptera)	_____ Crayfish (Decapoda)	___ C _____ Pouch snails (Gastropoda)
_____ Gilled Snails (Gastropoda)	_____ Damselfly nymphs (Odonata)	___ C _____ Sowbugs (Isopoda)
___ C _____ Stonefly nymphs (Plecoptera)	_____ Dragonfly nymphs (Odonata)	_____ True Bugs (Hemiptera)
_____ Water penny (Coleoptera)	___ C _____ Scuds (Amphipoda)	_____ Other Diptera
_____ Blackfly larvae (Diptera)	_____ Alderfly larvae (Megaloptera)	

Group 1	Group 2	Group 3
___ 1 # of R's * 5.0 = <u>5.0</u>	___ 1 # of R's * 3.0 = <u>3.0</u>	___ 0 # of R's * 1.1 = <u>0.0</u>
___ 2 # of C's * 5.3 = <u>10.6</u>	___ 1 # of C's * 3.2 = <u>3.2</u>	___ 4 # of C's * 1.0 = <u>4.0</u>
Group 1 Total = <u>15.6</u>	Group 2 Total = <u>6.2</u>	Group 3 Total = <u>4.0</u>

Total Stream Quality Score (sum of totals for Groups 1-3) = **25.8**

_____ Excellent (>48) _____ Good (34-48) **"X"** Fair (19-33) _____ Poor (<19)

During the sampling and evaluation, did you observe any fish or wildlife? Yes No

If yes, please describe (if possible):

(Data Sheet Version 4/27/00)

Instream Survey Data Sheet

Station #: **Cold Creek Adventure Sports**

CC-1

Date: **04/28/03**

Average Water Depth (ft.):

Is the substrate covered with excessive silt? Yes No
 Substrate Embeddedness: 0-25% 25-50% > 50%

Benthic Macroinvertebrates

Describe the types of habitats and substrates from which invertebrates were collected:

Sand, Gravel, and Cobble bottom. Planarians were present (Saved in Bottle).

Use letter codes (R = 1-10, C = 11 or more) to record the approximate numbers of organisms in each taxa found in the stream reach.

Group 1 Sensitive	Group 2 Somewhat-Sensitive	Group 3 Tolerant
_____ Beetle adults (Coleoptera)	___ R ___ Beetle larvae (Coleoptera)	___ C ___ Aquatic worms (Oligochaeta)
___ C ___ Caddisfly larvae (Trichoptera)	_____ Clams (Pelecypoda)	_____ Leeches (Hirudina)
_____ Hellgrammites (Megaloptera)	___ R ___ Crane fly larvae (Diptera)	___ C ___ Midge larvae (Diptera)
___ R ___ Mayfly nymphs (Ephemeroptera)	_____ Crayfish (Decapoda)	_____ Pouch snails (Gastropoda)
_____ Gilled Snails (Gastropoda)	_____ Damselfly nymphs (Odonata)	___ C ___ Sowbugs (Isopoda)
___ C ___ Stonefly nymphs (Plecoptera)	_____ Dragonfly nymphs (Odonata)	_____ True Bugs (Hemiptera)
_____ Water penny (Coleoptera)	___ C ___ Scuds (Amphipoda)	_____ Other Diptera
_____ Blackfly larvae (Diptera)	_____ Alderfly larvae (Megaloptera)	

Group 1	Group 2	Group 3
___ 1 ___ # of R's * 5.0 = 5.0	___ 2 ___ # of R's * 3.0 = 6.0	___ 0 ___ # of R's * 1.1 = 0.0
___ 2 ___ # of C's * 5.3 = 10.6	___ 1 ___ # of C's * 3.2 = 3.2	___ 3 ___ # of C's * 1.0 = 3.0
Group 1 Total = 15.6	Group 2 Total = 9.2	Group 3 Total = 3.0

Total Stream Quality Score (sum of totals for Groups 1-3) = **27.8**

_____ Excellent (>48) _____ Good (34-48) **"X"** Fair (19-33) _____ Poor (<19)

During the sampling and evaluation, did you observe any fish or wildlife? Yes No

If yes, please describe (if possible):

(Data Sheet Version 4/27/00)

Instream Survey Data Sheet

Station #: **Cold Creek (North Branch) MNB-UB NB-9A**

Date: **04/30/02**

Average Water Depth (ft.): **<1**

Is the substrate covered with excessive silt? () Yes **(X)** No
 Substrate Embeddedness: **(X)** 0-25% () 25-50% () > 50%

Benthic Macroinvertebrates

Describe the types of habitats and substrates from which invertebrates were collected:

Riffles, gravel and submerged wood.

Use letter codes (R = 1-10, C = 11 or more) to record the approximate numbers of organisms in each taxa found in the stream reach.

Group 1
Sensitive

Group 2
Somewhat-Sensitive

Group 3
Tolerant

_____ Beetle adults (Coleoptera) <u> C </u> Caddisfly larvae (Trichoptera) _____ Hellgrammites (Megaloptera) _____ Mayfly nymphs (Ephemeroptera) _____ Gilled Snails (Gastropoda) <u> C </u> Stonefly nymphs (Plecoptera) _____ Water penny (Coleoptera) _____ Blackfly larvae (Diptera)	_____ Beetle larvae (Coleoptera) _____ Clams (Pelecypoda) <u> R </u> Cranefly larvae (Diptera) _____ Crayfish (Decapoda) _____ Damselfly nymphs (Odonata) <u> R </u> Dragonfly nymphs (Odonata) <u> C </u> Scuds (Amphipoda) _____ Alderfly larvae (Megaloptera)	_____ Aquatic worms (Oligochaeta) _____ Leeches (Hirudina) _____ Midge larvae (Diptera) <u> R </u> Pouch snails (Gastropoda) <u> C </u> Sowbugs (Isopoda) <u> C </u> True Bugs (Hemiptera) _____ Other Diptera
---	--	---

Group 1

Group 2

Group 3

 0 # of R's * 5.0 = **0.0**
 2 # of C's * 5.3 = **10.6**

 2 # of R's * 3.0 = **6.0**
 1 # of C's * 3.2 = **3.2**

 1 # of R's * 1.1 = **1.1**
 2 # of C's * 1.0 = **2.0**

Group 1 Total = **10.6**

Group 2 Total = **9.2**

Group 3 Total = **3.1**

Total Stream Quality Score (sum of totals for Groups 1-3) = **22.9**

_____ Excellent (>48)

_____ Good (34-48)

 "X" Fair (19-33)

_____ Poor (<19)

During the sampling and evaluation, did you observe any fish or wildlife? () Yes **(X)** No

If yes, please describe (if possible):

(Data Sheet Version 4/27/00)

Instream Survey Data Sheet

Station #: **Cold Creek (North Branch) MNB-UB NB-9A**

Date: **11/11/02**

Average Water Depth (ft.):

Is the substrate covered with excessive silt? () Yes (X) No
 Substrate Embeddedness: (X) 0-25% () 25-50% () > 50%

Benthic Macroinvertebrates

Describe the types of habitats and substrates from which invertebrates were collected:

Use letter codes (R = 1-10, C = 11 or more) to record the approximate numbers of organisms in each taxa found in the stream reach.

Group 1 Sensitive	Group 2 Somewhat-Sensitive	Group 3 Tolerant
<u> R </u> Beetle adults (Coleoptera)	_____ Beetle larvae (Coleoptera)	<u> R </u> Aquatic worms (Oligochaeta)
_____ Caddisfly larvae (Trichoptera)	_____ Clams (Pelecypoda)	_____ Leeches (Hirudina)
_____ Hellgrammites (Megaloptera)	_____ Crane fly larvae (Diptera)	_____ Midge larvae (Diptera)
_____ Mayfly nymphs (Ephemeroptera)	_____ Crayfish (Decapoda)	_____ Pouch snails (Gastropoda)
_____ Gilled Snails (Gastropoda)	_____ Damselfly nymphs (Odonata)	<u> R </u> Sowbugs (Isopoda)
_____ Stonefly nymphs (Plecoptera)	_____ Dragonfly nymphs (Odonata)	_____ True Bugs (Hemiptera)
_____ Water penny (Coleoptera)	_____ Scuds (Amphipoda)	_____ Other Diptera
_____ Blackfly larvae (Diptera)	<u> C </u> Alderfly larvae (Megaloptera)	

Group 1	Group 2	Group 3
<u> 1 </u> # of R's * 5.0 = <u> 5.0 </u>	<u> 0 </u> # of R's * 3.0 = <u> 0.0 </u>	<u> 2 </u> # of R's * 1.1 = <u> 2.2 </u>
<u> 0 </u> # of C's * 5.3 = <u> 0.0 </u>	<u> 1 </u> # of C's * 3.2 = <u> 3.2 </u>	<u> 0 </u> # of C's * 1.0 = <u> 0.0 </u>
Group 1 Total = <u> 5.0 </u>	Group 2 Total = <u> 3.2 </u>	Group 3 Total = <u> 2.2 </u>

Total Stream Quality Score (sum of totals for Groups 1-3) = **10.4**

_____ Excellent (>48) _____ Good (34-48) _____ Fair (19-33) X Poor (<19)

During the sampling and evaluation, did you observe any fish or wildlife? () Yes (X) No

If yes, please describe (if possible):

(Data Sheet Version 4/27/00)

Instream Survey Data Sheet

Station #: Cold Creek (North Branch) MNB-LB NB-9B

Date: 04/30/02

Average Water Depth (ft.):

Is the substrate covered with excessive silt? Yes No
 Substrate Embeddedness: 0-25% 25-50% > 50%

Benthic Macroinvertebrates

Describe the types of habitats and substrates from which invertebrates were collected:

Use letter codes (R = 1-10, C = 11 or more) to record the approximate numbers of organisms in each taxa found in the stream reach.

Group 1 Sensitive	Group 2 Somewhat-Sensitive	Group 3 Tolerant
_____ Beetle adults (Coleoptera)	_____ Beetle larvae (Coleoptera)	__ R _____ Aquatic worms (Oligochaeta)
__ R _____ Caddisfly larvae (Trichoptera)	__ R _____ Clams (Pelecypoda)	_____ Leeches (Hirudina)
_____ Hellgrammites (Megaloptera)	_____ Cranefly larvae (Diptera)	__ R _____ Midge larvae (Diptera)
_____ Mayfly nymphs (Ephemeroptera)	_____ Crayfish (Decapoda)	_____ Pouch snails (Gastropoda)
_____ Gilled Snails (Gastropoda)	_____ Damselfly nymphs (Odonata)	__ C _____ Sowbugs (Isopoda)
_____ Stonefly nymphs (Plecoptera)	_____ Dragonfly nymphs (Odonata)	__ C _____ True Bugs (Hemiptera)
_____ Water penny (Coleoptera)	__ C _____ Scuds (Amphipoda)	_____ Other Diptera
_____ Blackfly larvae (Diptera)	_____ Alderfly larvae (Megaloptera)	

Group 1	Group 2	Group 3
__ 1 _____ # of R's * 5.0 = 5.0	__ 1 _____ # of R's * 3.0 = 3.0	__ 2 _____ # of R's * 1.1 = 2.2
__ 0 _____ # of C's * 5.3 = 0.0	__ 1 _____ # of C's * 3.2 = 3.2	__ 2 _____ # of C's * 1.0 = 2.0
Group 1 Total = 5.0	Group 2 Total = 6.2	Group 3 Total = 4.2

Total Stream Quality Score (sum of totals for Groups 1-3) = **15.4**

_____ Excellent (>48) _____ Good (34-48) _____ Fair (19-33) **"X"** _____ Poor (<19)

During the sampling and evaluation, did you observe any fish or wildlife? Yes No

If yes, please describe (if possible):

(Data Sheet Version 4/27/00)

Instream Survey Data Sheet

Station #: Cold Creek (North Branch) MNB-LB NB-9B

Date: 11/11/02

Average Water Depth (ft.):

Is the substrate covered with excessive silt? Yes No
 Substrate Embeddedness: 0-25% 25-50% > 50%

Benthic Macroinvertebrates

Describe the types of habitats and substrates from which invertebrates were collected:

Use letter codes (R = 1-10, C = 11 or more) to record the approximate numbers of organisms in each taxa found in the stream reach.

Group 1 Sensitive	Group 2 Somewhat-Sensitive	Group 3 Tolerant
_____ Beetle adults (Coleoptera)	_____ Beetle larvae (Coleoptera)	_____ Aquatic worms (Oligochaeta)
R _____ Caddisfly larvae (Trichoptera)	_____ Clams (Pelecypoda)	_____ Leeches (Hirudina)
_____ Hellgrammites (Megaloptera)	_____ Crane fly larvae (Diptera)	_____ Midge larvae (Diptera)
_____ Mayfly nymphs (Ephemeroptera)	_____ Crayfish (Decapoda)	R _____ Pouch snails (Gastropoda)
_____ Gilled Snails (Gastropoda)	_____ Damselfly nymphs (Odonata)	C _____ Sowbugs (Isopoda)
_____ Stonefly nymphs (Plecoptera)	_____ Dragonfly nymphs (Odonata)	_____ True Bugs (Hemiptera)
_____ Water penny (Coleoptera)	C _____ Scuds (Amphipoda)	_____ Other Diptera
_____ Blackfly larvae (Diptera)	_____ Alderfly larvae (Megaloptera)	

Group 1	Group 2	Group 3
<u> 1 </u> # of R's * 5.0 = <u> 5.0 </u>	<u> 0 </u> # of R's * 3.0 = <u> 0.0 </u>	<u> 1 </u> # of R's * 1.1 = <u> 1.1 </u>
<u> 0 </u> # of C's * 5.3 = <u> 0.0 </u>	<u> 1 </u> # of C's * 3.2 = <u> 3.2 </u>	<u> 1 </u> # of C's * 1.0 = <u> 1.0 </u>
Group 1 Total = <u> 5.0 </u>	Group 2 Total = <u> 3.2 </u>	Group 3 Total = <u> 2.1 </u>

Total Stream Quality Score (sum of totals for Groups 1-3) = **10.3**

_____ Excellent (>48) _____ Good (34-48) _____ Fair (19-33) **"X"** Poor (<19)

During the sampling and evaluation, did you observe any fish or wildlife? Yes No

If yes, please describe (if possible):

(Data Sheet Version 4/27/00)

Instream Survey Data Sheet

Station #: Cold Creek (North Branch) MNB-MB NB-9D

Date: 04/28/03

Average Water Depth (ft.):

Is the substrate covered with excessive silt? () Yes (X) No
 Substrate Embeddedness: () 0-25% () 25-50% () > 50%

Benthic Macroinvertebrates

Describe the types of habitats and substrates from which invertebrates were collected:

Use letter codes (R = 1-10, C = 11 or more) to record the approximate numbers of organisms in each taxa found in the stream reach.

Group 1 Sensitive	Group 2 Somewhat-Sensitive	Group 3 Tolerant
_____ Beetle adults (Coleoptera)	__ R _____ Beetle larvae (Coleoptera)	_____ Aquatic worms (Oligochaeta)
__ C _____ Caddisfly larvae (Trichoptera)	_____ Clams (Pelecypoda)	_____ Leeches (Hirudina)
_____ Hellgrammites (Megaloptera)	__ R _____ Crane-fly larvae (Diptera)	_____ Midge larvae (Diptera)
_____ Mayfly nymphs (Ephemeroptera)	_____ Crayfish (Decapoda)	_____ Pouch snails (Gastropoda)
_____ Gilled Snails (Gastropoda)	_____ Damselfly nymphs (Odonata)	__ R _____ Sowbugs (Isopoda)
__ C _____ Stonefly nymphs (Plecoptera)	_____ Dragonfly nymphs (Odonata)	__ R _____ True Bugs (Hemiptera)
_____ Water penny (Coleoptera)	__ C _____ Scuds (Amphipoda)	_____ Other Diptera
_____ Blackfly larvae (Diptera)	_____ Alderfly larvae (Megaloptera)	

Group 1	Group 2	Group 3
__ 0 # of R's * 5.0 = <u> 0.0 </u>	__ 2 # of R's * 3.0 = <u> 6.0 </u>	__ 2 # of R's * 1.1 = <u> 2.2 </u>
__ 2 # of C's * 5.3 = <u> 10.6 </u>	__ 1 # of C's * 3.2 = <u> 3.2 </u>	__ 2 # of C's * 1.0 = <u> 2.0 </u>
Group 1 Total = <u> 10.6 </u>	Group 2 Total = <u> 9.2 </u>	Group 3 Total = <u> 4.2 </u>

Total Stream Quality Score (sum of totals for Groups 1-3) = **24.0**

_____ Excellent (>48) _____ Good (34-48) **"X"** Fair (19-33) _____ Poor (<19)

During the sampling and evaluation, did you observe any fish or wildlife? () Yes (X) No

If yes, please describe (if possible):

(Data Sheet Version 4/27/00)

Instream Survey Data Sheet

Station #: Cold Creek (North Branch)

NB-10A Date: 04/30/02

Average Water Depth (ft.):

Is the substrate covered with excessive silt? Yes No
 Substrate Embeddedness: 0-25% 25-50% > 50%

Benthic Macroinvertebrates

Describe the types of habitats and substrates from which invertebrates were collected:

Use letter codes (R = 1-10, C = 11 or more) to record the approximate numbers of organisms in each taxa found in the stream reach.

Group 1 Sensitive	Group 2 Somewhat-Sensitive	Group 3 Tolerant
___ Beetle adults (Coleoptera)	___ Beetle larvae (Coleoptera)	__ C Aquatic worms (Oligochaeta)
___ Caddisfly larvae (Trichoptera)	__ C Clams (Pelecypoda)	___ Leeches (Hirudina)
___ Hellgrammites (Megaloptera)	___ Crane fly larvae (Diptera)	__ C Midge larvae (Diptera)
___ Mayfly nymphs (Ephemeroptera)	___ Crayfish (Decapoda)	___ Pouch snails (Gastropoda)
__ R Gilled Snails (Gastropoda)	___ Damselfly nymphs (Odonata)	__ R Sowbugs (Isopoda)
___ Stonefly nymphs (Plecoptera)	___ Dragonfly nymphs (Odonata)	___ True Bugs (Hemiptera)
___ Water penny (Coleoptera)	__ R Scuds (Amphipoda)	___ Other Diptera
___ Blackfly larvae (Diptera)	___ Alderfly larvae (Megaloptera)	

Group 1	Group 2	Group 3
__ 1 # of R's * 5.0 = 5.0	__ 1 # of R's * 3.0 = 3.0	__ 1 # of R's * 1.1 = 1.1
__ 0 # of C's * 5.3 = 0.0	__ 1 # of C's * 3.2 = 3.2	__ 2 # of C's * 1.0 = 2.0
Group 1 Total = 5.0	Group 2 Total = 6.2	Group 3 Total = 3.1

Total Stream Quality Score (sum of totals for Groups 1-3) = **14.3**

___ Excellent (>48) ___ Good (34-48) ___ Fair (19-33) **"X"** Poor (<19)

During the sampling and evaluation, did you observe any fish or wildlife? Yes No

If yes, please describe (if possible): **Minnows**

(Data Sheet Version 4/27/00)

Instream Survey Data Sheet

Station #: Cold Creek (North Branch)

NB-10A Date: 11/11/02

Average Water Depth (ft.):

Is the substrate covered with excessive silt? Yes () No
 Substrate Embeddedness: () 0-25% () 25-50% () > 50%

Benthic Macroinvertebrates

Describe the types of habitats and substrates from which invertebrates were collected:

Use letter codes (R = 1-10, C = 11 or more) to record the approximate numbers of organisms in each taxa found in the stream reach.

Group 1 Sensitive	Group 2 Somewhat-Sensitive	Group 3 Tolerant
___ Beetle adults (Coleoptera)	___ Beetle larvae (Coleoptera)	___ C Aquatic worms (Oligochaeta)
___ Caddisfly larvae (Trichoptera)	___ C Clams (Pelecypoda)	___ Leeches (Hirudina)
___ Hellgrammites (Megaloptera)	___ Crane fly larvae (Diptera)	___ R Midge larvae (Diptera)
___ Mayfly nymphs (Ephemeroptera)	___ Crayfish (Decapoda)	___ Pouch snails (Gastropoda)
___ R Gilled Snails (Gastropoda)	___ Damselfly nymphs (Odonata)	___ C Sowbugs (Isopoda)
___ Stonefly nymphs (Plecoptera)	___ Dragonfly nymphs (Odonata)	___ True Bugs (Hemiptera)
___ Water penny (Coleoptera)	___ Scuds (Amphipoda)	___ Other Diptera
___ Blackfly larvae (Diptera)	___ Alderfly larvae (Megaloptera)	

Group 1 ___ 1 # of R's * 5.0 = 5.0 ___ 0 # of C's * 5.3 = 0.0 Group 1 Total = 5.0	Group 2 ___ # of R's * 3.0 = ___ ___ 1 # of C's * 3.2 = 3.2 Group 2 Total = 3.2	Group 3 ___ 1 # of R's * 1.1 = 1.1 ___ 2 # of C's * 1.0 = 2.0 Group 3 Total = 3.1
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Total Stream Quality Score (sum of totals for Groups 1-3) = **11.3**

___ Excellent (>48) ___ Good (34-48) ___ Fair (19-33) ___ **"X"** Poor (<19)

During the sampling and evaluation, did you observe any fish or wildlife? Yes () No

If yes, please describe (if possible): **Minnows.**

(Data Sheet Version/27/00)

Instream Survey Data Sheet

Station #: **Cold Creek (North Branch)**

NB-10B Date: **04/30/02**

Average Water Depth (ft.):

Is the substrate covered with excessive silt? Yes No
 Substrate Embeddedness: 0-25% 25-50% > 50%

Benthic Macroinvertebrates

Describe the types of habitats and substrates from which invertebrates were collected:

Muck and silt in the whole ditch. Spirogyra was present as well as one snapping turtle.

Use letter codes (R = 1-10, C = 11 or more) to record the approximate numbers of organisms in each taxa found in the stream reach.

Group 1 Sensitive	Group 2 Somewhat-Sensitive	Group 3 Tolerant
_____ Beetle adults (Coleoptera)	___ R ___ Beetle larvae (Coleoptera)	___ C ___ Aquatic worms (Oligochaeta)
_____ Caddisfly larvae (Trichoptera)	_____ Clams (Pelecypoda)	_____ Leeches (Hirudina)
_____ Hellgrammites (Megaloptera)	_____ Crane fly larvae (Diptera)	___ C ___ Midge larvae (Diptera)
_____ Mayfly nymphs (Ephemeroptera)	_____ Crayfish (Decapoda)	_____ Pouch snails (Gastropoda)
_____ Gilled Snails (Gastropoda)	_____ Damselfly nymphs (Odonata)	_____ Sowbugs (Isopoda)
_____ Stonefly nymphs (Plecoptera)	_____ Dragonfly nymphs (Odonata)	_____ True Bugs (Hemiptera)
_____ Water penny (Coleoptera)	_____ Scuds (Amphipoda)	_____ Other Diptera
_____ Blackfly larvae (Diptera)	_____ Alderfly larvae (Megaloptera)	

Group 1	Group 2	Group 3
_____ # of R's * 5.0 = <u>0.0</u>	___ 1 ___ # of R's * 3.0 = <u>3.0</u>	___ 1 ___ # of R's * 1.1 = <u>0.0</u>
_____ # of C's * 5.3 = <u>0.0</u>	___ 0 ___ # of C's * 3.2 = <u>0.0</u>	___ 2 ___ # of C's * 1.0 = <u>2.0</u>
Group 1 Total = <u>0.0</u>	Group 2 Total = <u>3.0</u>	Group 3 Total = <u>2.0</u>

Total Stream Quality Score (sum of totals for Groups 1-3) = 5.0

_____ Excellent (>48) _____ Good (34-48) _____ Fair (19-33) ___ **"X"** ___ Poor (<19)

During the sampling and evaluation, did you observe any fish or wildlife? Yes No

If yes, please describe (if possible): **One snapping turtle was sitting buried in the muck along the shore.** (Data Sheet Version 4/27/00)

Instream Survey Data Sheet

Station #: Cold Creek (North Branch)

NB-10B Date: 11/11/02

Average Water Depth (ft.):

Is the substrate covered with excessive silt? Yes No
 Substrate Embeddedness: 0-25% 25-50% > 50%

Benthic Macroinvertebrates

Describe the types of habitats and substrates from which invertebrates were collected:

Muck and silt in the whole ditch.

Use letter codes (R = 1-10, C = 11 or more) to record the approximate numbers of organisms in each taxa found in the stream reach.

Group 1 Sensitive	Group 2 Somewhat-Sensitive	Group 3 Tolerant
_____ Beetle adults (Coleoptera)	_____ Beetle larvae (Coleoptera)	___ C ___ Aquatic worms (Oligochaeta)
_____ Caddisfly larvae (Trichoptera)	___ R ___ Clams (Pelecypoda)	_____ Leeches (Hirudina)
_____ Hellgrammites (Megaloptera)	_____ Crane-fly larvae (Diptera)	_____ Midge larvae (Diptera)
_____ Mayfly nymphs (Ephemeroptera)	_____ Crayfish (Decapoda)	_____ Pouch snails (Gastropoda)
___ R ___ Gilled Snails (Gastropoda)	_____ Damselfly nymphs (Odonata)	___ R ___ Sowbugs (Isopoda)
_____ Stonefly nymphs (Plecoptera)	_____ Dragonfly nymphs (Odonata)	_____ True Bugs (Hemiptera)
_____ Water penny (Coleoptera)	_____ Scuds (Amphipoda)	_____ Other Diptera
_____ Blackfly larvae (Diptera)	_____ Alderfly larvae (Megaloptera)	

Group 1	Group 2	Group 3
___ 1 ___ # of R's * 5.0 = 5.0	___ 1 ___ # of R's * 3.0 = 3.0	___ 1 ___ # of R's * 1.1 = 1.1
___ 0 ___ # of C's * 5.3 = 0.0	___ 0 ___ # of C's * 3.2 = 0.0	___ 1 ___ # of C's * 1.0 = 1.0
Group 1 Total = 5.0	Group 2 Total = 3.0	Group 3 Total = 2.1

Total Stream Quality Score (sum of totals for Groups 1-3) = **10.1**

_____ Excellent (>48) _____ Good (34-48) _____ Fair (19-33) ___ **"X"** ___ Poor (<19)

During the sampling and evaluation, did you observe any fish or wildlife? Yes No

If yes, please describe (if possible):

(Data Sheet Version 4/27/00)

Instream Survey Data Sheet

Station #: **Cold Creek (North Branch) MB-NG MB-7**

Date: **04/30/02**

Average Water Depth (ft.):

Is the substrate covered with excessive silt? Yes No
 Substrate Embeddedness: 0-25% 25-50% > 50%

Benthic Macroinvertebrates

Describe the types of habitats and substrates from which invertebrates were collected:

Use letter codes (R = 1-10, C = 11 or more) to record the approximate numbers of organisms in each taxa found in the stream reach.

Group 1 Sensitive	Group 2 Somewhat-Sensitive	Group 3 Tolerant
_____ Beetle adults (Coleoptera)	_____ Beetle larvae (Coleoptera)	___ R ___ Aquatic worms (Oligochaeta)
___ R ___ Caddisfly larvae (Trichoptera)	___ R ___ Clams (Pelecypoda)	_____ Leeches (Hirudina)
_____ Hellgrammites (Megaloptera)	___ R ___ Crane fly larvae (Diptera)	___ C ___ Midge larvae (Diptera)
___ R ___ Mayfly nymphs (Ephemeroptera)	_____ Crayfish (Decapoda)	_____ Pouch snails (Gastropoda)
_____ Gilled Snails (Gastropoda)	_____ Damselfly nymphs (Odonata)	___ C ___ Sowbugs (Isopoda)
___ R ___ Stonefly nymphs (Plecoptera)	___ R ___ Dragonfly nymphs (Odonata)	___ C ___ True Bugs (Hemiptera)
_____ Water penny (Coleoptera)	___ C ___ Scuds (Amphipoda)	_____ Other Diptera
___ R ___ Blackfly larvae (Diptera)	_____ Alderfly larvae (Megaloptera)	
<hr/>		
Group 1	Group 2	Group 3
___ 4 ___ # of R's * 5.0 = 20.0	___ 3 ___ # of R's * 3.0 = 9.0	___ 1 ___ # of R's * 1.1 = 1.1
___ 0 ___ # of C's * 5.3 = 0.0	___ 1 ___ # of C's * 3.2 = 3.2	___ 3 ___ # of C's * 1.0 = 3.0
Group 1 Total = 20.0	Group 2 Total = 12.2	Group 3 Total = 4.1
Total Stream Quality Score (sum of totals for Groups 1-3) = 36.3		
_____ Excellent (>48)	___ "X" ___ Good (34-48)	_____ Fair (19-33)
		_____ Poor (<19)

During the sampling and evaluation, did you observe any fish or wildlife? Yes No

If yes, please describe (if possible):

(Data Sheet Version 4/27/00)

Instream Survey Data Sheet

Station #: **Cold Creek (North Branch) MB-NG 7 MB-7**

Date: **11/11/02**

Average Water Depth (ft.):

Is the substrate covered with excessive silt? Yes No
 Substrate Embeddedness: 0-25% 25-50% > 50%

Benthic Macroinvertebrates

Describe the types of habitats and substrates from which invertebrates were collected:

Use letter codes (R = 1-10, C = 11 or more) to record the approximate numbers of organisms in each taxa found in the stream reach.

Group 1 Sensitive	Group 2 Somewhat-Sensitive	Group 3 Tolerant
_____ Beetle adults (Coleoptera)	_____ Beetle larvae (Coleoptera)	__ R ___ Aquatic worms (Oligochaeta)
_____ Caddisfly larvae (Trichoptera)	__ R ___ Clams (Pelecypoda)	_____ Leeches (Hirudina)
_____ Hellgrammites (Megaloptera)	_____ Crane-fly larvae (Diptera)	_____ Midge larvae (Diptera)
_____ Mayfly nymphs (Ephemeroptera)	_____ Crayfish (Decapoda)	__ R ___ Pouch snails (Gastropoda)
__ R ___ Gilled Snails (Gastropoda)	_____ Damselfly nymphs (Odonata)	__ C ___ Sowbugs (Isopoda)
_____ Stonefly nymphs (Plecoptera)	_____ Dragonfly nymphs (Odonata)	_____ True Bugs (Hemiptera)
_____ Water penny (Coleoptera)	__ C ___ Scuds (Amphipoda)	__ R ___ Other Diptera
_____ Blackfly larvae (Diptera)	_____ Alderfly larvae (Megaloptera)	

Group 1	Group 2	Group 3
<u> 1 </u> # of R's * 5.0 = <u> 5.0 </u>	<u> 1 </u> # of R's * 3.0 = <u> 3.0 </u>	<u> 3 </u> # of R's * 1.1 = <u> 3.3 </u>
<u> 0 </u> # of C's * 5.3 = <u> 0.0 </u>	<u> 1 </u> # of C's * 3.2 = <u> 3.2 </u>	<u> 1 </u> # of C's * 1.0 = <u> 1.1 </u>
Group 1 Total = <u> 5.0 </u>	Group 2 Total = <u> 6.2 </u>	Group 3 Total = <u> 4.4 </u>

Total Stream Quality Score (sum of totals for Groups 1-3) = 15.6

_____ Excellent (>48) _____ Good (34-48) _____ Fair (19-33) **X** Poor (<19)

During the sampling and evaluation, did you observe any fish or wildlife? Yes No

If yes, please describe (if possible):

(Data Sheet Version 4/27/00)

Instream Survey Data Sheet

Station #: **Cold Creek (South Branch)**

SB-6

Date: **11/11/02**

Average Water Depth (ft.):

Is the substrate covered with excessive silt? () Yes (X) No
 Substrate Embeddedness: () 0-25% () 25-50% () > 50%

Benthic Macroinvertebrates

Describe the types of habitats and substrates from which invertebrates were collected:

Gravel & sand; riffles, cobbles, runs, undercut banks; overhanging vegetation, submerged wood; banks bordered with watercress; Tribonema.

Use letter codes (R = 1-10, C = 11 or more) to record the approximate numbers of organisms in each taxa found in the stream reach.

Group 1
Sensitive

Group 2
Somewhat-Sensitive

Group 3
Tolerant

_____ Beetle adults (Coleoptera) <u> R </u> Caddisfly larvae (Trichoptera) _____ Hellgrammites (Megaloptera) _____ Mayfly nymphs (Ephemeroptera) <u> R </u> Gilled Snails (Gastropoda) <u> C </u> Stonefly nymphs (Plecoptera) _____ Water penny (Coleoptera) _____ Blackfly larvae (Diptera)	_____ Beetle larvae (Coleoptera) <u> C </u> Clams (Pelecypoda) <u> R </u> Crane fly larvae (Diptera) _____ Crayfish (Decapoda) _____ Damselfly nymphs (Odonata) _____ Dragonfly nymphs (Odonata) <u> C </u> Scuds (Amphipoda) _____ Alderfly larvae (Megaloptera)	_____ <u> C </u> Aquatic worms (Oligochaeta) _____ Leeches (Hirudina) <u> C </u> Midge larvae (Diptera) <u> C </u> Pouch snails (Gastropoda) <u> C </u> Sowbugs (Isopoda) _____ True Bugs (Hemiptera) _____ Other Diptera
--	--	---

Group 1

Group 2

Group 3

 2 # of R's * 5.0 = 10.0
 1 # of C's * 5.3 = 5.3

 1 # of R's * 3.0 = 3.0
 1 # of C's * 3.2 = 3.2

 0 # of R's * 1.1 = 0.0
 4 # of C's * 1.0 = 4.0

Group 1 Total = 15.3

Group 2 Total = 6.4

Group 3 Total = 4.0

Total Stream Quality Score (sum of totals for Groups 1-3) = 28.7

_____ Excellent (>48) _____ Good (34-48) X Fair (19-33) _____ Poor (<19)

During the sampling and evaluation, did you observe any fish or wildlife? () Yes (X) No

If yes, please describe (if possible):

(Data Sheet Version 4/27/00)

Instream Survey Data Sheet

Station #: **Cold Creek (South Branch)**

SB-6

Date: **04/28/03**

Average Water Depth (ft.):

Is the substrate covered with excessive silt? () Yes (X) No
 Substrate Embeddedness: () 0-25% () 25-50% () > 50%

Benthic Macroinvertebrates

Describe the types of habitats and substrates from which invertebrates were collected:

Gravel & sand; riffles, cobbles, runs, undercut banks; overhanging vegetation, submerged wood; banks bordered with watercress; Tribonema.

Use letter codes (R = 1-10, C = 11 or more) to record the approximate numbers of organisms in each taxa found in the stream reach.

Group 1 Sensitive	Group 2 Somewhat-Sensitive	Group 3 Tolerant
_____ Beetle adults (Coleoptera)	_____ Beetle larvae (Coleoptera)	__ C _____ Aquatic worms (Oligochaeta)
__ C _____ Caddisfly larvae (Trichoptera)	_____ Clams (Pelecypoda)	_____ Leeches (Hirudina)
_____ Hellgrammites (Megaloptera)	_____ Crane-fly larvae (Diptera)	__ R _____ Midge larvae (Diptera)
__ C _____ Mayfly nymphs (Ephemeroptera)	_____ Crayfish (Decapoda)	_____ Pouch snails (Gastropoda)
_____ Gilled Snails (Gastropoda)	_____ Damselfly nymphs (Odonata)	__ C _____ Sowbugs (Isopoda)
__ C _____ Stonefly nymphs (Plecoptera)	__ R _____ Dragonfly nymphs (Odonata)	_____ True Bugs (Hemiptera)
_____ Water penny (Coleoptera)	__ C _____ Scuds (Amphipoda)	_____ Other Diptera
_____ Blackfly larvae (Diptera)	_____ Alderfly larvae (Megaloptera)	

Group 1	Group 2	Group 3
<u> 0 </u> # of R's * 5.0 = <u> 0.0 </u> <u> 3 </u> # of C's * 5.3 = <u> 15.9 </u>	<u> 1 </u> # of R's * 3.0 = <u> 3.0 </u> <u> 1 </u> # of C's * 3.2 = <u> 3.2 </u>	<u> 1 </u> # of R's * 1.1 = <u> 1.1 </u> <u> 2 </u> # of C's * 1.0 = <u> 2.0 </u>
Group 1 Total = <u> 15.9 </u>	Group 2 Total = <u> 6.2 </u>	Group 3 Total = <u> 3.1 </u>

Total Stream Quality Score (sum of totals for Groups 1-3) = 25.2

_____ Excellent (>48) _____ Good (34-48) X Fair (19-33) _____ Poor (<19)

During the sampling and evaluation, did you observe any fish or wildlife? (X) Yes () No

If yes, please describe (if possible): **One 12-inch Brook Trout.**

(Data Sheet Version 4/27/00)

Instream Survey Data Sheet

Station #: **Cold Creek (South Branch)**

SB-6A

Date: **11/12/02**

Average Water Depth (ft.):

Is the substrate covered with excessive silt? () Yes (X) No
 Substrate Embeddedness: () 0-25% () 25-50% () > 50%

Benthic Macroinvertebrates

Describe the types of habitats and substrates from which invertebrates were collected:

Sandy bottom.

Use letter codes (R = 1-10, C = 11 or more) to record the approximate numbers of organisms in each taxa found in the stream reach.

Group 1 Sensitive	Group 2 Somewhat-Sensitive	Group 3 Tolerant
_____ Beetle adults (Coleoptera)	_____ Beetle larvae (Coleoptera)	___ R ___ Aquatic worms (Oligochaeta)
___ R ___ Caddisfly larvae (Trichoptera)	_____ Clams (Pelecypoda)	_____ Leeches (Hirudina)
_____ Hellgrammites (Megaloptera)	___ R ___ Cranefly larvae (Diptera)	___ C ___ Midge larvae (Diptera)
___ R ___ Mayfly nymphs (Ephemeroptera)	_____ Crayfish (Decapoda)	_____ Pouch snails (Gastropoda)
_____ Gilled Snails (Gastropoda)	_____ Damselfly nymphs (Odonata)	_____ Sowbugs (Isopoda)
___ C ___ Stonefly nymphs (Plecoptera)	_____ Dragonfly nymphs (Odonata)	_____ True Bugs (Hemiptera)
_____ Water penny (Coleoptera)	___ C ___ Scuds (Amphipoda)	_____ Other Diptera
_____ Blackfly larvae (Diptera)	_____ Alderfly larvae (Megaloptera)	

Group 1	Group 2	Group 3
___ 2 ___ # of R's * 5.0 = 10.0	___ 1 ___ # of R's * 3.0 = 3.0	___ 1 ___ # of R's * 1.1 = 1.1
___ 1 ___ # of C's * 5.3 = 5.3	___ 1 ___ # of C's * 3.2 = 3.2	___ 1 ___ # of C's * 1.0 = 1.0
Group 1 Total = 15.3	Group 2 Total = 6.2	Group 3 Total = 2.1

Total Stream Quality Score (sum of totals for Groups 1-3) = **23.6**

_____ Excellent (>48) _____ Good (34-48) **"X"** Fair (19-33) _____ Poor (<19)

During the sampling and evaluation, did you observe any fish or wildlife? () Yes (X) No

If yes, please describe (if possible):

(Data Sheet Version 4/27/00)

Instream Survey Data Sheet

Station #: **Cold Creek (South Branch)**

SB-6B

Date: **11/12/02**

Average Water Depth (ft.):

Is the substrate covered with excessive silt? Yes No
 Substrate Embeddedness: 0-25% 25-50% > 50%

Benthic Macroinvertebrates

Describe the types of habitats and substrates from which invertebrates were collected:

Sandy bottom.

Use letter codes (R = 1-10, C = 11 or more) to record the approximate numbers of organisms in each taxa found in the stream reach.

Group 1 Sensitive	Group 2 Somewhat-Sensitive	Group 3 Tolerant
_____ Beetle adults (Coleoptera)	_____ Beetle larvae (Coleoptera)	___ C _____ Aquatic worms (Oligochaeta)
___ C _____ Caddisfly larvae (Trichoptera)	_____ Clams (Pelecypoda)	_____ Leeches (Hirudina)
_____ Hellgrammites (Megaloptera)	___ C _____ Crane-fly larvae (Diptera)	___ C _____ Midge larvae (Diptera)
___ C _____ Mayfly nymphs (Ephemeroptera)	_____ Crayfish (Decapoda)	_____ Pouch snails (Gastropoda)
_____ Gilled Snails (Gastropoda)	_____ Damselfly nymphs (Odonata)	_____ Sowbugs (Isopoda)
___ C _____ Stonefly nymphs (Plecoptera)	_____ Dragonfly nymphs (Odonata)	_____ True Bugs (Hemiptera)
_____ Water penny (Coleoptera)	___ C _____ Scuds (Amphipoda)	_____ Other Diptera
_____ Blackfly larvae (Diptera)	_____ Alderfly larvae (Megaloptera)	

Group 1	Group 2	Group 3
___ 0 # of R's * 5.0 = <u>___ 0.0 ___</u>	___ 0 # of R's * 3.0 = <u>___ 0.0 ___</u>	_____ # of R's * 1.1 = <u>___ 0.0 ___</u>
___ 3 # of C's * 5.3 = <u>___ 15.9 ___</u>	___ 2 # of C's * 3.2 = <u>___ 6.4 ___</u>	___ 2 # of C's * 1.0 = <u>___ 2.0 ___</u>
Group 1 Total = <u>___ 15.9 ___</u>	Group 2 Total = <u>___ 6.4 ___</u>	Group 3 Total = <u>___ 2.0 ___</u>

Total Stream Quality Score (sum of totals for Groups 1-3) = ___ **24.3** ___

_____ Excellent (>48) _____ Good (34-48) ___ **"X"** ___ Fair (19-33) _____ Poor (<19)

During the sampling and evaluation, did you observe any fish or wildlife? Yes No

If yes, please describe (if possible):

(Data Sheet Version 4/27/00)

Instream Survey Data Sheet

Station #: **Cold Creek (South Branch)**

SB-6D

Date: **11/12/02**

Average Water Depth (ft.):

Is the substrate covered with excessive silt? () Yes (X) No
 Substrate Embeddedness: () 0-25% () 25-50% () > 50%

Benthic Macroinvertebrates

Describe the types of habitats and substrates from which invertebrates were collected:

Sandy bottom.

Use letter codes (R = 1-10, C = 11 or more) to record the approximate numbers of organisms in each taxa found in the stream reach.

Group 1 Sensitive	Group 2 Somewhat-Sensitive	Group 3 Tolerant
_____ Beetle adults (Coleoptera)	_____ Beetle larvae (Coleoptera)	_____ Aquatic worms (Oligochaeta)
C _____ Caddisfly larvae (Trichoptera)	_____ Clams (Pelecypoda)	_____ Leeches (Hirudina)
_____ Hellgrammites (Megaloptera)	R _____ Crane fly larvae (Diptera)	_____ Midge larvae (Diptera)
C _____ Mayfly nymphs (Ephemeroptera)	_____ Crayfish (Decapoda)	_____ Pouch snails (Gastropoda)
_____ Gilled Snails (Gastropoda)	_____ Damselfly nymphs (Odonata)	_____ Sowbugs (Isopoda)
C _____ Stonefly nymphs (Plecoptera)	_____ Dragonfly nymphs (Odonata)	_____ True Bugs (Hemiptera)
_____ Water penny (Coleoptera)	C _____ Scuds (Amphipoda)	_____ Other Diptera
_____ Blackfly larvae (Diptera)	_____ Alderfly larvae (Megaloptera)	

Group 1	Group 2	Group 3
<u> 0 </u> # of R's * 5.0 = <u> 0.0 </u>	<u> 1 </u> # of R's * 3.0 = <u> 3.0 </u>	<u> 0 </u> # of R's * 1.1 = <u> 0.0 </u>
<u> 3 </u> # of C's * 5.3 = <u> 15.9 </u>	<u> 2 </u> # of C's * 3.2 = <u> 6.4 </u>	<u> 0 </u> # of C's * 1.0 = <u> 0.0 </u>
Group 1 Total = <u> 15.9 </u>	Group 2 Total = <u> 6.4 </u>	Group 3 Total = <u> 0.0 </u>

Total Stream Quality Score (sum of totals for Groups 1-3) = 22.1

_____ Excellent (>48) _____ Good (34-48) **"X"** _____ Fair (19-33) _____ Poor (<19)

During the sampling and evaluation, did you observe any fish or wildlife? () Yes (X) No

If yes, please describe (if possible):

(Data Sheet Version 4/27/00)

Instream Survey Data Sheet

Station #: **Cold Creek (South Branch)**

SB-6E

Date: **11/11/02**

Average Water Depth (ft.):

Is the substrate covered with excessive silt? () Yes () No
 Substrate Embeddedness: () 0-25% () 25-50% () > 50%

Benthic Macroinvertebrates

Describe the types of habitats and substrates from which invertebrates were collected:

Sandy and gravel bottom.

Use letter codes (R = 1-10, C = 11 or more) to record the approximate numbers of organisms in each taxa found in the stream reach.

Group 1 Sensitive	Group 2 Somewhat-Sensitive	Group 3 Tolerant
<u> R </u> Beetle adults (Coleoptera)	<u> </u> Beetle larvae (Coleoptera)	<u> R </u> Aquatic worms (Oligochaeta)
<u> R </u> Caddisfly larvae (Trichoptera)	<u> R </u> Clams (Pelecypoda)	<u> </u> Leeches (Hirudina)
<u> </u> Hellgrammites (Megaloptera)	<u> R </u> Cranefly larvae (Diptera)	<u> R </u> Midge larvae (Diptera)
<u> R </u> Mayfly nymphs (Ephemeroptera)	<u> </u> Crayfish (Decapoda)	<u> </u> Pouch snails (Gastropoda)
<u> </u> Gilled Snails (Gastropoda)	<u> </u> Damselfly nymphs (Odonata)	<u> R </u> Sowbugs (Isopoda)
<u> R </u> Stonefly nymphs (Plecoptera)	<u> </u> Dragonfly nymphs (Odonata)	<u> </u> True Bugs (Hemiptera)
<u> </u> Water penny (Coleoptera)	<u> C </u> Scuds (Amphipoda)	<u> </u> Other Diptera
<u> </u> Blackfly larvae (Diptera)	<u> </u> Alderfly larvae (Megaloptera)	

Group 1	Group 2	Group 3
<u> 4 </u> # of R's * 5.0 = <u>20.0</u>	<u> 2 </u> # of R's * 3.0 = <u>6.0</u>	<u> 1 </u> # of R's * 1.1 = <u>3.3</u>
<u> 0 </u> # of C's * 5.3 = <u>0.0</u>	<u> 1 </u> # of C's * 3.2 = <u>3.2</u>	<u> 0 </u> # of C's * 1.0 = <u>0.0</u>
Group 1 Total = <u>20.0</u>	Group 2 Total = <u>9.2</u>	Group 3 Total = <u>3.3</u>

Total Stream Quality Score (sum of totals for Groups 1-3) = 32.5

 Excellent (>48) Good (34-48) X Fair (19-33) Poor (<19)

During the sampling and evaluation, did you observe any fish or wildlife? () Yes (X) No

If yes, please describe (if possible):

(Data Sheet Version 4/27/00)

Appendix D. Chemical Monitoring.

Table D-1. Hydrolab[®] Multiprobe Analyses.

BRANCH	SMPL NO.	PLOT SYMBOL	DATE	Time	Temp	pH	SpCond	Salin	DO	Turb	Redox	Depth
				HHMMSS	Deg C		mS/cm	ppt	mg/l	NTU	mV	feet
CC	1	1	11/12/02	134057	6.08	7.59	0.433	0.2	10.73	0.0	397	0.6
CC	1	1	04/28/03	95251	9.69	8.07	0.474	0.2	10.90	0.0	386	0.8
NB	8	8	04/30/02	131353	10.57	7.84	0.845	0.4	9.65	0.0	420	0.1
NB	8	8	11/11/02	172202	6.96	7.67	0.389	0.2	10.23	0.0	429	0.2
NB	8A	8A	04/30/02	123757	8.68	7.87	0.305	0.1	10.38	0.0	457	0.4
NB	8A	8A	11/11/02	171736	7.95	7.63	0.705	0.4	9.58	0.0	445	0.0
NB	8D	8D	04/30/02	125930	9.65	8.00	0.449	0.2	10.05	0.0	418	0.5
NB	9A	9A	04/30/02	133851	10.20	7.97	0.425	0.2	10.39	0.0	456	0.3
NB	9A	9A	11/11/02	153441	7.45	7.66	0.465	0.2	10.48	24.7	436	0.2
NB	9B	9B	04/30/02	150105	11.92	7.73	0.374	0.2	9.79	15.5	416	0.5
NB	9B	9B	11/11/02	161547	7.30	7.67	0.448	0.2	10.10	21.1	475	0.5
NB	9B	9B	04/28/03	92412	10.06	8.06	0.452	0.2	10.61	0.0	360	0.4
NB	9D	9D	04/30/02	143050	11.28	8.05	0.421	0.2	10.27	0.0	480	0.5
NB	9D	9D	11/11/02	155549	7.36	7.87	0.465	0.2	10.56	0.0	464	0.2
NB	9D	9D	04/28/03	85751	9.66	8.21	0.483	0.2	11.06	0.0	423	0.3
NB	10A	10A	04/30/02	153251	14.73	8.01	0.596	0.3	11.37	6.3	420	0.5
NB	10A	10A	11/11/02	163319	7.31	7.73	0.608	0.3	10.57	16.3	481	0.3
NB	10B	10B	04/30/02	155036	13.37	7.93	0.632	0.3	10.71	0.0	416	0.3
NB	10B	10B	11/11/02	164817	7.36	8.15	0.619	0.3	10.50	15.1	451	0.6
MB	7	7	04/30/02	162648	12.78	8.02	0.439	0.2	10.24	44.5	455	0.3
MB	7	7	11/11/02	173127	7.24	7.82	0.441	0.2	10.59	87.6	435	0.1
MB	7C	7C	04/30/02	164556	15.50	7.73	0.441	0.2	10.51	5.7	428	0.3
MB	7C	7C	11/11/02	140133	5.98	7.59	0.490	0.2	9.05	476.0	378	0.6
SB	6	6	11/12/02	123447	7.12	7.91	0.370	0.2	10.98	7.2	421	0.3
SB	6	6	04/28/03	81233	8.05	7.98	0.397	0.2	11.68	0.7	325	0.2
SB	6A	6A	11/12/02	123041	7.67	7.84	0.379	0.2	11.13	17.9	424	0.3
SB	6B	6B	11/12/02	124524	7.29	7.94	0.351	0.2	10.91	9.0	425	0.2
SB	6D	6D	11/12/02	131212	7.55	7.78	0.367	0.2	9.95	1.5	407	0.2
SB	6E	6E	11/11/02	131410	7.24	7.87	0.389	0.2	10.68	0.0	414	0.6

Table D-2. Phosphorus and Nitrogen Analyses.

BRANCH	SMPLNO.	PLOT SYMBOL	DATE	TDP(ug/L)	TP(ug/L)	TP(ug/g)	TP/TP	NO3(ug/L)	NH4(ug/L)
				WATER	WATER	SEDIMENTS	S/W		
CC	1	1	11/12/02	7.76	18.28	934	51	97.8	5.28
CC	1	1	04/28/03						
NB	8	8	04/30/02		15.17			135.2	
NB	8	8	11/11/02	5.71	11.58	1041	90	155.3	2.2
NB	8A	8A	04/30/02		9.69			52.3	
NB	8A	8A	11/11/02		11.01	1428	130		
NB	8D	8D	04/30/02		16.89	2278	135	101.9	
NB	9A	9A	04/30/02		17.00			89.1	
NB	9A	9A	11/11/02	4.25	11.46	933	81	130.6	2.0
NB	9B	9B	04/30/02		45.22			101.0	
NB	9B	9B	11/11/02	12.27	19.72	1892	96	115.7	2.2
NB	9B	9B	04/28/03	3.06	17.03			1212.9	0.3
NB	9D	9D	04/30/02						
NB	9D	9D	11/11/02	4.46	21.38	727	34	131.8	1.6
NB	9D	9D	04/28/03	1.70	8.73			1099.3	0.0
NB	10A	10A	04/30/02		38.98			51.5	
NB	10A	10A	11/11/02	7.51	14.11	3498	248	59.6	3.1
NB	10B	10B	04/30/02		14.98			64.8	
NB	10B	10B	11/11/02	4.75	10.68	4329	405	73.9	2.0
MB	7	7	04/30/02		17.62			85.8	
MB	7	7	11/11/02	6.25	33.96	994	29	94.3	2.3
MB	7C	7C	04/30/02		86.35			58.2	
MB	7C	7C	11/11/02	19.25	39.56	2289	58	82.2	6.8
SB	6	6	11/12/02	1.98	5.59	447	80	101.9	1.8
SB	6	6	04/28/03	13.00	38.72			1299.9	0.0
SB	6A	6A	11/12/02	3.30	10.18			189.5	3.8
SB	6B	6B	11/12/02	3.00	4.27			80.6	1.9
SB	6D	6D	11/12/02	4.15	5.36			107.5	2.2
SB	6E	6E	11/11/02	3.34	9.23	478	52	100.8	1.2

Table D-3. Analysis of Cold Creek Watershed During Dredging (10/12/00).

Site	Location	TP, ug/L	SRP, ug/L	NO3-N, ug/L	TDS, mg/L	Secchi, ft
South B.	Upstream	9.6	3.1	86	353	
North B.	Upstream	27.1	18.9	113	244	
Sed. Basin	In Basin	129.	2.8	144	332	< 0.5
Main B.	Downstream	13.0	3.4	53	250	
Site	T, C	DO, mg/L	pH	C., mS/cm	Redox, mv	Turb., NTU
South B.	10.00	11.06	8.13	0.383	420	2.8
North B.	11.38	9.5	7.89	0.469	416	1.2
Basin	10.01	0.95	7.20	0.689	425	106
Main B.	10.26	10.84	8.08	0.407	415	<2

Table D-5. Stage-Discharge of Cold Creek

Date	Stage, ft	Flow, cfs	In Flow
5/15/1976	6.95	7.0	1.94591
5/31/1976	6.54	17.6	2.86790
6/19/1976	6.91	6.4	1.85630
7/5/1976	7.00	5.3	1.66203
7/17/1976	7.00	4.5	1.49739
8/1/1976			
8/14/1976	6.91	6.8	1.90954
9/7/1976	6.98	5.2	1.64866
10/2/1976	6.95	5.6	1.72277
10/31/1976	6.74	10.6	2.36085
12/12/1976	6.78	10.0	2.30259
1/15/1977			
2/13/1977	6.88	7.6	2.02815
3/11/1977	6.50	16.8	2.82138
3/21/1977			
3/27/1977	6.48	17.2	2.84491
3/28/1977	6.52	15.6	2.74727
4/6/1977	6.50	16.8	2.82138
4/16/1977	6.83	8.8	2.17475
4/17/1977	6.79	9.8	2.28238
4/22/1977	6.83	8.8	2.17475
4/30/1977	6.91	6.6	1.88707
5/15/1977	6.95	5.6	1.72277
5/29/1977	6.95	5.6	1.72277
7/3/1977	7.00	4.6	1.52606
8/7/1977	6.85	8.0	2.07944
Arith Avg	cfs	9.2	
Count			20
Sum In Flow			48.60701
Geom Avg	cfs	11.4	

Appendix E. Quarterly Progress Reports.

Progress Report for the Period: 4/1/02 - 6/30/02

Progress Report for the Period: 7/1/02 - 9/30/02

Progress Report for the Period: 10/1/02 - 12/31/02

Progress Report for the Period: 01/01/03 - 03/31/03

Progress Report for the Period: 04/01/03 - 06/30/03

Biomonitoring of the Cold Creek Watershed

This project is funded as part of the Volunteer Monitoring, Clean Water Fund, Clean Michigan Initiative, administered by the SWQD Division, MDEQ, and conducted by personnel of the Crystal Lake Watershed Fund, Inc. (CLWF), a 501c3 organization, in Benzie County, MI (www.CLWF.org). This project involves training of personnel of the CLWF to conduct biomonitoring of Cold Creek, the major tributary to Crystal Lake, (Benzie Co., MI) a large oligotrophic lake with exceptional high quality water. The project consists of two parts: (i) a screening evaluation of benthic invertebrate communities and stream habitat, and (ii) additional monitoring of chemical and physical parameters. The system to be assessed consists of the three Wadeable Branches of Cold Creek, and the Cold Creek Sediment Basin, a former USDA RC&D protection measure limiting sediment and nutrient loadings to Crystal Lake.

Progress Report for the Period: 4/1/02 - 6/30/02

What Was Accomplished This Quarter

The training session held on April 9, 2002, was hosted by the Benzie Conservation District in Beulah MI. Nicole Vadales, MDEQ, provided an overview of the Volunteer Monitoring program. Representatives of the CLWF and the Grand Traverse Regional Land Conservancy (GTRLC) in attendance were instructed in the basic terminology and identification of benthic invertebrates for taxonomic and enumeration purposes. Procedures for sampling and data recording were also discussed. A brief field session followed. Techniques and use of equipment were demonstrated. Representative samples from the Main Branch of Cold Creek downstream of the Sediment Basin were collected and evaluated.

The North and Middle Branches of Cold Creek upstream of the Sediment Basin were surveyed for suitable sampling sites by representatives of the CLWF and the GTRLC. The GTRLC is involved in a cooperative manner since much of the lower reaches of the North and Middle Branches of Cold Creek flow through the Trapp Nature Preserve that is under the management of this 501c3 organization.

A dissection scope was made available by the Dow Chemical Company as an in-kind match. This match will allow a portion of the grant funds originally specified for this item to be reallocated for other purposes. A battery-powered, hand-held data logger for the level (and temperature) gage (Troll 4000, In-Situ, Inc.) is under consideration. This device will allow direct data logging without having to take a desktop PC into the field. An inexpensive lighted, low-power magnifier was also obtained from an independent source.

The Quality Assurance Project Plan (QAPP) was submitted, reviewed, modified, and accepted.

What Will Be Accomplished Next Quarter

Several of the preliminary samples will be used for demonstration purposes at the Crystal Lake **"Walkabout"** - Summer 2002. This highly successful educational program is intended to instill and nurture in young people and adults a sense of awareness of their watershed environment through an interactive program of science education involving "hands-on" observational monitoring and environmental exploring. A similar use is anticipated as part of the Fall 2002 event involving 300-400 students from Benzie Central and Frankfort/Elberta School Districts. The South Branch of Cold Creek will be surveyed for suitable sampling sites at a later time. Major sampling and collection activities will be conducted in mid-October 2002 on all three Branches.

Problems Encountered

Available equipment was deemed sufficient for this project. No major problems were encountered.

Respectfully submitted,
Dr. Stacy L. Daniels, Principal Investigator
Mr. Paul Murphy, Coordinator Sampling & testing
Crystal Lake Watershed Fund, Inc.

Biomonitoring of the Cold Creek Watershed

This project is funded as part of the Volunteer Monitoring, Clean Water Fund, Clean Michigan Initiative, administered by the SWQD Division, MDEQ, and conducted by personnel of the Crystal Lake Watershed Fund, Inc. (CLWF), a 501c3 organization, in Benzie County, MI (www.CLWF.org). This project involves training of personnel of the CLWF to conduct biomonitoring of Cold Creek, the major tributary to Crystal Lake, (Benzie Co., MI) a large oligotrophic lake with exceptional high quality water. The project consists of two parts: (i) a screening evaluation of benthic invertebrate communities and stream habitat, and (ii) additional monitoring of chemical and physical parameters. The system to be assessed consists of the three Wadeable Branches of Cold Creek, and the Cold Creek Sediment Basin, a former USDA RC&D protection measure limiting sediment and nutrient loadings to Crystal Lake.

Progress Report for the Period: 7/1/02 - 9/30/02

What Was Accomplished This Quarter

No active biomonitoring other than incidental sampling was conducted during the current quarter. During the last quarter, representatives of the CLWF and the Grand Traverse Regional Land Conservancy (GTRLC) were instructed in the basic terminology and identification of benthic invertebrates for taxonomic and enumeration purposes. Procedures for sampling and data recording were also discussed. Representative samples from the Main Branch of Cold Creek downstream of the Sediment Basin were collected and evaluated.

A small in-house "laboratory" was organized by Paul Murphy in anticipation of more extensive biomonitoring to be conducted during the fourth quarter. The "lab" includes several scopes for sample sorting and identification. A battery-powered, hand-held data logger for the level (and temperature) gage (Troll 4000, In-Situ, Inc.) has been tentatively identified for purchase. This device (estimated cost \$375) will allow direct data logging without having to take a desktop PC into the field.

The Crystal Lake Walkabout is highly successful educational program that is intended to instill and nurture in young people and adults a sense of awareness of their watershed environment through an interactive program of science education involving "hands-on" observational monitoring and environmental exploring. Sampling equipment obtained for the biomonitoring project and a series of type organisms were used for instructional purposes as part of the Crystal Lake Walkabout - Summer 2002. About 50 participants from the general public attended this event on July 27, 2002.

Progress and Financial Reports for the second quarter were submitted.

What Will Be Accomplished Next Quarter

Equipment and samples from the biomonitoring project will also be used as part of the Crystal Lake Walkabout - Fall 2002 event which will involve 160 8th grade students from Benzie Central and Frankfort/Elberta School Districts. The Spring 2003 event will involve a like number of 6th grade students.

Major sampling and collection activities will be conducted in early November 2002 on all three Branches. Samples will be collected for subsequent enumeration and evaluation.

Problems Encountered

Available equipment was deemed sufficient for this project. No major problems were encountered.

Respectfully submitted,
Dr. Stacy L. Daniels, Principal Investigator
Mr. Paul Murphy, Coordinator Sampling & testing
Crystal Lake Watershed Fund, Inc.

Biomonitoring of the Cold Creek Watershed

This project is funded as part of the Volunteer Monitoring, Clean Water Fund, Clean Michigan Initiative, administered by the SWQD Division, MDEQ, and conducted by personnel of the Crystal Lake Watershed Fund, Inc. (CLWF), a 501c3 organization, in Benzie County, MI (www.CLWF.org). This project involves training of personnel of the CLWF to conduct biomonitoring of Cold Creek, the major tributary to Crystal Lake, (Benzie Co., MI) a large oligotrophic lake with exceptional high quality water. The project consists of two parts: (i) a screening evaluation of benthic invertebrate communities and stream habitat, and (ii) additional monitoring of chemical and physical parameters. The system to be assessed consists of the three Wadeable Branches of Cold Creek, and the Cold Creek Sediment Basin, a former USDA RC&D protection measure limiting sediment and nutrient loadings to Crystal Lake.

Progress Report for the Period: 10/1/02 - 12/31/02

What Was Accomplished This Quarter

Significant biomonitoring of all branches of Cold Creek was done during the current quarter. Personnel from the CLWF and the Grand Traverse Regional Land Conservancy (GTRLC), were previously instructed in taxonomic identification and enumeration of benthic invertebrates using standard protocols. Characteristics of stream habitats at all sampling sites were recorded. Benthos samples were collected for subsequent identification and enumeration. A small in-house "laboratory" organized by Paul Murphy was used for extensive sample separation of composite samples of benthic invertebrates by genus and subsequent enumeration of each genus. The "lab" includes several scopes for sample sorting and identification. Chemical sampling included: (a) direct monitoring of stream water for temperature, dissolved oxygen, pH, conductivity, redox, and turbidity using a Hydrolab® H20 multiprobe; and (b) indirect analyses of 15 water samples for nitrogen and phosphorus concentrations and 13 sediment samples for phosphorus and nitrogen concentrations, and solids content.

The Crystal Lake Walkabout is highly successful educational program that is intended to instill and nurture in young people and adults a sense of awareness of their watershed environment through an interactive program of science education involving "hands-on" observational monitoring and environmental exploring. Equipment and type organisms from the biomonitoring project were used for instructional purposes as part of the Crystal Lake Walkabout - Fall 2002 attended by 180 8th grade students from Benzie Central and Frankfort/Elberta School Districts on October 10, 2002.

Progress and Financial Reports for the third quarter were submitted.

What Will Be Accomplished in Next Quarters (Jan-Mar 2003 and Apr-Jun 2003)

Another major sampling and collection activity will be conducted in April-May 2003 on all three Branches. Samples will be collected for subsequent enumeration and evaluation. Evaluation of the benthic inventory and chemical analyses will be done in preparation of the final report. Equipment and samples from the biomonitoring project will also be used as part of the Crystal Lake Walkabout - Spring 2003 event which will involve 160 6th grade students from local schools.

Problems Encountered

No major problems were encountered. Purchase of a battery-powered, hand-held data logger for the level (and temperature) gage (Troll 4000, In-Situ, Inc.) has been proposed pending deployment of the unit. This device (est. cost \$375) will allow direct data logging without having to take a laptop PC into the field. Purchase of a flowmeter has been delayed pending availability of matching funding. It is also proposed to transfer \$541 allocated for travel to cover additional contractual chemical analytical work.

Respectfully submitted,

Dr. Stacy L. Daniels, Principal Investigator
Mr. Paul Murphy, Coordinator Sampling & testing
Crystal Lake Watershed Fund, Inc.

Biomonitoring of the Cold Creek Watershed

This project is funded as part of the Volunteer Monitoring, Clean Water Fund, Clean Michigan Initiative, administered by the SWQD Division, MDEQ, and conducted by personnel of the Crystal Lake Watershed Fund, Inc. (CLWF), a 501c3 organization, in Benzie County, MI (www.CLWF.org). This project involves training of personnel of the CLWF to conduct biomonitoring of Cold Creek, the major tributary to Crystal Lake, (Benzie Co., MI) a large oligotrophic lake with exceptional high quality water. The project consists of two parts: (i) a screening evaluation of benthic invertebrate communities and stream habitat, and (ii) additional monitoring of chemical and physical parameters. The system to be assessed consists of the three Wadeable Branches of Cold Creek, and the Cold Creek Sediment Basin, a former USDA RC&D protection measure limiting sediment and nutrient loadings to Crystal Lake.

Progress Report for the Period: 01/01/03 - 03/31/03

What Was Accomplished This Quarter

Significant biomonitoring of all branches of Cold Creek was done during the 4th quarter of 2002. Personnel from the CLWF and the Grand Traverse Regional Land Conservancy (GTRLC), were previously instructed in taxonomic identification and enumeration of benthic invertebrates using standard protocols. Characteristics of stream habitats at all sampling sites were recorded. Benthos samples were collected for subsequent identification and enumeration. A small in-house "laboratory" organized by Paul Murphy was used for extensive sample separation of composite samples of benthic invertebrates by genus and subsequent enumeration of each genus. The "lab" includes several scopes for sample sorting and identification. Chemical sampling included: (a) direct monitoring of stream water for temperature, dissolved oxygen, pH, conductivity, redox, and turbidity using a Hydrolab® H20 multiprobe; and (b) indirect analyses of 15 water samples for nitrogen and phosphorus concentrations and 13 sediment samples for phosphorus and nitrogen concentrations, and solids content.

Results continued to be tabulated in the current quarter. Evaluation of the benthic inventory is being done in preparation for the final report. Results will also be used in two presentations planned for the next quarter. The Crystal Lake Walkabout is a highly successful educational program that is intended to instill and nurture in young people and adults a sense of awareness of their watershed environment through an interactive program of science education involving "hands-on" observational monitoring and environmental exploring. Equipment and type organisms from the biomonitoring project were used for instructional purposes as part of the Crystal Lake Walkabout - Fall 2002 attended by 180 8th grade students from Benzie Central and Frankfort/Elberta School Districts on October 10, 2002.

Progress and Financial Reports for the fourth quarter 2002 were submitted.

What Will Be Accomplished in Next Quarters (Apr-Jun 2003)

Some limited sampling will be conducted in April-May 2003 to add further perspective to the inventory. A poster session and display defining the procedures and results of the project will be presented at the 42nd Annual Conference of the Michigan Lake & Stream Associations (ML&SA) at Bellaire, MI, on April 25-27, 2003. Equipment and samples from the biomonitoring project will be used as part of the Crystal Lake Walkabout - Spring 2003 event involving 160 6th grade students from local schools.

Problems Encountered

No major problems were encountered. Funds now remaining in supplies and equipment (~\$615) and others anticipated to be remaining in travel (~\$200) are being proposed for reallocation to fully cover contractual services performed by the Michigan Water Resource Center.

Respectfully submitted,

Dr. Stacy L. Daniels, Principal Investigator
Mr. Paul Murphy, Coordinator Sampling & testing
Crystal Lake Watershed Fund, Inc.

Biomonitoring of the Cold Creek Watershed

This project is funded as part of the Volunteer Monitoring, Clean Water Fund, Clean Michigan Initiative, administered by the SWQD Division, MDEQ, and conducted by personnel of the Crystal Lake Watershed Fund, Inc. (CLWF), a 501c3 organization, in Benzie County, MI (www.CLWF.org). This project involves training of personnel of the CLWF to conduct biomonitoring of Cold Creek, the major tributary to Crystal Lake, (Benzie Co., MI) a large oligotrophic lake with exceptional high quality water. The project consists of two parts: (i) a screening evaluation of benthic invertebrate communities and stream habitat, and (ii) additional monitoring of chemical and physical parameters. The system to be assessed consists of the three Wadeable Branches of Cold Creek, and the Cold Creek Sediment Basin, a former USDA RC&D protection measure limiting sediment and nutrient loadings to Crystal Lake.

Progress Report for the Period: 04/01/03 - 06/31/03

What Was Accomplished This Quarter

Significant biomonitoring of all branches of Cold Creek was completed during the 4th quarter of 2002. Some limited sampling also was conducted in April-May 2003 to add further perspective to the inventory. Personnel from the CLWF and the Grand Traverse Regional Land Conservancy (GTRLC) were previously instructed in taxonomic identification and enumeration of benthic invertebrates using standard protocols. Characteristics of stream habitats at all sampling locations were recorded. Benthos samples were collected for subsequent identification and enumeration. A small in-house "laboratory" organized by Paul Murphy was used for extensive sample separation of composite samples of benthic invertebrates by genus and subsequent enumeration of each genus. The "lab" includes several scopes for sample sorting and identification. Chemical sampling included: (a) direct monitoring of stream water for temperature, dissolved oxygen, pH, conductivity, redox, and turbidity using a Hydrolab® H20 multiprobe; and (b) indirect analyses of 15 water samples for nitrogen and phosphorus concentrations and 13 sediment samples for phosphorus and nitrogen concentrations, and solids content.

Results continued to be tabulated in the current quarter. Evaluation of the benthic inventory has been done in preparation for the final report. Results were used in two presentations. The Crystal Lake Walkabout is a highly successful educational program that is intended to instill and nurture in young people and adults a sense of awareness of their watershed environment through an interactive program of science education involving "hands-on" observational monitoring and environmental exploring. Equipment and type organisms from the biomonitoring project were used for instructional purposes as part of the Crystal Lake Walkabout - Spring 2003 attended by 160 6th grade students from Benzie Central and Frankfort/Elberta School Districts on May 28, 2003. A poster session and display defining the procedures and results of the project was presented at the 42nd Annual Conference of the Michigan Lake & Stream Associations (ML&SA) at Bellaire, MI, on April 25-27, 2003.

Progress and Financial Reports for the first quarter 2003 were submitted.

What Will Be Accomplished in Next Quarter

The final report is in preparation. It will include a supplement containing historical data collected on the Cold Creek Watershed during past studies.

Problems Encountered

No major problems were encountered. Funds now remaining in supplies and equipment (~\$615) and others anticipated to be remaining in travel (~\$200) have been proposed for reallocation to fully cover contractual services preformed by the Michigan Water Resource Center.

Respectfully submitted,

Dr. Stacy L. Daniels, Principal Investigator
Mr. Paul Murphy, Coordinator Sampling & testing
Crystal Lake Watershed Fund, Inc.

Appendix F.

Biomonitoring of the Cold Creek Watershed

Quality Assurance Project Plan (QAPP)

July 2002

Supported By:

Michigan Department of Environmental Quality
Crystal Lake Watershed Fund, Inc.

Principal Investigator: _____
Dr. Stacy L. Daniels, Crystal Lake Watershed Fund, Inc.

Sampling Coordinator: _____
Paul Murphy, Crystal Lake Watershed Fund, Inc.

DEQ Project Manager: _____
Gary Kohlhepp, Michigan DEQ

Table of Contents

Project Organization
Problem Definition and Background
Project Description
Data Quality Objectives For Measurement Data
Training Requirements
Documentation and Records
Project Design and Sampling Process
Sampling Methods Requirements
Sample Handling and Custody Requirements
Analytical Methods Requirements
Quality Control Requirements
Equipment Testing, Inspection, and Maintenance Requirements
Instrument Calibration and Frequency
Inspection/Acceptance Requirements For Supplies
Data Acquisition Requirements
Data Management
Assessment and Response Actions
Reports
Data Review, Validation, and Verification Requirements
Validation and Verification Methods
Reconciliation With Data Quality Objectives

Project Organization

The “Biomonitoring of the Cold Creek Watershed” project is a part of an integrated watershed management plan for the Crystal Lake watershed in Benzie County, MI. The monitoring will be conducted by the Crystal Lake Watershed Fund, Inc., a nonprofit 501c3 organization. Dr. Stacy L. Daniels is the Principal Investigator. Mr. Paul Murphy is the Coordinator for Sampling & Testing. Volunteers from the local community will also participate in the Project on an as needed basis. Several of the volunteers have previous experience in biology, microbiology, limnology, and water resource management. Students and classes from local schools have been involved through the Crystal Lake “Walkabout” program. Data users include the Crystal Lake Watershed Fund, Inc. and the Michigan Department of Environmental Quality (MDEQ).

Problem Definition and Background

The goals of this project are conduct biological monitoring of Cold Creek, the major tributary to Crystal Lake, (Benzie Co., MI). Fieldwork will include: (i) assessing benthic invertebrate communities and stream habitats, and (ii) monitoring of water quality parameters. The project encompasses three wadeable branches of Cold Creek, and the Cold Creek Sediment Basin, a former USDA RC&D protection measure limiting sediment and nutrient loadings to Crystal Lake. This Project will complement existing program infrastructure for nonpoint source pollution activities. Potential future projects will address flow control, soil erosion prevention, sediment/nutrient removal, water quality improvement, and public education.

The objective of this project is to assist in determining the feasibilities of five management options for improved operation of the Cold Creek Sediment Basin to reduce sediment and nutrient loadings from nonpoint sources to Crystal Lake. Pending funding under the Great Lakes Basin Program, a parallel feasibility study will be conducted of five management options: (1) Flow Bypass, (2) Flow Diversion, (3) Basin Modification, (4) Chemical Treatment, and (5) Source Reduction. These options are more dynamic than the current passive management system, and all are impacted by stream flows, nutrient and sediment levels, and biomonitoring. More detailed engineering assessments and cost estimations will be considered at the completion of these two projects. Definition of engineered structures and operational modes requires coordination among local governments, identification of funding, and permitting, all of which bear directly on evaluation of stream biota and habitat.

For further background on the Crystal Lake Watershed and the Cold Creek subwatersheds, see the project proposal.

Project Description

This project will involve sampling of representative stream segments within the Cold Creek subwatersheds: North, Middle, and South Branches; and the Cold Creek Sediment Basin. Almost 50 locations on 13 tributaries throughout the Crystal Lake watershed have been sampled historically for various water quality parameters. Of these, 29 are located within the Cold Creek subwatershed. Six of these locations may be conducive for fixed-site biomonitoring (Table I). It is anticipated that in addition to providing taxonomic key guidance, MDEQ personnel will help in refining a flexible sampling design and identifying sampling locations, given the expected temporal and spatial variability of organisms. The streambanks of the lower reaches of the Cold Creek Watershed are well stabilized. The margins of the upper reaches, however, still reflect the effects of the extensive channelization of the original streambeds for irrigation and drainage purposes that occurred early in the 20th century. Although the land has laid fallow for several decades, occasional extreme runoff events have altered the stream morphology, and still can cause noticeable soil erosion and sediment deposition.

Table I. Crystal Lake – Subwatersheds and Sampling Locations.

Subwatershed Number	Proposed Sampling Site Description / Lat & Long	LAT 44 N +	LON 086 W +	Possible Locations
*7	Cold Creek (Main Branch)	37' 46.62"	05' 45.62"	1 of 3
*8	Cold Creek (South Branch)	37' 48.18"	05' 30.41"	2 of 8
*9	Cold Creek (Middle Branch)	37' 55.97"	05' 22.25"	1 of 3
*10	Cold Creek (North Branch)	37' 46.62"	05' 45.62"	2 of 15

In association with the Northwest Michigan Council of Governments (NWMCOG), the CLWF has developed Geographic Information System (GIS) maps of the Crystal Lake Watershed to define subwatersheds (including Cold Creek), topographic and bathymetric contours, wetlands, land use, and vegetation. Biomonitoring and habitat data will be included in a future overlay. The CLWF has experience with a Global Positioning System (GPS) (Garmin MapSport) that has been used to locate sampling stations along the tributary streams, within the nearshore (littoral) zones, and in the deepwaters of Crystal Lake. The CLWF also owns and operates a Hydrolab H20 multiprobe that has been used to define vertical profiles of temperature, dissolved oxygen, pH, conductivity, redox, and turbidity. In addition, water samples have been collected at depth using a beta bottle for nutrient analysis (N and P species) and other analyses. Water samples are collected, labeled, and transported to independent laboratories for analysis. The CLWF has also done some limited sediment collection using a Ballcheck corer and an Eckman dredge, and thermogravimetric analysis to define content of organic matter, marl (CaCO₃), and sand.

Associated chemical and physical monitoring will include: temperature, dissolved oxygen, pH, conductivity, redox, and turbidity (T, DO, pH, C, Redox, Turb; to be done by CLWF using a Hydrolab H20 multiprobe in situ); and ammonia nitrogen, nitrate nitrogen, total phosphorus, soluble total phosphorus, and orthophosphorus (NH₄-N, NO₃-N, tP, sP, and oP; to be done by The Michigan Water Research Center, Central Michigan University, Mt. Pleasant, MI, on collected grab samples). Composite water samples will be collected and analyzed pending funding of a parallel project evaluating five management options for the Sediment Basin.

Stream elevations and stream flows will be monitored in conjunction with this project. The CLWF will deploy a Troll 4000 (In-Situ, Inc.) level indicator that is capable of remote monitoring with subsequent downloading of stream level (and temperature) measurements. A probe flowmeter will be used to monitor stream flows.

Training in sample collection and assessment procedures was provided by MDEQ staff on April 9, 2002. It included presentations on sampling protocols and data collection forms, followed by a field session. The project will closely follow guidelines, procedures, and data collection forms provided by the MDEQ in the biomonitoring training program. Screening of benthic invertebrates, evaluation of stream habitat, and chemical/physical monitoring will follow established protocols and QA/QC procedures. Equipment maintenance and calibration will be performed.

Beginning in Spring 2002, the six chosen sites throughout the watershed will be monitored twice per year, once in April and once in September. Depending upon results, additional sampling at other sites will be considered. Volunteers will sample benthic invertebrates and enumerate the relative abundance of major taxonomic Orders. These data will be used to calculate a water quality index value, by which sites are rated as excellent, good, fair, or poor. Volunteers will sample all habitats within a stream reach to ensure a complete assessment of organisms that are present. These data are the primary means for assessing site condition.

Volunteers also will evaluate habitat and physical conditions at each site. They will note the relative proportions of substrate, riparian vegetation, and the extent of sedimentation. Observations concerning land use and potential sources/causes of stress also will be recorded. These physical observations are necessary as a complement to the benthic invertebrate data to fully evaluate site conditions.

Volunteer data will be recorded, evaluated, and entered into databases maintained by the CLWF and the MDEQ. The results will be used to prepare the final report.

Data Quality Objectives

Accuracy and Precision

It is more difficult to generate quantitative goals for accuracy and precision for benthic invertebrate and habitat measurements than for chemical measurements. A benthic invertebrate index score used to rank sites is described on the Volunteer Stream Survey Form (MI DEQ). The measurement range for this numerical value is 0 to 72. In any given stream reach, there are likely to be some taxa that are very rare, and would not be found even by professional biologists after a long search. Therefore, unlike chemical measurements, it is impossible to quantify the accuracy of a benthic invertebrate score. It is, however, possible to outline precision goals. The goal for precision among volunteer monitors is that multiple measurements of a stream reach should yield invertebrate scores in which the difference between the maximum and minimum score is not more than 9 points. This value is based on the potential for a site to contain one rare Group One taxa (which would impact the score by 5 points), one rare Group 2 taxa (which would impact the score by 3 points), and one rare Group 3 taxa (which would affect the score by 1 point). A difference of 9 points assumes that one individual found all of these rare taxa while another did not find any of them. In addition, it seems probable that precision would be affected by the number of taxa present. It is difficult to set different precision goals based on scores *a priori*, but this issue will be reviewed as data are collected. As QA/QC procedures are implemented, MDEQ will consider setting precision goals based on the number of taxa present.

With regard to the habitat assessment, there are a number of attributes for which volunteers are asked to estimate relative percentages. The program goal is that the maximum and minimum estimates differ by less than 20%. These and other accuracy and precision goals are listed in Table 2 (Source: MI DEQ).

Table 2. Accuracy and precision goals for measurements taken by citizen volunteers.

Measurement	Accuracy	Precision
Benthic invertebrate scores	NA	+ or - 9 points
Water temperature	+ or - 0.5 degrees C	+ or - 20%
Stream width	+ or - 2 feet	+ or - 10%
Stream depth	+ or - 3 inches	+ or - 25%
Stream velocity	+ or - 2 cfs	+ or - 25%
% estimates (substrate, riparian vegetation, land use)	NA	+ or - 20%
Category estimates (substrate embeddedness, stream shading, bank erosion, woody debris)	NA	All responses in 2 adjacent categories

NA = Not Applicable

These are initial estimates that may need revision as the Project develops and monitoring and QA data become available. This QAPP will be updated to reflect modifications.

Representativeness

The initial six monitoring sites are specifically located within the Cold Creek Watershed to ensure that they are representative. Likewise, the assessment procedures will ensure that the data are representative of each location. At each site, volunteers will evaluate a 300 ft. stream reach, ensuring that any unusual microhabitat patches do not overly influence the results. Because streams in this watershed have variable physical characteristics, benthic invertebrates will be collected from all available habitat types and composited for scoring. This procedure will allow site scores to reflect the entire community at each location.

Comparability

The MDEQ has developed standardized habitat and benthic invertebrate collection and analysis procedures for use by volunteers across Michigan. Volunteers who collect data for use by MDEQ must undergo training by MDEQ or by an entity approved by MDEQ. Further, all data are recorded on standard data forms and maintained in the same database. These procedures, training requirements, and data management activities ensure that not only are data collected by volunteers within a watershed comparable, but that data collected by organizations throughout the state are comparable.

Completeness

These data will not be used for legal or compliance purposes, and there are no statistical reasons why a certain percentage of the anticipated data must be collected. However, it is recognized that failure to monitor even a few sites twice per year could be indicative of waning volunteer interest in the program. Therefore, a target of 90% completeness will be established for the Cold Creek Watershed. When data are not collected as scheduled from a site, MDEQ and volunteer leaders will attempt to ascertain the reasons for this failure and correct them if possible. Unfavorable weather on several consecutive weekends in the spring, for example, may lead to failure to achieve the 90% target, about which nothing can be done. However, if a volunteer consistently shows a lack of interest or commitment, then we will work with that individual to identify reasons for the apathy and try to remedy any problems. In extreme cases, it may be necessary to find another volunteer to take over a site.

Training Requirements and Certification

Training is provided by MDEQ or another qualified individual. A “qualified individual” is defined as someone with two years experience in benthic invertebrate monitoring and habitat assessment procedures. Eventually, it is anticipated that experienced volunteers will be able to train new volunteers, thus minimizing the need for MDEQ staff to perform this task. However, MDEQ will be present for training sessions given by inexperienced trainers to ensure quality.

Volunteers are required to attend 2 half-day training sessions. The first half-day is conducted in a classroom and the following topics are covered:

- Goals of the volunteer monitoring program;
- Safety protocols;
- Description of needed equipment;
- Explanation of field data sheet (volunteer stream survey form);
- Slide show demonstrating various stream habitat characteristics; and
- Identification of a reference collection of benthic invertebrates using a dichotomous key.

During the second half-day session, participants visit 2 stream sites to sample invertebrates and assess habitat quality. This gives volunteers an opportunity to “get their feet wet” and to ask questions that may not have occurred in the classroom setting. Volunteers also can practice benthic invertebrate identifications in the field.

Performance will be measured by an annual side-by-side monitoring event with volunteers and MDEQ. Results will be compared to evaluate data consistency. If some results are questionable, then the source of any problems will be identified and steps taken to remedy the situation. Volunteers are required to demonstrate competence in the identification (to Order) of a reference collection of benthic invertebrates in the laboratory using a basic taxonomic key. Volunteers also are asked to keep voucher specimens so that identifications can be verified periodically.

Documentation and Records

Volunteers will complete the volunteer stream survey form during each site visit. Information includes the stream name, station number, location (road crossing if applicable), county, township, date, time, and name(s) of the investigator(s), as well as habitat and benthic invertebrate data. All data sheets will be returned to Mark Kelley, Field Leader, at the NRCS office in Shelby, MI. Copies of the data sheets will be

sent to MDEQ, where data will be entered into a volunteer monitoring program database. The field data sheets will be stored at the NRCS office for 5 years and at the MDEQ office in Lansing for 10 years. All records in the database will be maintained, ensuring that historical data are not lost. QA documentation generated from this project will be maintained by MDEQ for 5 years.

Volunteers will collect and preserve (in jars with 90% ethanol) one or a few specimens of all invertebrate taxa found at a site for laboratory identification (if necessary) and verification purposes. These jars will be clearly labeled, identifying the stream name and location, collection date and time, and the name(s) of the volunteer(s) that collected the data. Voucher specimens will be stored and maintained for 3 years by the Laboratory Manager, Paul Murphy, for the Crystal Lake Watershed Fund.

Project Design and Sampling Process

The Cold Creek Watershed sites are sampled twice per year, once in April and once in November. A sampling visit includes an assessment of stream habitat quality and the collection and identification (either in the field or laboratory) of benthic macroinvertebrates. Volunteers are asked to wait at least 5 days after heavy precipitation before sampling. There is a place on the field data sheet to note the extent of precipitation in the previous 5 days. It is recognized that during extremely wet periods (common in April), sampling may have to be delayed. However, this situation is to be avoided if possible because of invertebrate life history characteristics.

Volunteers are encouraged to work in groups of two or more, and safety procedures are discussed during the training sessions (see attached "Safety Guidelines"). If a volunteer cannot make a scheduled sampling visit for any reason, they must notify their partner(s) and the Field Leader, and volunteers and the Field Leader will attempt to find a replacement. If a replacement cannot be found, then the site visit may have to be rescheduled or canceled. Final decisions will be made by the Field Leader.

If site access requires crossing private property, then volunteers must seek permission from the owner. If the owner refuses permission, then a nearby alternate site will be selected.

The initial 10 sites were chosen randomly (with consideration of accessibility) to ensure reasonably broad coverage of the watershed. As more volunteers are recruited, additional sites will be chosen either randomly or in response to specific issues or concerns. For example, if a new road is planned, then a site will be selected to measure potential impacts. If cattle access to the stream is noted, then a nearby site may be selected to document the extent of the problem. If a farm implements BMPs, then a nearby site will be chosen to document improvements in stream quality. This site selection process will ensure that volunteer monitoring provides both an overview of water quality in the Cold Creek Watershed and information about suspected or known stressors.

Sampling Method Requirements

Volunteers will visually inspect the stream reach to assess habitat. The only equipment needed is a thermometer to record the air and water temperature, and a tape measure to determine stream width and depth. It is recommended that volunteers use an orange or apple to measure current velocity. Specific procedures are attached ("Volunteer Monitoring Procedures").

For benthic invertebrate collections, volunteers will use 3' by 3' kick-nets with a mesh size of 400 microns. Samples will be preserved in jars with 90% ethanol. There is no specific holding time for preserved specimens, but laboratory identifications should be completed within one month of a site visit. Prior to leaving a site, volunteers are instructed to wash the kick nets and remove invertebrates that may remain on the net. Specific procedures are attached ("Volunteer Monitoring Procedures").

Sample Handling and Custody Requirements

The only samples that are brought into the laboratory are benthic invertebrates. Volunteers will clearly label the jars (using pencil), with information about sample location, date and time, and collectors. After identification (if necessary), these voucher specimen jars will be turned over to the Laboratory Manager,

who will maintain them for 3 years. A reference collection of taxa found in the watershed, based on voucher specimens, will be maintained indefinitely by the college.

Analytical Methods Requirements

The habitat and benthic macroinvertebrate assessment methods have been developed by the MDEQ for the volunteer monitoring program and are attached to this QAPP (“Volunteer Monitoring Procedures”). These methods are consistently used by volunteer organizations throughout Michigan.

Quality Control Requirements

All Cold Creek Watershed volunteers will convene annually and conduct a site assessment at the same location, along with MDEQ staff. The purpose of this activity is to ensure that all volunteers are following proper procedures and to evaluate variability among individual assessments. If a volunteer is not following recommended procedures, then the problem(s) will be pointed out by MDEQ and the proper procedure will be explained and/or demonstrated. The habitat evaluations by volunteers and MDEQ staff will be compared for accuracy and variability. If variability among volunteers is high (based upon best professional judgment since habitat assessments are not quantitative), then the Project Manager will attempt to determine the reasons for the variability (e.g. whether it is spread among all variables, or is confined to one or a couple of variables). These issues will be addressed at the next training session. It is anticipated that variability among volunteers will decrease as they gain more experience and confidence in the monitoring procedures.

With regard to benthic macroinvertebrates, the goal is for the minimum and maximum scores to differ by < 10 points, as described in the “Data Quality Objectives” section above. If variability is greater than 10 points, then the Project Manager will determine whether differences are caused by different sampling efficiency among volunteers and/or by problems with invertebrate identifications. Once the cause of the variability is determined, it will be addressed at the next training session. Volunteers may be asked to practice invertebrate identification in the laboratory, or to work with an experienced individual to improve sampling efficiency. Volunteers are asked to maintain voucher specimens from each sampling event, and the identifications of each individual will be checked once per year (at least for the first 2 years of the program). If a sample has multiple misidentifications, then results will be flagged or discarded and the volunteer will be provided with additional training.

Equipment Testing, Inspection, and Maintenance Requirements

Kick nets will be inspected for tears/holes in the mesh by volunteers prior to each sampling event. Nets with holes will be repaired or, as a last resort, replaced. Volunteers are required to thoroughly rinse and clean kick nets prior to returning from the field. Nets will be stored at the West Shore Community College biology laboratory. Voucher specimen jars also will be inspected by volunteers for cracks prior to sample collection. Thermometers will be checked each year to ensure that they are in working order and giving accurate readings.

Instrument Calibration and Frequency

The only instruments requiring calibration are the thermometers. This will be done by placing thermometers into a jar of water at room temperature and taking readings from each. If one is found to differ from the others by more than 1 degree C, it will be properly discarded and replaced. These calibrations will be done once per year.

Inspection and Acceptance Requirements For Supplies

The Cold Creek Watershed volunteers use kick-nets for benthic macroinvertebrate sampling, and preserve voucher specimens in jars with 90% ethanol. The nets, jars, and thermometers are purchased

from a scientific supply house and are inspected upon arrival for any defects or problems. Defective materials are immediately returned to the supplier for replacement.

Data Acquisition Requirements

Macroinvertebrate pollution tolerance groupings and index calculations are based on 1995 volunteer monitoring guidance from U.S. EPA. Habitat categories also are based on this guidance, as well as forms used by other volunteer organizations. County and U.S. Geological Survey maps are used for site selection.

Data Management

The field data sheet is reviewed by volunteers prior to leaving a site to ensure that the forms are fully completed and that nothing is left blank (unless there is a specific reason). The Field Leader also will examine the data sheets for completeness when submitted by volunteers. At that time, volunteers will be questioned about any omissions or possible errors. The Field Leader will spot check the invertebrate score calculations to ensure accuracy. The Laboratory Manager will inspect voucher collections to ensure that they are properly labeled, and any necessary corrections/additions will be made. Voucher specimens will be checked once a year to ensure the accuracy of identifications.

Data will be entered into a spreadsheet/database designed by MDEQ for the statewide volunteer monitoring program. The quality of data entry will be evaluated by comparing 20% of the data sheets to the appropriate database records. If multiple errors are found, then all data sheets will be compared with their database records, and steps will be taken to address the source of the data entry errors.

Assessments and Response Actions

As mentioned previously, all volunteers will convene once per year with the Field Leader and Project Manager to assess performance and variability. Problems will be corrected by demonstrating proper techniques to individuals not following recommended sampling and assessment procedures. Volunteers are required to attend annual refresher training sessions, which will help to ensure that proper procedures are consistently followed. Identifications of voucher specimens will be checked annually for accuracy, and volunteers that appear to be having difficulty will receive additional instruction from the Field Leader and/or the Project Manager.

Reports

The Project Manager will produce an annual report summarizing the Pentwater River watershed monitoring results from the previous field season (spring and autumn sampling). This report, to be completed each February, will be distributed to all volunteers, project participants, and any others who request it. In addition to the monitoring results, the report will describe any problems that occurred, QA results, notable achievements, how the data were used by federal, state, and local agencies, a list of monitored sites, and the names of volunteers and future project sponsors. Data also will be compared to those collected in previous years to establish water quality trends in the Pentwater River watershed.

An annual statewide report also will be prepared by MDEQ that summarizes data collected by all volunteer organizations in Michigan. As more groups adopt the standard procedures developed by the state and generate similar, consistent types of data, such comparisons become relatively easy and valuable. This report will show where volunteer data are being collected, list the participating organizations, and identify sites of high quality as well as sites that are degraded. The report will point out areas chosen for detailed assessment by MDEQ biologists based on volunteer information.

Data Review, Validation, and Verification Requirements

All data collected during this project will be reviewed by the Project Manager to determine whether the QA objectives are met. The Project Manager will decide whether data are accepted, rejected, or qualified. The main reason for rejecting data is likely to be poor identification of invertebrates.

Validation and Verification Methods

Field data sheets will be reviewed by the Field Leader for completeness, unusual measurements, and accuracy of calculations. In addition, the Field Leader and Project Manager will check invertebrate identifications by each volunteer once per year to verify data accuracy. Any problems in these areas will be corrected through the annual training sessions. Suspect data will either be dropped or flagged as appropriate. A subset (20%) of the database records will be compared to the field data sheets to ensure the accuracy of the data entry procedure. If numerous errors are found, all data sheets will be compared to their respective database records to correct errors.

Reconciliation With Data Quality Objectives

During the annual QA monitoring effort, the benthic macroinvertebrate index scores will be compared to assess variability among volunteers. If the difference between the minimum and maximum score is greater than 9 points, then corrective steps will be taken. This may involve additional training in sampling procedures and/or taxonomic identifications. It is expected that variability will decrease as volunteers gain more experience and confidence in the methods. Differences in the habitat assessments also will be analyzed to determine whether interpretation problems exist. The Field Leader and Project Manager will decide whether to discard data and the remedial actions that are necessary to improve the quality of volunteer data.

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