

Estimating Monitoring Costs

Monitoring and Assessment for Watershed Plans
November, 2007

Assumptions

- **Watersheds: 14-digit HUAs**
 - **5,000 Acres**
 - 50 miles driven for site selection/prep
 - 6 miles driven for sampling events
 - **20,000 Acres**
 - 80 miles driven for site selection/prep
 - 13 miles driven for sampling events
 - **Laboratory 60 mile R/T away**
- **\$0.40/mile driving**
- **Labor costs:**
 - **Field staff = \$27/hour**
 - **Volunteers = \$0/hour**

Assumptions

- All monitoring completed in 1 year
- 4 monitoring sites per watershed except Scenarios 8 & 9
- Sampling frequency sufficient for use support analysis
- Every sample replicated (excessive)
- Macroinvertebrate sampling equipment needs from EPA RBP
- Staff gage at each site except Scenario 7
- Incubator holds 16 E. coli samples

Assumptions

- **No site access fees**
- **No LU/LT treatment tracking**
- **Data analysis performed by group collecting samples**
- **Office supplies = ink and paper**
- **100 paper and CD copies of all annual/final reports**

Cost Items

- **Salaries**
- **Site Selection**
- **Site Establishment**
- **Installed Structures**
- **Fees**
- **Monitoring Equipment Purchase & Rental**
- **Monitoring Supplies**

Cost Items

- **Travel and Vehicles**
- **Laboratory Analysis**
- **Office Equipment and Supplies**
- **Electricity and Fuel**
- **Site Service and Repair**
- **Data Analysis, Reports, and Printing**
- **Station demolition/site restoration**

RBP Field Equipment Needs

(Barbour, et al., 1999)

- **Standard kick-net, 500 F opening mesh, 1.0 meter width**
- **Sieve bucket, with 500 F opening mesh**
- **95% ethanol**
- **Sample containers, sample container labels**
- **Forceps**
- **Pencils, clipboard**
- **Benthic Macroinvertebrate Field Data Sheet***
- **First aid kit**
- **Waders (chest-high or hip boots)**
- **Rubber gloves (arm-length)**
- **Camera**
- **Global Positioning System (GPS) Unit**

RBP Analysis Equipment Needs

(Barbour, et al., 1999)

- **Log-in sheet for samples**
- **Standardized gridded pan (30 cm x 36 cm) with approximately 30 grids (6 cm x 6 cm)**
- **500 micron sieve**
- **Forceps**
- **White plastic or enamel pan (15 cm x 23 cm) for sorting**
- **Specimen vials with caps or stoppers**
- **Sample labels**
- **Standard laboratory bench sheets for sorting and identification**
- **Dissecting microscope for organism identification**
- **Fiber optics light source**
- **Compound microscope with phase contrast for identification of mounted organisms (e.g., midges)**
- **70% ethanol for storage of specimens**
- **Appropriate taxonomic keys**

Scenarios

- 1. E. coli - 5 samples/30 days**
- 2. E. coli - 10 samples; 2 incubators**
- 3. E. coli - 20 samples; 3 incubators**
- 4. N, P, D.O., stage – 3 samples**
 - a. HRW-NO₃, NO₂, Ortho-PO₄, D.O., stage**
 - b. Paid - NO₃ + NO₂, TP, D.O. probe, discharge**
 - c. HRW- Lab for N, P; D.O. probe, stage**
- 5. N, P, D.O., stage – 20 samples**
- 6. N, P, D.O., stage – 20 samples plus
Scenario 1**

Scenarios

- 7. Bugs and habitat – 1 sample, no staff gage**
 - a. Kick net, trays, and tweezers for Kick method**
 - b. With/without RBP equipment, paid**
- 8. Refrigerated automatic samplers, bugs, habitat – 6 Years for 1 site**
 - b. Paid**
 - c. Volunteers do 40 of 52 sampling trips; 1 day of training**
- 9. Scenario 8 with no new equipment**

Scenarios

- **Two basic variations on each scenario**
 - **Volunteers perform all labor (e.g., Hoosier Riverwatch) and conduct all analyses in the field**
 - **Paid state/local/contractor staff perform all labor and use laboratories for chemical analyses**
- **A mix of volunteer labor and professional laboratory analysis was assumed for Scenarios 4c and 5c to provide data suitable for use support analysis.**

Scenario 8

- 1. Tipping bucket rain gage**
- 2. Stilling well, float gage, and staff gage**
- 3. Bubble flow meter**
- 4. Power drop**
- 5. Refrigerated Isco model 6712FR sampler**
- 6. Isco Flow Link software and 581 RTD**

Scenario 8 (cont.)

- 7. Weekly flow-based composite samples – 2 bottles**
- 8. EPA Method 353.2 - NO₂+ NO₃ by colorimetry**
- 9. EPA Method 365.4 – Total Phosphorus by automated colorimetry**
- 10.2710 OxyGuard D.O. Probe**
- 11. RBP equipment**

Results

- **Cost difference between 5,000 acre and 20,000 acre watershed trivial for volunteers so used 20,000 acres**

Cost Summary

Scenario (HRW)	Cost (\$)	Scenario (Paid/Lab)	Cost (\$)	Scenario (HRW/Lab)	Cost (\$)
1a	1,130	1b	4,874	1c	1,958
2a	1,300	2b	7,440	2c	2,904
3a	1,544	3b	12,626	3c	4,796
4a	1,120 ^a	4b	7,272	4c	2,665 ^b
5a	1,734 ^a	5b	20,388	5c	7,833 ^b
6a	1,867 ^a	6b	24,972	6c	13,632 ^b
7a	741	7b	7,101 ^c 2,911 ^d		
		8b	62,429	8c	40,210
		9b ^d	39,557	9c ^d	17,338

^aN, P, and D.O. may not meet needs for use assessment

^bAll samples suitable for use assessment

^c Includes purchase of GPS, camera, 2 microscopes, and other equipment

^d Assumes no new equipment purchases

Results

- **Volunteers can perform use support analysis with E. coli samples for \$285-\$325/site (Scenarios 1a and 2a)**
- **Using a D.O. probe and lab for N & P, volunteers can perform 3-sample Aquatic Life use support analysis and D.O. for under \$700/site. (Scenario 4c)**
- **Salary accounts for 33-83% of total costs when volunteers not used**
 - **60-62% for Scenarios 1b, 2b, 3b**
 - **36-49% for Scenarios 4b, 5b, 6b**

Closing Thoughts

- **Data that don't support the purpose have no value regardless of the cost**
- **Purchase the right equipment**
- **Monitor the right variables**
- **Use the right methods**

References

- **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, Second Edition.* EPA 841-B-99-002. U.S. Environmental Protection Agency; Office of Water; Washington, D.C.**