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Illinois EcoWatch Network

RiverWatch Stream Monitoring Program

Quality Assurance Project Plan

by
Alice Brandon
Illinois EcoWatch QA/QC Officer

February 13, 2002

ILLINOIS
NATURAL
HISTORY
SURVEY

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Illinois EcoWatch Network

RiverWatch Stream Monitoring Program

DRAFT QUALITY ASSURANCE PROJECT PLAN

For

Illinois EcoWatch Network

Illinois Department of Natural Resources

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4.0 PROJECT / TASK ORGANIZATION

Illinois RiverWatch (RW) is the stream-monitoring component of the Illinois EcoWatch Network (EW), a volunteer monitoring program that is coordinated through the Division of Ecosystems, Office of Realty and Environmental Planning, under the Illinois Department of Natural Resources (IDNR). EcoWatch is a component of the Critical Trends Assessment Program (CTAP), an umbrella program developed to monitor trends in Illinois ecosystems. Scientists at the Illinois Natural History Survey (INHS) and Illinois EcoWatch Network (EW) collaborated to develop the CTAP professional and volunteer monitoring programs for Illinois forests, streams, wetlands, and prairies. The CTAP team consists of staff from IDNR's Division of Resource Review and Coordination, Office of Realty and Environmental Planning, Office of Research and Scientific Analysis, Illinois Waste Management and Research Center, INHS, and the Illinois State Water Survey. In CTAP, the collective knowledge and judgment of professionals and EW staff, taking into account the resources available, have developed protocols for volunteer use in these ecosystems.

Primary funding for the development and implementation of EW comes from Conservation 2000, the CTAP, and other IDNR sources. Previously (1995–2000), EW was partially supported through AmeriCorps, a national volunteer service program created by President Clinton and Congress in 1994.

RiverWatch Staff

A list of RW personnel, their job responsibilities, and where they are housed within the IDNR is provided in Table 1. RW also receives technical support from other CTAP staff at the Illinois Natural History Survey. An organization chart is not a feasible option for displaying how program staff are organized because RW personnel work for different IDNR divisions and have different immediate supervisors.

Table 1. Personnel for the RiverWatch Program.

Name/Title	Responsibilities	Agency/Division	Immediate Supervisor
John Marshall Ecosystem Monitoring Section Manager	Oversees EcoWatch Program & integration with other IDNR programs including Conservation 2000.	IDNR-Division of Ecosystems	Marvin Hubbell-Manager Ecosystems Division
Dana Curtiss EcoWatch Program Coordinator	Coordinates all EcoWatch Programs.	IDNR-Division of Ecosystems	John Marshall Ecosystem Monitoring Section Manager
Shelly Fuller RiverWatch Program Coordinator	Coordinates RiverWatch Program, trains and certifies EW trainers on RW procedures, supervises all volunteer training procedures.	INHS-Office of the Chief	Dr. William Ruesink Assistant Chief for Planning
Alice Brandon QA Officer	Ensures volunteer data quality, assesses data to ensure it meets data quality objectives, provides technical assistance to EW Trainers.	INHS-Office of the Chief	Dr. William Ruesink Assistant Chief for Planning
Amy Osterman EcoWatch Database Manager & Web master	Designs and manages EcoWatch databases and Web site.	INHS-Office of the Chief	Dr. William Ruesink Assistant Chief for Planning
Amy Ent Outreach	Editor of *the EcoWatcher Newsletter.*	INHS-Office of the Chief	Dr. William Ruesink Assistant Chief for Planning
Will Hinsman Geographic Information Systems	Manages, analyzes, and maps geographic data for EcoWatch.	IDNR-Division of Ecosystems	John Marshall Ecosystem Monitoring Section Manager
Dominic Carmona Region 1 EcoWatch Trainer	Recruits, trains, and coordinates volunteer efforts to monitor streams at the regional level.	INHS-Office of the Chief	Shelly Fuller RW Program Coordinator
Becky Hefter Region 1 EcoWatch Trainer	Recruits, trains, and coordinates volunteer efforts to monitor streams at the regional level.	INHS-Office of the Chief	Shelly Fuller RW Program Coordinator
Dale Harness Region 2 EcoWatch Trainer	Recruits, trains, and coordinates volunteer efforts to monitor streams at the regional level.	INHS-Office of the Chief	Shelly Fuller RW Program Coordinator
Jason Zylka Region 2 EcoWatch Trainer	Recruits, trains, and coordinates volunteer efforts to monitor streams at the regional level.	INHS-Office of the Chief	Shelly Fuller RW Program Coordinator
Patti Brown Region 4 EcoWatch Trainer	Recruits, trains, and coordinates volunteer efforts to monitor streams at the regional level.	INHS-Office of the Chief	Shelly Fuller RW Program Coordinator

Table 1. Continued

Name/Title	Responsibilities	Agency/Division	Immediate Supervisor
Andrea Davis Region 2 EcoWatch Trainer	Recruits, trains, and coordinates volunteer efforts to monitor streams at the regional level.	INHS-Office of the Chief	Shelly Fuller RW Program Coordinator
Dax Dugaw Region 2 EcoWatch Trainer	Recruits, trains, and coordinates volunteer efforts to monitor streams at the regional level.	INHS-Office of the Chief	Shelly Fuller RW Program Coordinator
Debbie Fluegel Region 3 EcoWatch Trainer	Recruits, trains, and coordinates volunteer efforts to monitor streams at the regional level.	INHS-Office of the Chief	Shelly Fuller RW Program Coordinator
Rachel Avery Region 3 EcoWatch Trainer	Recruits, trains, and coordinates volunteer efforts to monitor streams at the regional level.	INHS-Office of the Chief	Shelly Fuller RW Program Coordinator
Mary Beth Kaufman Region 4 EcoWatch Trainer	Recruits, trains, and coordinates volunteer efforts to monitor streams at the regional level.	INHS-Office of the Chief	Shelly Fuller RW Program Coordinator
Shelley Fabry Region 5 EcoWatch Trainer	Recruits, trains, and coordinates volunteer efforts to monitor streams at the regional level.	INHS-Office of the Chief	Shelly Fuller RW Program Coordinator
Jim LeBel Region 5 EcoWatch Trainer	Recruits, trains, and coordinates volunteer efforts to monitor streams at the regional level.	INHS-Office of the Chief	Shelly Fuller RW Program Coordinator

Partnerships

EW has multiple partners at the local and state level. More than 100 schools, conservation groups, government agencies, and businesses supporting the program, including the Audubon Society, The Nature Conservancy, Cypress Creek National Wildlife Refuge, Illinois Chapter of the Sierra Club, City of Urbana Park District, University of Illinois Cooperative Extension Service, and the Mercer County Natural Area Guardians.

EW partners with Chicago Wilderness to recruit and train high school science teachers, members of The Nature Conservancy's Volunteer Stewardship Network, and other volunteers in the northeastern Illinois region. This relationship is facilitated through The Field Museum of Natural History, which helps involve urban residents in volunteer monitoring.

EcoWatch also works closely with Conservation 2000 (C2000) Ecosystems Program, which provides Ecosystem Grants to Ecosystem Partnerships—coalitions of local stakeholders united by a common interest in the natural resources of their watershed. Ecosystem Partnerships and EW work together to monitor streams and inform stakeholders about the importance of stream quality at the local level. C2000 has recently suggested that Partnerships use RW protocols or CTAP professional protocols to monitor the performance of restoration projects funded by C2000 grants.

Data Users

RW data are primarily used by the CTAP program to analyze trends in Illinois streams. RW data were a critical component of the recently released *Critical Trends in Illinois Ecosystems* (IDNR 2001b). This report describes the condition of the state's forests, grasslands, streams, and wetlands based on CTAP professional scientist and EW monitoring data. Assemblages of organisms used in the CTAP monitoring framework to assess streams include fish and benthic macroinvertebrates by INHS scientists and benthic macroinvertebrates by RW volunteers (Bailey et al. 2000).

Other important RW data users include, but are not limited to, C2000 Ecosystem Partnerships, private landowners, professional scientists, and local communities wishing to assess long-term trends in stream health.

5.0 PROBLEM DEFINITION / BACKGROUND

History of Volunteer Monitoring

The Izaak Walton League of America (IWLA) was the first organization to use volunteers to monitor streams when the organization founded Maryland's Save Our Streams (SOS) program in 1969 (Firehock and West 1995). Initial programs were very simple with volunteers picking up garbage or looking for pipes directly impacting streams.

One of the first programs to use aquatic insects was developed by the Maryland Department of Natural Resources in 1976 and relied on three indicator taxa 1.) Ephemeroptera, 2.) Plecoptera, and 3.) Trichoptera (EPT) to rate stream quality. If all three taxa were collected at the stream site it was rated excellent; if Trichoptera and Ephemeroptera were present it was rated as good, and if only Trichoptera were found the stream was rated as fair (Firehock and West 1995).

In 1983, the Ohio Department of Natural Resources began using volunteers to monitor the state's 10 scenic rivers. A new qualitative monitoring method was developed for this program called Stream Quality Monitoring (SQM) (Firehock and West 1995). This program divided benthic macroinvertebrates into three groups based on a taxon's tolerance to pollution (Kopec and Lewis 1983). SQM uses a kick-seine technique to collect macroinvertebrates from riffles. Volunteers then estimate the number of macroinvertebrates for each group before returning the specimens to the stream (Dilley 1991). The purpose of the SQM was to indicate general conditions and was not intended to assess the degree of degradation occurring at a stream site (Dilley 1991; Firehock and West 1995).

In the 1990s the U.S. EPA developed the Intensive Stream Bioassessment (ISB) for volunteer groups wishing to collect more rigorous data. The ISB is modeled after the U.S. EPA Rapid Bioassessment Protocol II (Plafkin et al. 1989) and uses a kick net to collect samples (Penrose and Call 1995). However, unlike the SQM, specimens are preserved and identified in the laboratory to family level (Penrose and Call 1995). Data collected by groups using the ISB or similar protocols are more likely to be used by state and local agencies such as a state's EPA for evaluating stream quality (Penrose and Call 1995).

Since volunteer stream monitoring began in the 1960s it has grown from a solitary project begun in Maryland to a nationwide effort with over 240 volunteer stream monitoring programs in the U.S. (U.S. EPA 1998a).

EcoWatch Program Background

The first Illinois citizen stream monitoring program was developed in 1990 by the Illinois Department of Energy and Natural Resources in cooperation with other state agencies including the Lieutenant Governor's Office. The program changed numerous times to become the Illinois EcoWatch Program, which is now managed by the Illinois Department of Natural Resources (IDNR). CTAP provides a comprehensive assessment of the Illinois environment and is designed to give the state and its citizens the data necessary to create a plan for the future of its ecosystems. As the volunteer stream-monitoring component of CTAP, RW coordinates a statewide network of volunteers working to collect information on Illinois streams. These data document long-term trends in stream health as reflected by biological monitoring of benthic macroinvertebrates. A habitat survey of the stream site is also conducted to complement the biological data. The program also encourages long-term public interest in the quality of Illinois streams and rivers, educates and informs participants about their ecology, and provides opportunities for Illinois citizens to take an active role in protecting their local streams.

RiverWatch Goals

The primary goals of RW are to:

1. Use a large and willing volunteer monitoring community to track the condition of Illinois streams through both space and time in conjunction with and with the support from professional scientists of the CTAP.

2. Provide support and stream monitoring protocols to various Illinois volunteer watershed-based organizations such as the 38 Ecosystem Partnerships of Conservation 2000.

4. Provide quality, volunteer-collected stream monitoring data to Illinois state agencies including the IDNR and IEPA, to augment their professional stream biologist's efforts to monitor Illinois waters.

5. Provide educational opportunities for Illinois schools and interested adults concerning the

importance of protecting the state's stream resources.

6.0 PROJECT / TASK DESCRIPTION

The sampling and analytical procedures of RW are detailed in the *Illinois RiverWatch Stream Monitoring Manual* (IDNR 2001a) (see appendices and sections of this QAPP). RW uses macroinvertebrate sample data to calculate several measures of stream condition e.g., Ephemeroptera, Plecoptera, and Trichoptera (EPT), total taxa richnesses, taxa dominance, and organic pollution tolerance of the assemblages collected. Volunteers also conduct a habitat survey of the stream site at each location.

Why Aquatic Macroinvertebrates?

Firehock and West (1995) present a history of volunteer biological water monitoring where they state that benthic macroinvertebrates are the most common assemblage used to monitor stream condition. The rationale for supporting the use of macroinvertebrates has been presented in U.S. EPA documents (Barbour et al. 1999; U.S. EPA 1997):

1. They are relatively easy to collect and identify for volunteers and require minimal resources (Firehock and West 1995; U.S. EPA 1997).

2. They have relatively well known tolerances to habitat degradation and organic pollution (Barbour et al. 1999; U.S. EPA 1997). Their presence or absence and the taxa richness of indicator organisms provide an indirect measure of stream conditions (U.S. EPA 1997).

3. They usually live from several months to multiple years and therefore they reflect an integrated response to multiple stressors and long-term conditions at stream segments. In contrast, infrequent chemical monitoring lacks this integrative ability and provides relatively short-term information about stream condition (Barbour et al. 1999).

4. They are an important food source for many organisms including fish and wading birds, so they provide a link between producers and consumers (Barbour et al. 1999; U.S. EPA 1997).

Several other programs using macroinvertebrates to assess stream conditions include Missouri's Stream Team Program, the Ohio Department of Natural Resources-Stream Quality Monitoring Program, the Connecticut River Watch Program and the Save Our Streams Project of the Izaak Walton League of America (Firehock and West 1995; U.S. EPA 1998a). According to the U.S. EPA (1998a), macroinvertebrates are the third most common type of data collected by volunteer stream monitoring programs after water temperature and pH. A survey conducted by the U.S. EPA (1998a) indicated that there were no volunteer monitoring programs collecting biological data on fish and few collecting information on birds.

Why A Habitat Survey?

Instream habitat is a primary determinant of aquatic community potential (Barbour et al. 1999) and supplies additional information on why certain benthic macroinvertebrates are either found or not detected in a biological survey. Specifically the RW habitat survey is used to:

1. evaluate whether a poor macroinvertebrate sample can be partially attributed to habitat limitations such as severe bank erosion (U.S. EPA 1997) or the lack of a riparian tree buffer;

2. document how a stream's habitat changes over time, including channelization, riprap installations, or other nonpoint or point source modifications in the watershed.

Type of Stream Monitored

Volunteers monitor wadeable streams that are less than three feet deep. This limitation was decided upon due to safety concerns and equipment costs. RW collects data from all stream types including rocky bottom and soft bottom streams. Intermittent streams, determined through multiple visits by the volunteer or EW staff, are unacceptable for monitoring. Volunteers are directed not to sample flooded sites.

Stream Site Requirements

Volunteers may choose their own sites as long as it meets the minimum physical and safety requirements. EW realizes that these sites do not accurately reflect statewide stream conditions due to their nonrandom selection. Therefore, CTAP and EW generated a list of 100 random sites and encourage volunteers to adopt these sites. Approximately 60 of these sites are currently monitored. They will form the population from which to make statistical inference for statewide trends. Random sites will also provide a context in which to place all non-random stream samples.

EcoWatch Program Work Cycle

RiverWatch trains new volunteers and conducts review sessions for veteran volunteers from March through May (Table 2). The RW monitoring season begins May 1 and ends June 30. During this time, EW staff assist and support volunteers in their monitoring efforts. Volunteers submit their macroinvertebrate samples and hard copies of their data sheets to regional offices by July 15. EW staff check the data for errors and enter data on-line for volunteers who do not have Internet access from late July through August. There is a final check of the data by the Quality Assurance Officer during September and October for completeness and accuracy. Once all quality control checks are complete, including a blind check of 30% of the macroinvertebrate samples collected, the QA officer summarizes the results. All reports are typically complete by early January. EW staff use the remainder of the year to complete site assessments, recruit, and train volunteers.

Table 2. RiverWatch Program annual work cycle

Major Task Categories	J	F	M	A	M	J	J	A	S	O	N	D
Volunteer training & review sessions			X	X	X							
Volunteer recruitment	X	X	X	X	X	X	X	X	X	X	X	X
RW monitoring season					X	X						
Data entry							X	X				
Data entry QA/QC checks							X	X	X			
Macroinvertebrate sample verification									X	X		
Data analysis and reporting										X	X	X
RW site evaluations	X	X	X						X	X	X	X

7.0 DATA QUALITY OBJECTIVES FOR MEASUREMENT DATA

RW Data Precision

Precision is a measure of mutual agreement among repeated measurements of the same characteristic on the same sample or on separate samples collected as close as possible in time and place (U.S. EPA 1996a). EW recognizes the need to assess both intra- and inter-observer precision. EW has made efforts to assess inter-observer precision using shadow sampling (or duplicate sampling, the term used by the U.S. EPA), where two samples or sets of data are collected at the same site (U.S. EPA 1998b).

Shadowing compares data collected by volunteers with data collected by EcoWatch staff (Trainers) from the same stream site. It is the responsibility of EW staff to train volunteers; therefore, the two groups should obtain similar results when using the same procedures. A RW shadow study was first carried out in 1999 comparing habitat survey parameters only. There were no significant differences between volunteer and EW staff data for percent boulder, cobble, gravel, algae, stream canopy cover, stream width, depth, and discharge (paired t-test, P < 0.05, n= 29) (Brandon 2001). However, significant differences were detected for percent embeddedness, bedrock, sand, and silt.

In response to these findings the *Stream Monitoring Manual* was rewritten to more clearly define confusing definitions. EW staff were instructed to spend additional training time on these parameters. EW plans to conduct a follow-up study to determine if these changes were successful. Unfortunately, no macroinvertebrate shadowing has been conducted but is planned for 2002. Additional information on inter-observer precision could be derived from having multiple volunteers sample one location, EW has not yet conducted such a test.

Intra-observer precision was briefly addressed in DeWalt (1999) where volunteers were asked to collect two replicates (normally they collect one) from 10 sites. The relationship for abundance in replication 1 and 2 were not statistically correlated ($R = 0.48$, $p = 0.15$). However, this was not surprising since variation in abundance from one sample to another is known to be high (Plafkin et al. 1989). RW plans to address intra-observer precision in future QA studies.

RW Data Accuracy

Accuracy is a measure of confidence or closeness in an individual measurement and the difference between the individual measurement of a given parameter and its "true" or actual value (U.S. EPA 1998b). The Quality Assurance (QA) Officer assesses the accuracy of macroinvertebrate identification, abundance, and habitat parameter assessments on a yearly basis. The EW goal is to meet an accuracy rate of 80% for taxon identification, abundance, and habitat parameters.

For taxon identification, EW utilizes several methods to enhance accuracy. First, the QA officer compiles and maintains reference collections at each of the six regional offices. These are curated with the help of CTAP professional aquatic biologists every two years. Additionally, INHS malacologists confirm the presence of exotic species such as zebra mussels and Chinese mystery snails.

The QA Officer assesses macroinvertebrate identification and abundance by a blind (where volunteers are unaware of the check), random check of 30% of the samples collected in any given year. QA-derived measures are compared to volunteer measures using percentages, percent deviation, Spearman rank correlation, and Wilcoxon rank-sum tests. The percent deviation for each taxon is calculated using the following equation:

$$(\text{Taxon Abundance}_{V} - \text{Taxon Abundance}_{QA}) / \text{Taxon Abundance}_{QA} \text{ (X) } 100$$

where V = volunteer taxon abundance values for samples and QA = Quality Assurance taxon abundance values for those same samples.

Separating abundance from identification accuracy is difficult. To address this issue, identification matches between the volunteer and the QA Officer are considered correct identification for a taxon regardless of the number of organisms. The accuracy rate for identification of each taxon was determined by only using those samples where I found that taxon. For example, if 88 out of the 102 samples contained midges and of those 88 samples, only 71 contained midges that were correctly identified by volunteers then this would result in an identification accuracy rate of 81% for midges. On average, 29 (out of 37) taxa are identified with an 80% (or better) accuracy rate. However, dobsonfly larvae, crane fly, bloodworm, and other flies typically have accuracy rates below 80% (unpublished data). Inaccuracies here did not lead to large errors in the calculation of the MBI, total abundance, and taxonomic richness. The QA Officer has recently documented the accuracy of these parameters and found a range from 96% to 99% (Table 3). Moreover, there was no significant difference between volunteer and QA officer results using a Wilcoxon Rank-sum Test in 2000.

Table 3. Difference between QA Officer and volunteer MBI, taxa richness, and abundance scores for the same samples using a Wilcoxon Rank-Sum Test (N = 92).

	QA/QC Mean ± [1]SE	Volunteer Mean ± [1]SE	Wilcoxon Rank Sum Test (Z)	Probability (p)
MBI score	5.96 ± 0.13	6.02 ± 0.13	Z = 0.3336	P = 0.7387
Taxa richness	8.6 ± 0.35	9 ± 0.35	Z = 1.1234	P = 0.2612
Sample density	95.2 ± 7	98 ± 7	Z = 0.3474	P = 0.7283

[1]SE = standard error

There is no parallel for assessing habitat survey accuracy as there is for biological data as no sample can be brought to a laboratory for verification. The best option for testing habitat survey accuracy would be to have professional scientists collect habitat information on volunteer stream sites to compare with RW data. However, RW has yet to conduct such a study. RW has tested the precision of the habitat survey by having the EW Trainers collect habitat data from volunteer stream sites (see above).

An on-going comparison study was implemented in 1998 to examine the congruence between RW and professionally collected data originating from the Illinois Natural History Survey (INHS). This study allowed RW to examine the accuracy of RW biological metrics in comparison to those of CTAP professionals. Several richness measures were significantly correlated, indicating that some RW indices accurately predict species richness in streams (DeWalt 1999). Therefore, a large number of RW sites could be used to model stream quality across the state (DeWalt 1999). The study also identified discrepancies between RW and professional CTAP data in assigning quality ratings for each site (DeWalt 1999). This was attributed to problems with the MBI in terms of tolerance values assigned to taxa and ranges of MBI assigned to stream quality ratings (DeWalt 1999).

RW Data Representativeness

Representativeness, in the context of RW, is the extent to which data accurately represent community and habitat characteristics at multiple scales, e.g., across the state and at individual stream sites (U.S. EPA 1998b). Representativeness across the state and regions depends largely upon the use of a scheme to randomize stream sampling. Sampling of random streams ensures that RW can accurately depict statewide stream conditions. Initial sampling was done at nonrandom sites, however, the data revealed bias towards higher quality sites since volunteers preferred aesthetically pleasing stream segments. Therefore, RW only uses data from randomly selected stream sites to assess statewide and regional conditions. Placing nonrandom sites into the context of more representative, random ones permits direct comparisons between the two sampling schemes and still allows for trend analysis for random and nonrandom sites alike.

RW adopted a multi-habitat composite sampling approach to collect relatively large biological samples. A similar sampling scheme demonstrated that this approach produced representative estimates of dominant species occurring in a given stream reach (Diamond et al. 1996). INHS scientists suggested that this multi-habitat approach would allow for comparable effort across all stream types in Illinois. Available U.S.EPA guidance for volunteer stream monitoring was scanty during the development phase of RW, but what was available suggested a multi-habitat approach was most appropriate (U.S. EPA draft). A formal guidance document (U.S. EPA 1997) subsequently recommended sampling from four standard habitats if the stream was mud bottomed, while riffles were the preferred habitat in rock-bottomed streams. RW declined to change the protocols in order to maintain comparability with the first three seasons of data.

RW Data Comparability

Comparability in terms of RW data is the extent to which we can compare data across years and to other similar studies (U.S. EPA 1996a). Comparison of multi-year data from the same site is made possible by the use of a standard operating procedure discussed throughout this QAPP and in IDNR (2001). This is the general approach espoused by the U.S. EPA (Barbour et al. 1999; U.S. EPA 1997). The second approach is to document performance-based characteristics such as precision, accuracy, and representativeness for our method and to make direct comparisons with other programs with which we hope to share data (Barbour et al. 1999; Diamond et al. 1996). Performance characteristics of RW data have been made in this QAPP, but we have not conducted direct comparisons of RW data with such groups as the IEPA. An indirect comparison of our RW stream quality ratings, as measured by the MBI, has been conducted in the past. In 1996, the RW MBI stream quality ratings were compared to IEPA's Biological Stream Characterization ratings (BSC) reported for those streams in the Illinois Water Quality Report 1992–1993 (IEPA 1994). Overall, results for this comparison were mixed with RW volunteers underestimating excellent and good ratings as indicated by BSC, however, streams rated as poor by volunteers were in good agreement with IEPA basic ratings of D streams (Limited Aquatic Resources; Stoeckel, unpublished).

RW data are comparable to professional CTAP data when using data subsets. The professional data are sampled using a dip net (as is RW) and up to four habitats are sampled for EPT taxa (riffles, silt substrates, woody debris, overhanging banks, and macrophyte banks) depending upon their occurrence at a stream site. These macroinvertebrate samples are stored separately by habitat type making it possible to compare EPT RW data with subsets of the professional data. Other state agencies, such as IEPA, may also utilize subsets of the data for their own uses.

Completeness

Completeness is defined as a measurement of the number of samples one must take to be able to use the information, as compared to the original number of samples one planned to take (U.S. EPA 1996a). In 1995, the goal was to eventually have 10% of the total streams in the state monitored by citizen scientists. Information concerning the number of streams in each watershed was obtained from the Illinois Streams Information System (ISIS) coverages (Johnston et al. 1991). ISIS subdivides the state's streams into 10 major watersheds (Table 4), and RW has met or exceeded its completeness target except for the Wabash River Watershed (4% monitored in 1999) where volunteer recruitment has been poor. The Fox and Des Plaines Rivers Basins have consistently exceeded their completeness goal (36% monitored in 2000) due to a strong volunteer base from the Chicago metropolitan area. See the list of streams monitored each year by watershed for more information (Table 4).

Professional scientists with the CTAP program monitor 30 sites per year. In 2000, citizen scientists monitored 309 sites (Table 4). Therefore, volunteers cover over 10 times the number of sites as professionals each year.

Table 4. Number of streams (sites) monitored by RiverWatch 1995–2000. This does not include sites where volunteers intended to monitor but could not due to flooding / low water.

Watershed	Streams in watershed	1995	1996	1997	1998	1999	2000
Rock	190	9 (10)	29 (35)	34 (40)	36 (47)	32 (46)	28 (36)
Fox	135	9 (9)	30 (42)	39 (64)	61 (110)	55 (88)	49 (84)
Kankakee	174	8 (11)	17 (21)	9 (10)	8 (9)	14 (20)	23 (24)
Spoon	133	10 (10)	15 (16)	13 (16)	15 (17)	14 (16)	13 (15)
Sangamon	136	2 (2)	20 (21)	11 (11)	3 (3)	10 (10)	14 (15)
Lamoine	191	16 (18)	22 (23)	29 (37)	32 (38)	36 (41)	32 (37)
Kaskaskia	195	4 (4)	29 (30)	43 (48)	41 (43)	40 (42)	34 (36)
Embarras	153	19 (23)	17 (21)	10 (14)	10 (11)	14 (17)	17 (20)
Little Wabash	120	4 (4)	4 (4)	3 (3)	4 (4)	5 (5)	0
Big Muddy	160	15 (16)	33 (36)	43 (45)	49 (55)	51 (56)	38 (42)
Total*	1587	96 (107)	216 (249)	234 (288)	259 (337)	271 (341)	248 (309)

*Number of streams is based on the Illinois Streams Information System database, which contains all streams that have a watershed size of 10 square miles or more. RiverWatch volunteers also monitor streams with watersheds smaller than 10 square miles.

RW Metrics

RW data are analyzed and evaluated using multiple metrics, including structural metrics (taxa richness and EPT richness), a community balance metric (% dominance), and a biotic index (the MBI) (Lenat and Barbour 1994). The use of several stream quality metrics that measure the macroinvertebrate community provides strength to an assessment of stream integrity since each metric provides a line of evidence for inferring stream health (Plafkin et al. 1989). The RW Macroinvertebrate Biotic Index

(MBI) is an index based on the relative pollution tolerances of macroinvertebrate taxa identified at a stream site. The IEPA modified the MBI from the Hilsenhoff Biotic Index (Hilsenhoff 1988), which provided family-level tolerance values for aquatic insects. The IEPA added tolerance values for non-insect macroinvertebrates, largely from best professional judgment of the conditions in which these taxa were found. A list of RW macroinvertebrate taxa and their respective tolerance values is in the appendices. The MBI calculation is as follows:

$$= \sum TV_i N_i / \text{Total } N$$

where TV_i is the tolerance value for a given taxon, N_i is the abundance of the taxon in the sample, and Total N is the abundance of all macroinvertebrates in the sample for which tolerance values exist. Other stream metrics include total taxa richness, EPT taxa richness, EPT%, Dominance%, and CO%. A more complete description of these metrics is provided in Table 5.

Table 5. Metrics used by RiverWatch Program, expected responses, and references.

Metric	Description	Response with Degradation	References
MBI	Ranges from 0 to 11	Increases	U.S. EPA (1996b)
Taxa Richness	Total number of taxa	Decreases	Barbour et al. (1999)
EPT Richness	Number EPT taxa	Decreases	Barbour et al. (1999)
EPT%	% abundance of EPT taxa	Decreases	Barbour et al. (1994) DeShon (1995)
Dominance%	% abund. top 3 taxa	Increases	Barbour et al. (1999)
CO%	% abund. Oligochaetes + Chironomids	Increases	Barbour et al. (1994)

8.0 TRAINING REQUIREMENTS / CERTIFICATION

EcoWatch Trainer Training

EcoWatch Trainers (ETs) are employed by the Illinois EcoWatch Program and are directly responsible for teaching all monitoring procedures to volunteers across the state. All ETs have a minimum of two years of college coursework in biology or a related field. However, the majority of ETs have a bachelor's degree in the biological sciences. RW requires new ETs to study all monitoring procedures and volunteer training requirements during their first two months with the program. RW provides all ETs with a detailed training guide on required topics to cover during training sessions. The guide used by ETs to instruct citizen scientists is provided in the appendices. Once trainers feel comfortable with the material, the RiverWatch Training Coordinator formally evaluates their abilities at a practice indoor and outdoor volunteer training session. Only ETs who pass this evaluation are allowed to train volunteers. In addition, all ETs must pass a written exam and a practical macroinvertebrate identification exam each year at a 90% accuracy level. First and second year ETs also conduct "practice" training sessions for other ETs and the RW Training Coordinator. Lastly, each year ETs are evaluated by the RW Training Coordinator while conducting an actual volunteer training session. The program dismisses ETs who cannot pass the exams. Those who pass the exams but whose performance is not satisfactory are required to complete additional training exercises as deemed appropriate by the RW Training Coordinator. Until their performance improves, ETs are not allowed to train volunteers without a qualified ET present.

Citizen Scientist Training

Volunteers must attend a training session to become recognized citizen scientists. Data may only be submitted by volunteers with a minimum of one citizen scientist per group. Training consists of an 8–10-hour training course. RW training is either comparable or longer in duration when compared to other volunteer monitoring groups. For example, the Virginia Save Our Streams Program training takes approximately three to four hours while the Maryland Stream Waders Program training is one day (Maryland Stream Waders Program 2001; Virginia Save Our Streams Program 2001). Training is conducted by the EcoWatch Trainers (ET) and encompasses field and lab instruction. The same guide is used for all sessions to provide consistency in volunteer training at a statewide level (see appendices).

Field training takes three to four hours to complete and RW maintains an ET:volunteer ratio of 1:4 during training. ETs use the field training to demonstrate procedures at the stream site for establishing a stream reach. Volunteers sketch the site and compare them for possible missing information. The ET defines each parameter on the data sheet, discusses its importance, and demonstrates how to estimate or measure it. Habitats where macroinvertebrates may be sampled are demonstrated at the field session. Volunteers help collect the macroinvertebrate sample and participate in a demonstration of sub-sampling. ETs emphasize the importance of verifying all data sheets in the field for completeness before leaving the stream site. RW encourages questions and active participation by the volunteer during the entire session.

The indoor or laboratory session instructs citizen scientists in basic insect morphology and the characteristics of each indicator organisms important for its identification. Volunteers also learn how to use an identification key, operate a microscope, and calculate the various metrics used to assess stream quality. Laboratory sessions take three to four hours with an expected ET:volunteer ratio of 1:10. ETs show photographic slides of the macroinvertebrates and key characteristics for each group are reviewed. Emphasis is placed on organisms that are commonly confused by volunteers. Microscope stations are set up with groups of organisms for volunteers to separate out and identify using keys and other aids. RW encourages volunteers to work with a partner and to compare their findings for each station with those of ETs.

Citizen scientists use the processed samples to fill out the Biological Survey Sheet. The ET completes the sheets on an overhead projector at the same time to familiarize volunteers with how to calculate stream quality indices including the MBI, taxa richness, and percent composition of indicator organisms.

ETs instruct volunteers on proper labeling of their macroinvertebrate samples. All samples labels are written in indelible ink or in pencil and inserted inside the tightly sealed container. The label should face outward so that it can be easily read from the outside. The label includes a unique site identification number, date of collection, name of collector(s), stream name, and county so that the sample can be easily matched with its data sheets. ETs also instruct volunteers on the proper procedures for preserving macroinvertebrate samples for storage.

Review Sessions

RW encourages citizen scientists to attend review sessions each year. Review sessions are similar in content to training sessions, but are of shorter duration. Any updates to the program or manual revisions are emphasized during review. Volunteers who do not attend reviews receive program updates through the mail. The content of the review is catered to the requests and concerns of the attending volunteers. Currently, RW is considering a more formalized review or certification procedure for veteran citizen scientists. Many other volunteer monitoring programs require certification by testing (Maryland Stream Waders Program 2001; Virginia Save Our Streams Program 2001). However, these programs do not require the submission of their macroinvertebrate samples making re-certification the only option for checking and eliminating identification problems.

Volunteer Feedback On Training and Review Sessions

RW monitors the quality of volunteer training sessions by regularly soliciting feedback from training session participants. ETs distribute **Volunteer Feedback Forms** to volunteers as part of a standard training packet and to all previously trained citizen scientists attending review sessions. New volunteers complete the form after attending both the lab and field components of the training program. Volunteer responses are reviewed by EW staff to ensure volunteer satisfaction with the program. RW distributes the results to ETs prior to the commencement of training activities for the next year. RW also provides many other opportunities for volunteer participation throughout the year including local stream clean-ups or events sponsored by RW partnership organizations. This allows volunteers to receive constant input into program content and offerings.

9.0 DOCUMENTATION AND RECORDS

Hard Copies

A hard file must be kept for each RiverWatch monitoring site. This file contains information on the site's landowner, location, and any other important characteristic information. This file acts as backup to the site identification database. It also includes any monitoring data for the site and a record of citizen scientist(s) responsible for monitoring the site. These files are maintained at the regional office serving the region in which the site is located. EW staff periodically review these files during field office visits. Each site file must include the following items:

1. **Site File Cover Sheet** serves as a quick reference sheet containing summary information for the site. It includes such information as landowner, citizen scientist names, site ID number, and comments concerning the site for each monitoring season.

2. **Site Map** highlights the site, including access points and surrounding roads.

3. **Site Evaluation Form** describes the site location, access points, suitability of the site, and landowner permission status.

4. **Site Identification Form** describes the location of the site, legal description, and other location descriptor information.

5. **Property Access Agreement Form** documents the landowner's permission to access the site for evaluation and monitoring purposes. It must be completed before monitoring starts.

6. **RW Data** *sheets* for the site are also included in the site file.

RiverWatch Databases

The EcoWatch Database Manager maintains the RW site description and site evaluation databases at a statewide level. The EW Database Manager reviews and confirms the following site information:

site name, site location (watershed, county, detailed location description, topographic map name, township, range, section and section quadrant), and site coordinates (latitude and longitude). The tools used to review the registration application are digital topographic software (Terrain Navigator by Maptech) and the Illinois Streams Information System's (ISIS) 10-watershed basin maps.

Each EcoWatch site identification number is comprised of seven digits with the program initials such as "R" for RiverWatch. The first two digits after the program letter are the ISIS's watershed numbers from 01 to 10. The next three digits after the watershed numbers are ISIS's stream numbers for RW. The last two digits of a site identification number signify the number of the site on a given stream or within a given county.

There are two versions of site ID databases, a database on the Web with simplified site information and another database with more detailed information. The Web version ID database is on a server hosted by an individual contractor. The Web address for the database is http://WWW.ecowatch.org/manage/index.htm. After each site receives a site ID number, the EcoWatch Database Manager notifies the regional EW offices and records the ID and related site information.

The Web version database includes the following information:

1. Site registration date and ID number,

2. Site name,

3. Watershed,

4. County,

5. Detailed location description,

6. Latitude/Longitude,

7. Topographic map name,

8. Township, range, section and section quadrat,

9. Unique section ID number,

10. Landowner/phone number, and

11. EcoWatch region and office.

The more detailed site ID database includes fields below in addition to the information listed above:

1. Site status,

2. Statewide ranking,

3. Ecosystem partnership,

4. Years site has been monitored, and

5. Site ownership (state, county, city, town, or privately owned).

These site databases are routinely updated. ETs send the manager a monthly regional site tracking file on the current status of sites. After every monitoring season the database is updated to reflect how long the site has been monitored and by which citizen scientist(s).

10.0 SAMPLING PROCESS DESIGN

The unique characteristics of Illinois and their influence upon a statewide monitoring program were considered when the sampling design for RW was developed. Many streams in Illinois do not contain rocky bottoms. For example, most reaches within the Big Muddy River system have clay and silt bottoms (Page et al. 1992). This meant that a monitoring program that involved sampling riffles only, like most volunteer monitoring programs, was not adequate for monitoring Illinois streams statewide (Dates and Byrne 1994; U.S. EPA 1996b). A program using separate protocols for the two types of streams was rejected since this would require volunteers to make a judgment call as to what type of stream they are monitoring and require a great deal of additional training that was not practical for volunteers to complete.

A multi-habitat approach was adopted to obtain a macroinvertebrate sample most representative of habitats available at most stream types across the state. Volunteers sample two of five listed habitats most likely to contain the highest abundance and diversity of organisms in each stream. Volunteers sample the same two habitats at a particular stream site over time to ensure data consistency. However, they have the option of sampling a different habitat when necessary (for example, snags may be washed downstream, requiring volunteers to sample a different habitat). This ensures all stream sites, whether rocky bottom or muddy bottom, will have habitat available for volunteers to sample. RW protocols were based on those recommended in the guide for Volunteer Intensive Stream Bioassessment (U.S. EPA draft) where a combined sample from two or three habitats was suggested in muddy-bottom streams. This design also ensures a manageable number of macroinvertebrates for volunteers to sort in approximately one to two hours. In addition, while sampling multiple habitats is necessary to obtain all species present, it is not needed to capture a representative sample of the several most abundant species in a stream reach (Diamond et al. 1996).

Monitoring Season

Volunteers monitor on an annual basis during the months of May and June. However, the season has been extended in previous years to July 15 when widespread environmental constraints, such as floods limiting safe access to sites, are less likely. Samples taken past June 30 are appropriately identified in the database.

Safety and Liability

Personal safety is a high priority of the RW program. Volunteers are instructed to never monitor a site alone. Volunteers are also instructed to use the following precautions described here and in the RW manual:

1. Always let someone know where one is going and when one plans to return,

2. Wear covered shoes when monitoring,

3. Watch out for poisonous plants, snakes, and biting insects, and

4. Do not monitor the stream if it is deemed unsafe because of obvious flooding or high velocity measurements.

All citizen scientists are required to sign liability waver forms when attending training sessions to ensure that EcoWatch and landowners are not held responsible for injuries or damages.

11.0 SAMPLING METHODS REQUIREMENTS

Equipment

Field equipment used in monitoring is listed in the *Stream Monitoring Manual*. Typically, small groups of volunteers borrow equipment from EW regional offices each year. Organizations or schools with funding tend to purchase the equipment from a recommended list of suppliers. An abbreviated list of required equipment includes the following.

1. **Dip net***:* 0.50 mm mesh, D-frame, hand length minimum of 5 feet marked in increments of 0.10 feet.

2. **Sub-sampling pan***:* white, no smaller than 10 X 13 inches and marked with grid squares of equal

size.

3. **Preserver**: 70% ethyl alcohol or 90% isopropyl alcohol.

4. **Measuring tape**: minimum of at least 50 feet marked in engineering rule (feet marked in tenths).

5. **Forceps, water droppers, alcohol thermometer, and pipettes**.

6. **Three-five-gallon bucket**.

All sampling procedures are discussed at length in the *Stream Monitoring Manual* (see appendices). An abbreviated version of the habitat and biological survey procedures is discussed here.

Habitat Survey

The habitat survey involves estimating percent cover of habitat features such as stream bottom embeddedness, stream substrate composition, and canopy cover over the stream reach. Volunteers also provide information on the past and present weather conditions, water odor, presence of submerged aquatic plants, presence of riparian vegetation, types of watershed land uses, and the amount of channelization. Additionally, stream discharge, velocity, depth, and width are estimated.

Biological Monitoring

Volunteers sample two of five habitat types typically containing the highest abundance and diversity of benthic macroinvertebrates. The potential habitats from which volunteers may sample are listed here from most diverse to least diverse: riffles, leaf packs, snag areas, undercut banks, and sediments. See the *Stream Monitoring Manual* in the appendices for detailed information on the monitoring procedures.

The two habitats selected are combined in a bucket to make one composite sample for the entire study reach. Subsequently, volunteers transfer sampling debris from the bucket to the sub-sampling pan. All large rocks, sticks, bark, and leaves are inspected for organisms and placed back in the stream. Visual inspection of the composite dictates the use of sub-sampling if more than 100 organisms are likely to result from the composite sample. See section 13.0 for a description of the sub-sampling procedure.

All macroinvertebrates collected or sub-sampled are identified to the appropriate taxonomic level of order or family. Volunteers use a dissecting microscope with a magnification range of at least 10X–30X to identify macroinvertebrates.

12.0 SAMPLE HANDLING AND CUSTODY REQUIREMENTS

All macroinvertebrates sampled are labeled by the volunteer using a standard format with the following information:

1. RW site identification number,
2. Date of collection,
3. Citizen scientist name(s),
4. County, and
5. Location description.

There is no formal chain of custody agreement form, as samples are not sent to an outside laboratory. Samples are turned into the EW regional office and stored. Samples that are selected for quality control checks are turned into the QA Officer, verified, and stored for a minimum of one year by the officer. Samples not used in quality control are stored for a minimum of one year at the respective EW office.

13.0 ANALYTICAL METHODS REQUIREMENTS

Most analytic methods discussed in the requirements for the QAPP, such as calibrating equipment for chemical testing, are not applicable to this program.

Sub-sampling Procedure

Volunteers are asked to use a sub-sampling technique if they collect a composite sample that at first inspection will likely yield more than 100 macroinvertebrates. They are asked to sort through sample debris subunits until 100 organisms have been obtained. Although more individuals would be desirable, the literature suggests that a sub-sample of 100 organisms may be considered a representative sample of macroinvertebrates from a stream site (Hilsenhoff 1982; U.S. EPA 1997). The option of sub-sampling helps to avoid volunteer fatigue when identifying organisms (U.S. EPA 1996b). A brief summary of the sub-sampling procedure is described here and is based on sub-sampling techniques used in Rapid Bioassessment Protocols for benthic macroinvertebrates (Barbour et al. 1999).

1. A sample is placed in a gridded white pan and ice-cold water is added to slow fast-moving organisms.

2. The pan is gently rocked to evenly distribute the organisms across the bottom and one grid location is randomly picked.

3. The sub-sample unit is removed from the selected grid and the organisms sorted from the debris and placed in alcohol. Remaining subunits continue to be randomly selected until there is a minimum of 100 organisms. However, once a grid has been started, it must be finished.

4. One specimen of each taxon not randomly selected is also included.

An estimate of the total number of organisms collected is determined by multiplying the number of organisms per square by the number of squares in the tray. See the *Stream Monitoring Manual* in the appendices for a thorough description of the sub-sampling procedure and the equipment used.

14.0 QUALITY CONTROL REQUIREMENTS

Macroinvertebrate Sample Submission

RiverWatch requires all volunteers to submit their macroinvertebrate sample to their regional offices. Data without a sample are not included in the database. All macroinvertebrate samples and data sheets must be turned in to the EW regional office by July 30. This acts as a quality assurance check by ensuring specimens are not misplaced before volunteers identify them. Data that were not turned in on time are also rejected from the database. This is in contrast to many volunteer monitoring programs, such as Virginia Save Our Streams Program and the Ohio Scenic Rivers Stream Quality Monitoring Program, where volunteers do not preserve their specimens for verification purposes. Volunteers with these programs identify the organisms in the field without a microscope and return them to the stream (Dilley 1991; Virginia Save Our Streams Program 2001).

Storing of Macroinvertebrate Samples

All volunteer macroinvertebrate samples are stored by RW staff for a minimum of one year for quality control purposes. After this time, specimens in good condition maybe used in regional reference collections for RW training sessions. Specimens in poor condition are discarded.

Macroinvertebrate Identification

RW instructs volunteers to pour the entire sample with the alcohol into a petri dish and to inspect the jar for organisms that may have stuck to the side when identifying and sorting samples. This minimizes the loss of small organisms during decanting. Next, citizen scientists sort the macroinvertebrates into groups based on general appearance. Specimens are then sorted into smaller groups based on the identification key and indicator quick reference cards. Beginning with the least numerous group of organisms in the dish, volunteers identify and count each taxon group. If in doubt, identification is double-checked by using another key or by asking for assistance from an ET. Final sample identification and number counts are recorded on the data sheets. Number totals and calculations are repeated until the same number is arrived upon twice. Volunteers are asked to note the number and type of nonindicator taxa found in the "macroinvertebrate notes section" of the data sheet. The section may also be used to describe any identification concerns or note any unknown specimens found in the sample.

Open Labs

Volunteers are encouraged to identify their macroinvertebrates at open laboratory sessions set up by the ET at convenient locations throughout the region (most volunteers do so). Volunteers may also set up an appointment at an EcoWatch Office to identify their specimens. ETs provide input and assistance if volunteers are unable to identify a taxon on their own.

Reference Collections

Each EW regional office maintains a Macroinvertebrate Reference Collection that is used by the ET for training and verification purposes. All reference collections include a minimum of one specimen for each indicator taxon. Specimens are preserved in 70% ethyl alcohol and labeled. ETs write the labels in indelible ink and include the taxon order, family, and common name. If possible, labels also note where the specimen(s) was collected, including the stream name, county, and location description. Specimens are identified using the RiverWatch Macroinvertebrate Key and other approved identification guides. These are checked periodically by the QA Officer and by INHS aquatic biologists.

15.0 INSTRUMENT / EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE REQUIREMENTS

RiverWatch equipment is available to volunteers at strategically placed local checkout stations as well as at regional offices. Equipment kits are checked annually by EcoWatch Trainers to evaluate their completeness and condition. RW instructs volunteers to check their equipment for damages before they go out to monitor their site. Volunteers turn in all damaged equipment to their regional office for repair or replacement if repair is impossible.

16.0 INSTRUMENT CALIBRATION AND FREQUENCY

This portion of the QAPP is not applicable to the RiverWatch program.

17.0 INSPECTION AND ACCEPTANCE REQUIREMENTS FOR SUPPLIES

RW uses dip nets for the biological survey. The nets are D-frame dip nets of 0.50-millimeter mesh size (US #30 sieve size) with a minimum handle length of five feet. All nets must meet these requirements to be used for monitoring. The program chose equipment suppliers based on their cost effectiveness and ability to consistently provide quality products.

18.0 DATA ACQUISITION REQUIREMENTS

The program uses indices based on those used by professional CTAP biologists and other state and federal agencies (Barbour et al. 1999; Deshon 1995; Hilsenhoff 1988). For example, the tolerance values for the RiverWatch MBI (Macroinvertebrate Biotic Index) are based on values assigned by the Illinois Environmental Protection Agency (IEPA). In instances where the IEPA identifies a taxon to lower levels than does RW, the mean of the tolerance values are used.

Recently, a comparison study concluded that MBI scores might not vary enough to discriminate RW sites based on stream quality. INHS stream ratings were not in agreement with RW ratings indicating that the RW MBI quality scale is less sensitive relative to that used by INHS (DeWalt 1999). This is not surprising considering that indices that identify taxa to the family level may not be sensitive enough to detect slight changes in stream quality along a good to poor spectrum (Penrose and Call 1995). RW is now considering rescaling the MBI to more accurately assess stream quality in the future. It has also added several other metrics useful in tracking stream health such as EPT taxa richness and taxa dominance.

19.0 DATA MANAGEMENT

Hard Copies

RW uses verification boxes on the data sheets and has strict guidelines for correcting mistakes to decrease data entry errors. Mistakes written on data sheets while monitoring are not erased or blackened. RW asks volunteers to place a single line through the error and write the correct answer next to it and note on the data sheet why the correction was made. RW requires volunteers to check their data sheets for completeness before leaving their stream site and to initial this on the first line of the verification box on each data page. Upon completion of the macroinvertebrate identification process indoors, the leader must again check all sheets and initial and date the second line in the verification box on each data sheet. Once the monitoring season has ended, volunteers turn in their original data sheets to their respective regional offices for data verification purposes. Finally, ETs check original data sheets for completeness and accuracy and initial the third line in the verification box on each data sheet.

On-line Data Entry

Volunteers who have access to the Internet and agree to enter their data online are given a username and password to access the database on the Web site. RW uses Microsoft Access 2000 for their database software. The Web site program design allows volunteers to enter data only for their own RW sites. Volunteers do not have access to other sites and cannot alter any other volunteer's data. Once data entry is complete, the volunteer submits it. The program returns the user to blank required fields and asks the user to enter something into those fields before being allowed to continue. This acts as an automatic quality control check to ensure data completion. This quality control check also eliminates calculation errors. As pages of data are submitted and the records in the database are updated, the completed pages become "grayed out", acting as a control check and eliminating duplications in the database. ETs enter data online for volunteers who do not have access to the Internet. ETs have access to all sites within their region and they can correct data that are entered incorrectly. ETs compare the online copy to the original data sheets and correct them before sending the completed database to the QA Officer. ETs contact citizen scientists for further information when data inconsistencies are detected that cannot be explained by entry error.

QA Officer Database Check

The final step for all data whether entered on-line by volunteers or ETs is a quality control check of the data by the QA Officer. The on-line data are again checked for completeness. See section 23.0 for additional information.

20.0 ASSESSMENTS AND RESPONSE ACTIONS

ET Assessments and Response Action

RW requires regional EW offices to communicate with each volunteer regarding their data and monitoring experience. ETs also check macroinvertebrate samples not selected by the QA Officer during verification. Personal letters are sent to volunteers describing identification problems that ETs detect in their samples. ETs document all correspondence with individual volunteers and keep the information in the site file.

RW encourages volunteers to attend review sessions or come into their regional office for individual assistance to maintain and improve their identification skills. In addition, ETs design their newsletters, reviews, and other activities to address current problems. ETs also accompany volunteers, who consistently submit "poor" data, to their stream site when they monitor. A review of procedures is made and suggestions provided to the volunteer on how to improve their sampling techniques.

QA Officer Assessments and Response Action

The QA Officer relays information on identification or counting errors to all EW staff, and the volunteers themselves through memos, meetings, reports, and the EcoWatcher Newsletter. See section 7.0 for information of how verification is conducted. RW has revised training and the manual numerous times to address errors and to clarify procedures where volunteers were having difficulty. For example, the program designed a new macroinvertebrate key with better pictures and descriptions to help volunteers tell the difference between difficult taxa such as operculate and right-handed snails. RW added a microscope station to the review and training sessions where volunteers sort bloodworms and midges in a petri dish to gain skill in differentiating the taxa from each other. These actions were in response to errors detected during QA Officer sample verification.

The program also conducts an evaluation of ETs each year; see section 8.0 for more information. EW staff also shadow procedures to determine if volunteers understand and collect data at an acceptable level. See section 7.0 for more information.

RW widely distributes all findings on data quality to EW personnel and posts the information on the Web site for interested volunteers or data users. In addition, data quality issues are routinely discussed at staff meetings.

21.0 REPORTS

EcoWatcher Newsletter

The quarterly published *EcoWatcher Newsletter* is the primary forum for discussing quality assurance issues with volunteers statewide. This newsletter is sent to all citizen scientists, landowners, and other interested groups and includes information on data results, quality assurance issues, and numerous other subjects.

Regional Newsletters

In addition to the *EcoWatcher*, each regional office has its own newsletter that addresses region-specific program issues on a quarterly basis.

Annual Reports

The QA officer produces year-end reports in the fall of each year. *The RW Verification Report* consists of the data results from the samples verified by the QA officer and includes guidelines and suggestions for reducing or eliminating taxa or counting errors. Information on how samples are checked is detailed in section 23.0. The report includes but is not limited to the following information:

1. Lists all sites rejected from inclusion to the statewide database due to error and the reason why the site was rejected (e.g. site was monitored in April before official monitoring season began May 1).

2. Volunteer misidentification and miscounts rates for each taxon using various statistics (see section 7.0 for specific information).

3. Comparison of QA Officer and volunteer results for the same samples when looking at the following measures: taxa richness, MBI scores, sample density, and percent-composition indicator organisms.

4. Specific guidelines and recommendations to increase accuracy rates for "problem" taxa or measures.

The *RW Summary Report* consists of the data results for the entire state. The report includes but is not limited to the following information:

1. Average MBI, taxa richness, sample density, and percent composition of indicator organism scores for each watershed.

2. Total number of streams monitored statewide and by watershed. Data comparisons are discussed in reference to previous monitoring years.

3. Statewide information on the occurrence and distribution of "macroinvertebrates of special interest."

Special Reports

The Quality Assurance Officer also produces special reports on shadowing results and other comparison studies periodically implemented by RW staff. Shadow reports include but are not restricted to the following:

1. Paired t-tests comparing results between volunteers and EW staff from the same shadowed site.

2. Ninety-five percent confidence intervals and error ranges for volunteer data in comparison to EW staff results.

3. Accuracy rates of volunteer data using percent deviations.

4. Recommendations for improving data quality.

In addition, RW data are used in the Annual CTAP Report in conjunction with data collected by CTAP professional scientists.

Report Distribution

All reports are available online at the EW Web site and are published in a condensed version in the *EcoWatcher Newsletter.* In addition, ETs use portions of these reports in feedback letters to volunteers, regional newsletters, and in other materials sent to volunteers. Finally, these reports are sent out to all EW Staff, ETs, and relevant CTAP staff including stream biologists at the INHS.

22.0 DATA REVIEW, VALIDATION AND VERIFICATION REQUIREMENTS

Minimum Data Requirements

The QA Officer reviews all data for verification purposes and has final decision as whether to accept or reject data. The QA Officer follows these minimum guidelines when deciding whether to accept or reject data:

1. Citizen scientists must monitor their site using the procedures as described in training and in the *Steam Monitoring Manual.*

2. Citizen Scientists must use RW approved monitoring equipment.

3. Citizen scientists must submit a complete macroinvertebrate sample and hard copies of data sheets. Samples containing only a portion of the total specimens collected are rejected.

5. The site must be monitored within the specified RW monitoring period.

5. The site monitored must meet minimum safety requirements and have all necessary paper work completed including site identification number and landowner permission.

Addressing Minor Errors

RW corrects minor errors by contacting the volunteer for clarification. If the volunteer is not able to supply the needed information, it is entered as a dash indicating the volunteer forgot to perform the given procedure. Documentation of these corrections and changes are inserted into the site's file at the regional offices.

23.0 VALIDATION AND VERIFICATION METHODS

Macroinvertebrate Sample Checks by QA Officer

The QA Officer verifies 30% of the macroinvertebrate samples each year. The QA Officer sorts and counts each randomly selected macroinvertebrate sample without any prior knowledge of the volunteer's results. The QA Officer's findings are then compared with the number and type of taxa within each sample determined by the volunteer. Taxa are considered misidentified if the volunteer records taxa not found by the QA Officer or when the QA Officer finds a taxa not recorded by the volunteer. Discrepancies in density within each taxon that cannot be attributed to misidentification are considered counting errors. Errors detected in the data during the verification process are corrected. The QA Officer then flags these verified sites in the database so data users can identify them. A report on these findings is written each fall and sent to all staff. A condensed version of the results is reported in a user-friendly format to volunteers in various newsletters.

Data Verification

All data undergo a rigorous quality control process including checks of all data sheets for completeness by the volunteers, ETs, and the QA Officer. Verification boxes are on each data sheet and must be initialed by volunteers and ETs to ensure all data sheets were checked for errors. Once data are entered into the database they are again checked for accuracy. RW built many quality control elements into the database field entries (see section 19.0).

All data (regardless of who entered it) are verified by the ETs after a minimum of 24 hours. Data entered by ETs (who do not have access to the Web site) are checked twice using a two-man data entry system. One ET enters the data and after a minimum of 24 hours and the second ET checks the data for completeness by comparing the database to the original data sheets. Finally, the QA Officer checks the database for errors and reviews all habitat and macroinvertebrate survey notes to ensure volunteers followed RW procedural guidelines. Questions concerning data inconsistencies are e-mailed to the respective ET. If the ET cannot address the issue by looking at the original data sheets, the volunteer is contacted. ETs will also flag a site for QA review if data is questionable.

Additional Verification Procedures

RW periodically implements comparability and replication studies to ensure data quality remains high. Identified problems are addressed in program changes or improvements. Specific examples of such studies are discussed below.

Comparison Studies with Professional Scientists

An on-going study is examining the congruence of RW and INHS professional scientist data (also discussed in sections 7.0 and 18.0). RW data must complement the professional data. A professional scientist collected macroinvertebrate samples from the same stream sites as the volunteers within a set time frame and compared indices obtained by the two groups. The RW MBI ratings and RW richness measures (EPT and total taxa richness) were compared to the professional measures of stream quality including EPT richness, Hilsenhoff Biotic Index (HBI), and habitat quality scores. Several RW richness measures were highly significantly ($p<0.01$) correlated with CTAP EPT richness suggesting that modeling of CTAP EPT using RW data is possible (DeWalt 1999). However, stream quality ratings between the two programs were not often congruent, suggesting that the use of the MBI as the sole metric should be avoided and that the relative importance of structural and community balance metrics should be greater, since they were highly correlated with professional data (see section 18.0).

24.0 RECONCILIATION WITH DATA QUALITY OBJECTIVES

Precision

EW is working to address both intra- and inter-observer data precision. Inter-observer precision has been addressed using shadowing (duplicate sampling) where two sets of data are collected using volunteers and EW staff at the same stream site. A previous shadowing study found no significant difference between volunteer and staff results for most habitat survey parameters (Brandon, 2001). For parameters where differences were detected, RW made procedural changes to help improve data precision. For example, additional information was inserted in the manual and greater time was spent in training to address volunteer confusion with the term embeddedness in 2001. Once volunteers have had a chance to use the new manual and have all undergone retraining, we will be able to conduct a follow-up study to determine if these changes had a positive result on data precision. Previously, procedures have been removed or altered when revisions still did not allow RW to meet data quality objectives. For example, volunteers conducted detailed habitat surveys based on an IEPA format during the first two years. Volunteers found the form extremely difficult to understand, and we failed to meet data quality objectives. Subsequently, the habitat survey was greatly simplified to accommodate volunteer capabilities.

RW plans but has not yet studied the precision of volunteer macroinvertebrate sampling using duplicate sampling with EW staff. Intra-observer precision was examined briefly in the DeWalt study

(1999) and additional studies will be completed in the near future. Once RW has more information, it will be able to make programmatic changes where necessary.

Accuracy

RW strives to meet an 80% accuracy rate for taxon identification and abundance. Verification checks by the QA Officer are completed on the macroinvertebrate samples each year. The majority of taxa do meet the 80% accuracy rate with no significant difference between volunteer and QA Officer results for taxa richness, sample density (abundance), and MBI (Table 3). However, taxa that are consistently misidentified have been targeted for new training strategies. Currently, RW has not substantially increased the accuracy rate for some difficult taxa including bloodworms and "other caddisfly." RW is in the process of evaluating what changes will be necessary to improve accuracy for these taxa. In the interim, samples verified by the QA Officer are corrected when taxa are misidentified. Verified data (with correct identification) are flagged in the database allowing data users to use subsets of the data known to meet data quality objectives.

There is no equivalent procedure for evaluating the habitat survey; we are not certain at this time if the habitat survey is meeting data quality objectives (80% accuracy). RW plans to conduct a study to compare professionally collected habitat information with volunteer data. However, a continuing comparison study was implemented in 1998 to examine the congruence of volunteer and professionally collected data. Several richness measures were positively correlated suggesting that some RW metrics accurately predict species richness (DeWalt 1999). Problems were also identified in the study including discrepancies between the two groups in assigning stream quality ratings for sites using the MBI. In response, RW began to de-emphasize the MBI as the primary metric for evaluating streams. RW is currently considering changes to the tolerance values for taxa to more accurately rate stream quality using the MBI.

Representativeness

The representativeness of RW data across sites (at a statewide scale) was originally dependent upon volunteer selected sites. However, it was determined that volunteers were frequently selecting "higher" quality sites, unrepresentative of typical Illinois streams. RW has since adopted a protocol using randomly selected sites in addition to maintaining sites chosen by volunteers. As a result, the proportion of randomly selected versus volunteer selected sites has increased from 0% to 10%. The emphasis on randomly chosen stream sites addresses a data quality objective since this provides RW with data from sites that more accurately represent stream conditions statewide and also allows us to place the volunteer selected sites in context to more typical stream conditions.

RW protocols for sampling habitats were developed with the best information available at the time from both INHS survey scientists and the U.S. EPA. Since then, the U.S. EPA has recommended sampling from four standard habitats (1997), which is not the protocol currently used by RW. RW is now awaiting results from IEPA's new habitat sampling methods piloted in 2001 to see if they provide consistent and better results than previous methods.

Comparability

Data comparability from the same sites over time is maintained by the use of standard operating procedures, which were discussed throughout this report. RW data are also comparable to professional CTAP data when using data subsets. In an ideal world both volunteers and professional scientists would collect stream data using the same methods. However, using the same method is not likely among different agencies with different reasons for collecting data and varying levels of technical skill (Barbour et al. 1999). The best alternative is to document performance-based characteristics such as precision, accuracy, and representativeness of one's methods so that direct comparisons can be made with other programs (Barbour et al. 1999; Diamond et al. 1996). Performance-based characteristics of our data have been made throughout this QAPP. However, we have not made direct comparisons of our data with other groups. RW would be interested in conducting such a study in the future.

Completeness

The original goal for RW was to monitor 10% of the total streams in the state. RW has exceeded this goal in most watersheds (Table 4). The exception being the Little Wabash where we have not met our data quality objective. Due to regional demographics it is unlikely we will have an adequate number of volunteers for some watersheds. RW has used EW staff to supplement data sets for watersheds where volunteers were not recruited. However, RW is still working on strategies to increase the volunteer recruitment in these regions.

25.0 RW INTERNET RESOURCES

The following is a list of resources available at the RW Web site related to QA with a brief description:

Database management Web site where volunteers enter their data:
http://WWW.ecowatch.org/manage/index.htm

Downloadable databases for all stream data starting in 1995:
http://dnr.state.il.us/orep/inrin/ecowatch/RIVER/Data1.htm

The annual data summary report for 2000:
http://dnr.state.il.us/orep/inrin/ecowatch/RIVER/DATA/RW2000DataSummary.htm

Report on the accuracy of volunteer data for 1999:
http://dnr.state.il.us/orep/inrin/ecowatch/RIVER/DATA/Bluetechreport2.htm

Report on the congruence of RW data with professional data collected by CTAP professional scientists: http://dnr.state.il.us/orep/inrin/ecowatch/RIVER/streamstudy.pdf

The quarterly statewide newsletter for EcoWatch Network volunteers:
http://dnr.state.il.us/orep/inrin/ecowatch/NEWS/EcoWatch vol4n1/index2.html

RW Methods Manual detailing how the data is collected and organized in the database.
http://dnr.state.il.us/orep/inrin/ecowatch/RIVER/DATA%5CMETHODSMANUAL.htm

Pictures and descriptions for all RW indicator organisms: http://dnr.state.il.us/orep/inrin/ctap/bugs/

RW macroinvertebrate key: http://dnr.state.il.us/orep/inrin/ecowatch/RIVER/NewKeyWeb.pdf

Fact sheet describing organisms reported but not necessarily collected by volunteers:
http://dnr.state.il.us/orep/inrin/ecowatch/RIVERBUGS/Macroinfo2.pdf

LITERATURE CITED

Bailey, S.D., A.L. Brandon, C.J. Carroll, R.E. DeWalt, J.L. Ellis, R.L. Jack, G.R. Spyreas, W.G. Ruesink. 2000. Critical Trends Assessment Program update. Illinois Natural History Survey Reports Winter 2001 (No. 366):1–12.

Barbour, M.T., M.L. Bowman, and J.S. White. 1994. Evaluation of the biological condition of streams in the middle Rockies—central ecoregion. Prepared for Wyoming Department of Environmental Quality.

Barbour, M.T., J. Gerritsen, B.D. Snyder, and J.B. Stribling. 1999. Rapid bioassessment protocols for use in streams and wadeable rivers: periphyton, benthic macroinvertebrates and fish, 2nd edition. EPA 841-B-99-002. U.S. Environmental Protection Agency; Office of Water; Washington, D.C.

Brandon, A.L. 2001. Assessing the accuracy of Illinois RiverWatch data: study results 1999. Illinois Natural History Survey, Champaign, IL, Office of the Chief, Technical Report 2001(1). 6 pp.

Dates, G., and J. Byrne. 1994. (Draft). River Watch Network benthic macroinvertebrate monitoring manual River Watch Network, Montpelier, Vermont.

DeShon, J.E. 1995. Development and application of the invertebrate community index (ICI). Pages 217–243 in W.S. Davis and T.P. Simon, eds. Biological assessment and criteria: tools for water resource planning and decision making. Lewis Publishers, Boca Raton, Florida.

DeWalt, R.E. 1999. Congruence of RiverWatch and CTAP stream bio-monitoring data: red study results for 1998. Illinois Natural History Survey, Champaign, IL, Center for Biodiversity, Technical Report 1999 (15). 17 pp.

Diamond, J., M. Barbour, and J. Stribling. 1996. Characterizing and comparing bioassessment methods and their results: a perspective. Journal of the North American Benthological Society 15 (4):713–727.

Dilley, M. 1991. A comparison of the results of a volunteer stream quality monitoring program and the Ohio EPA's Biological Indices. Undergraduate thesis, Ohio State University, Columbus.

Firehock, K., and J. West. 1995. A brief history of volunteer biological water monitoring using macroinvertebrates. Journal of the North American Benthological Society 14(1):197–202.

Hilsenhoff, W.L. 1982. Using a biotic index to evaluate water quality in streams. Technical Bulletin No. 132. Department of Natural Resources, Madison, WI.

Hilsenhoff, W.L. 1988. Rapid field assessment of organic pollution with a family-level biotic index. Journal of the North American Benthological Society 7:65–68.

Illinois Department of Natural Resources. 2001a. Illinois RiverWatch stream monitoring manual. Illinois Department of Natural Resources, Springfield, IL.

Illinois Department of Natural Resources. 2001b. Critical trends in Illinois ecosystems. Illinois Department of Natural Resources, Springfield, IL.

Illinois Environmental Protection Agency. 1994. Illinois water quality report 1992–1993. Volume 1. Illinois Environmental Protection Agency, Bureau of Water, Springfield, IL.

Johnston, D.M., M. Hinrichs, L.D. Hopkins, and D. Phillipe. 1991. Illinois streams information system computer users manual. Department of Landscape Architecture, Department of Urban and

Regional Planning, University of Illinois.

Kopec, J., and S. Lewis. 1983. Stream quality monitoring. Ohio Department of Natural Resources, Division of Natural Areas and Preserves, Scenic Rivers Program, Columbus, OH.

Lenat, D., and M. Barbour. 1994. Using benthic macroinvertebrate community structure for rapid, cost-effective, water quality monitoring: Rapid bioassessment in S. Loeb and A. Spacie, eds. Biological monitoring of aquatic insects. CRC Press Inc., U.S.A.

Maryland Stream Waders Program. 2001. Stream waders volunteering monitoring program: Maryland Department of Natural Resources. http://www.dnr.state.md.us/streams/mbss/mbss_volun.html

Page, L.M., K. Cummings, C. Mayer, S. Post, and M. Retzer. 1992. Biologically significant Illinois streams: an evaluation of the streams of Illinois based on aquatic biodiversity. Illinois Natural History Survey, Champaign, IL, Center for Biodiversity, Technical Report (1)264–272.

Penrose, D., and S. Call. 1995. Volunteer monitoring of benthic macroinvertebrates: regulatory biologists' perspectives. Journal of the North American Benthological Society 14(1):203–209.

Plafkin, J.L., M.T. Barbour, K.D. Porter, S.K. Gross, and R.M. Hughes. 1989. Rapid bioassessment protocols for use in streams and rivers: benthic macroinvertebrates and fish. U.S. Environmental Protection Agency, Office of Water, Assessment and Watershed Protection Division, Washington, D.C. EPA/440/4-89-001.

Stoeckel, Denise. (unpublished) IRWN citizen scientist stream monitoring program, 1995 annual report. Illinois Natural History Survey, Champaign, IL.

United States Environmental Protection Agency. (Draft) Volunteer stream monitoring: a methods manual, United States. Office of Water.

United States Environmental Protection Agency. 1996a. The volunteer monitor's guide to quality assurance project plans. Office of Wetlands, Oceans, and Watersheds. 4503F EPA 841-B-96-003.

United States Environmental Protection Agency. 1996b. Proceedings of the fifth national volunteer monitoring conference: promoting watershed stewardship. August 3–7, Madison, Wisconsin. Office of Water. EPA 841-R-97-007

United States Environmental Protection Agency. 1997. Volunteer stream monitoring: a methods manual, United States. Office of Water. 4503F EPA 841-B-97-003.

United States Environmental Protection Agency. 1998a. National directory of volunteer monitoring programs. Office of Water. http://www.epa.gov/OWOW/monitoring/dir.html

United States Environmental Protection Agency. 1998b. EPA guidance for quality assurance project plans. Office of Research and Development. EPA/600//R-98/018.

Virginia Save Our Streams Program. 2001. The modified VA Save Our Streams method. http://www.sosva.com/methods.htm

RW QAPP Appendix

- List of RW Indicator Organisms
- RW Site Evaluation Form
- RiverWatch Site Identification Form

Note: The Stream Monitoring Manual, Data Sheets, and Training Guide are not included here but are available upon request.

Macroinvertebrate taxa identified by RiverWatch volunteers with their tolerance values; values range from 1.5 to 10 with 10 being the most tolerant and 1.5 being the least tolerant to pollution.			
Common name	Order	Family	Tolerance Value
Flatworm	Turbellaria	-	6.0
Aquatic Worm	Oligochaeta	-	10.0
Leech	Hirudinea	-	8.0
Sowbug	Isopoda	-	6.0
Scud	Amphipoda	-	4.0
Dragonfly	Odonata	-	4.5
Broadwinged Damselfly	Odonata	Calopterygidae	3.5
Narrow-winged Damselfly	Odonata	Coenagrionidae	5.5
Hellgrammite	Megaloptera	-	3.5
Torpedo Mayfly	Ephemeroptera	Isonychiidae	3.0
Swimming Mayfly	Ephemeroptera	Baetidae, Siphlonuridae & Ameletidae	4.0
Clinging Mayfly	Ephemeroptera	Heptageniidae	3.5
Crawling Mayfly	Ephemeroptera	Tricorythidae & Caenidae	5.5
Burrowing Mayfly	Ephemeroptera	Potamanthidae & Ephemeridae	5.0
Other Mayfly	Ephemeroptera	All other families	3.0
Armored Mayfly	Ephemeroptera	Baetiscidae	3.0
Stonefly	Plecoptera	-	1.5
Hydropsychid Caddisfly	Trichoptera	Hydropsychidae	5.5
Saddle Case Caddisfly	Trichoptera	Glossosomatidae	0
Snail Case Caddisfly	Trichoptera	Helicopsychidae	3.0
Non- hydropsychid Caddisfly	Trichoptera	Various families	3.5
Riffle Beetle	Coleoptera	Elmidae & Dryopidae	5.0
Water Penny Beetle	Coleoptera	Gyrinidae	4.0

Whirligig beetle	Coleoptera	Psephenidae	4.0
Crane Fly	Diptera	Tipulidae	4.0
Biting Midge	Diptera	Ceratopogonidae	5.0
Bloodworm	Diptera	Chironomidae	11.0
Midge	Diptera	Chironomidae	6.0
Black Fly	Diptera	Simuliidae	6.0
Snipe Fly	Diptera	Athericidae	4.0
Other Fly	Diptera	Various families	10.0
Left-handed Snail	Basomamatophora	Physidae	9.0
Right-handed Snail	Basomamatophora	Lymnaeidae	7.0
Planorbid Snail	Basomamatophora	Planorbidae	6.5
Limpet	Basomamatophora	Ancyclidae	7.0
Operculate Snail	Mesogastropoda	Viviparidae	6.0

EcoWatch
NETWORK

RIVERWATCH
SITE EVALUATION FORM

RiverWatch

EcoWatch Network Regional Office: ______ **Circle One: ACCEPTED REJECTED**

Site Name: ______________________________ **Evaluation Date:** ________________

1. Owner / Manager Access Permission. _____YES ______NO

An X in the YES space indicates that a PROPERTY OWNER ACCESS PERMISSION form has been signed and completed for this site. The signed permission form must accompany the registration materials prepared for this site.

Landowner's Name: ________________________ **Phone Number:**
____

2. Protected Areas. Please check one.

❑ The site is located in an Illinois Nature Preserve/Illinois Land and Water Reserve.

NAME of PRESERVE
/RESERVE:____

NOTE: If the potential site is located within an Illinois Nature Preserve or an Illinois Land and Water Reserve, a permit MUST be requested from the Illinois Nature Preserves Commission. A permit may take up to, or more than, 30 days to receive. Permit application does not guarantee permission to monitor.

❑ The site is not located within an Illinois Nature Preserve nor an Illinois Land and Water Reserve.

3. Directions to Site. Provide directions to the stream site. Be specific in your directions. You may include travel routes and any obvious landmarks. Indicate where and how far one would walk or drive from an obvious reference point. For example: *Travel south on St. Hwy. 105 to Old Farm Road. Turn left. The stream is located underneath the third bridge crossing. You will see a foot bridge downstream. The beginning of the 200 ft site is marked by a large rock located 100 ft downstream from the foot bridge. Use the rock as your zero point and measure 200 ft downstream.*

4. Suitability of Site. Evaluate the site according to the physical and safety criteria.

PHYSICAL SUITABILITY	
❑ *Location*	If the site is located at a bridge crossing, the site must be located a minimum of 100 feet upstream or downstream from the bridge.
❑ *Depth*	The site must be wadeable; knee deep or less across most of the entire site at time of monitoring.
❑ *Stream flow*	An estimate of the stream flow must not exceed 9 ft^2/sec at the time of monitoring. If the product of the depth (feet) and velocity (feet/second) exceed nine, the stream flow is generally considered unsafe for monitoring. (stream flow = depth X velocity)
SAFETY	
❑ *Safe access*	The site must be safely accessible for monitoring activities and be located in an area free of dangerous waste, debris and other threats to personal safety. Parking availability must allow ample space for the safe loading and unloading of monitoring equipment. Bank stability and slope must be sufficient to allow safe, easy access to the stream from at least two points along the study reach.
❑ *Parking*	Location of parking and the number of cars that may be parked in this area: ________________ ____ ____ __________

EcoWatch
NETWORK

RIVERWATCH
SITE EVALUATION FORM

SITE NAME:____

5. General Observations. Provide any information in the space below that you feel is necessary to prove that the site is suitable or unsuitable for monitoring. This information may include notes and/or drawings. Note the presence of any possible hazardous condition and include any additional directions or observations about the location or condition of this site which may be of assistance to someone monitoring it for the first time. These notes may also include information concerning parking or finding the site.

COMPLETED BY: ______________________________ DATE: ________________________

EcoWatch NETWORK

RiverWatch

RIVERWATCH
SITE IDENTIFICATION FORM

1. SITE NAME: ______________________________

Use the name of the stream as it appears on a USGS 7-minute topographic map, or some other reliable road map. If the name of the stream is unknown, write "UNKNOWN STREAM", or ask the people who live around the stream if they know of a name for the stream.

2. WATERSHED NAME: ____________________________

Use one of the names of the 10 watersheds recognized by the EcoWatch Network (see list below).

3. COUNTY: ______________________________

Write the name of the county that the stream site lies within.

4. LOCATION DESCRIPTION: ____

Provide a brief statement on the direction and distance of the site from a stationary landmark that can be identified on a road map or topo map. A stationary landmark can be defined as a town, church, school, bridge, road, or road crossing. For example, a location description for a stream site would be written as: 1/2 MILE *SOUTH OF THE INTERSECTION OF CR 1200 E AND CR 800 N.*

5. LATITUDE: __________________ **LONGITUDE:** ______________

Latitude and longitude coordinates are to be written as decimal degrees to 4 decimal places. For example: *20.0075°*

How did you acquire the longitude/latitude coordinates? (Circle one) GPS TOPO MAP ArcView Unknown

6. TOPOGRAPHIC MAP NAME: ______________________________

Write the name of the **USGS 7-minute topographic map** that was used to determine the legal description of the site. The name of the map can be found in the upper and lower right hand corners of the map.

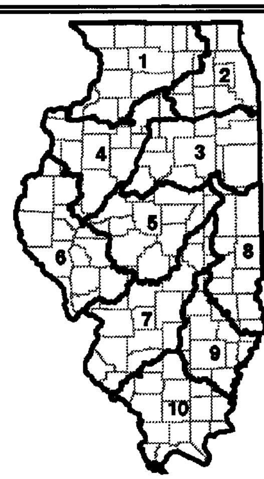
7. RANGE: ________ **TOWNSHIP:** ________ **SECTION:** ________ **QUARTER SECTION:** ________

Write the range, township, section and quarter section values in the blanks above.

8. VOLUNTEER NAME(S) (First and Last): ____

Watershed names used by EcoWatch Network programs:

1. Rock River
2. Fox and DesPlaines Rivers
3. Kankakee, Mackinaw, and Vermilion Rivers
4. Spoon River
5. Sangamon River
6. LaMoine River
7. Kaskaskia River
8. Embarras and Vermillion Rivers
9. Little Wabash River
10. Big Muddy River



DO NOT WRITE IN THIS SPACE. PROGRAM USE ONLY

Program Partner: ______________________________

Ecosystem Partnership: ______________________________

Unique Section ID: ______________________________

SITE ID #: ______________________________

DATE: ______________________________