

CHAPTER II: AN OVERVIEW OF THE STUDY DESIGN PROCESS

Designing a river or lake monitoring study is a straight-forward process. This process typically consists of 9 steps. Each of these steps is described briefly below.

Step 1: Getting Started -- Organize A Technical Committee

Form a technical committee of people who can provide you with advice and assistance in preparing your study design. Several options are presented in this guide. Your technical committee can help you make the choices.

Step 2: Why Are You Monitoring?

The next step in your study design is to define the questions you would like to answer by monitoring. Why are you monitoring? What specific water-related questions are you trying to answer? Questions addressed by each of the surveys in this guide are listed in Chapter III.

Step 3: What Will You Monitor?

The Merrimack River Watershed is a very complicated system of inter-related physical, chemical, and biological characteristics. The characteristics that are measurable are often referred to as "indicators."¹ Which indicators you choose to monitor will depend upon the question(s) you are asking as well as your available human and financial resources.

Things To Consider In Selecting Indicators:

Scientific Considerations:

- Does it help answer your question?
- Can you measure and quantify it?
- Does it respond to changes over a reasonable time period?
- Does it respond to the impacts you're evaluating?
- Can you isolate the conditions that cause it to change?
- Does it integrate effects over time and space?
- Does it respond to changes in other indicators?
- Is it a true measure of an environmental condition?

¹ The Intergovernmental Task Force on Monitoring Water Quality (ITFM) defines "environmental indicator" as follows: "A measurable feature which singly or in combination provides managerially and scientifically useful evidence of environmental and ecosystem quality or reliable evidence of trends in quality." ITFM, 1993 Report, Technical Appendixes, Appendix A.

- Is there a benchmark or reference condition against which it can be evaluated?
- Does it provide early warning of changes?

Practical and Program Considerations:

- Do you have the human and financial resources to measure it?
- How difficult is it to monitor?
- Does it help you understand a major component of the ecosystem?
- Is it understandable/explainable to your target audience?

Some indicators, such as heavy metals and many complex chemical contaminants such as pesticides, are not recommended for volunteer monitoring since they are difficult to sample and require expensive and sophisticated laboratory equipment and procedures to analyze.

Chapter III lists a menu of indicators appropriate for each survey.

Step 4: What Are Your Data Quality Goals?

Who is expected to use your monitoring information? How will they use it? How accurate does your information need to be? These are expressed in terms of data quality goals, or your general intentions and hopes for use of your data. They are listed for each survey. The one(s) that the survey addresses are checked.

Step 5: How Will You Monitor?

Determining how you will monitor involves making choices as to the appropriate monitoring approach, as well as the specific field and lab methods that you will use.

Things To Consider In Selecting Methods:***Scientific Considerations:***

- Does it meet your data quality requirements?
 - How accurate is it?
 - How precise (reproducible) is it?
 - How sensitive is it?
- Will it measure the indicator in the range that you need?
- What lab facilities are required?
- What equipment is required?
- Does it yield samples that are representative?
- Is it comparable to methods used by agencies collecting similar information?

Practical and Program Considerations:

- Do you have the human and financial resources to do it?
- How difficult is it?
- How time-consuming is it?
- Will it produce data useful to the target audience?

This guide lists examples of acceptable analytical methods for each water quality indicator for each survey.

Step 6: Where Will You Monitor?

Sampling locations are selected to answer your question(s). This guide lists site selection criteria for each survey.

Step 7: When Will You Monitor?

Next, you will put together your sampling schedule. Since the time of day, holding frequency, and time of year sampled greatly affect your results, consider these when you establish the sampling schedule. This guide suggests the frequency, time of day and year in, and weather conditions for each survey.

Step 8: Who Will Monitor?

Who is going to collect and analyze the samples? How are volunteers going to be trained? Who will coordinate their activities?

Make a list of all the tasks that need to be done and identify someone to be in charge of each task. Some examples of the necessary jobs are volunteer coordinator, field monitor, lab analyst, lab coordinator, sampling team leader, data manager, quality assurance supervisor, etc.

Step 9: What Are Your Quality Assurance Measures?

Quality Assurance (QA) measures are the operating procedures used to assure and assess the quality of the information you collect. QA is designed to assure that the information you collect meets your data quality goals as described in Step 4. This guide suggests quality assurance measures for each indicator for each survey.

A Final Word About Study Design – Put It In Writing and Evaluate It Annually

When you've answered the above why, what, how, where, when, and who questions, it's very important to organize and write down the answers in a study design document. This is your program's basic reference document.

You will need to re-evaluate and, if necessary, rework your study design annually, considering the results of your previous year's work.

The study design process may seem like a lot of work. However, time spent on designing the study can ultimately save you and your volunteers many hours of wasted effort and frustration by assuring that your monitoring matches your goals and resources.