

Appendix C
Lower Delaware Monitoring Program
Site Information and Quality Assurance and Control

Table C1: Continuous-Recording Water Quality and Flow Measurement Monitoring Locations, Delaware Water Gap to Trenton

| Location | Agency | Type |
|----------|--|--------------------------|
| 01443280 | East Branch Paulins Kill near Lafayette, NJ | USGS Continuous |
| 01443500 | Paulins Kill at Blairstown, NJ | USGS Continuous |
| 01443900 | Yards Creek near Blairstown, NJ | USGS Continuous |
| 01445500 | Pequest River at Pequest, NJ | USGS Continuous |
| 01446500 | Delaware R. at Belvidere, NJ | USGS Continuous** |
| 01447500 | Lehigh R. at Stoddartsville, PA | USGS Continuous** |
| 01447800 | Lehigh R blw FE Walter Resv nr White Haven, PA | USGS Continuous** |
| 01449000 | Lehigh R at Lehighon, PA | USGS Continuous** |
| 01451000 | Lehigh R at Walnutport, PA | USGS Continuous** |
| 01453000 | Lehigh R at Bethlehem, PA | USGS Continuous** |
| 01454700 | Lehigh R at Glendon, PA | USGS Continuous** |
| 01457500 | Delaware R. at Riegelsville, NJ | USGS Continuous** |
| 01457000 | Musconetcong River near Bloomsbury, NJ | USGS Continuous |
| 01460200 | Delaware R. at Point Pleasant, PA (QW Site Only) | USGS DO, pH, Temp, Cond. |
| 01459500 | Tohickon Cr near Pipersville, PA | USGS Continuous** |
| 01463620 | Assunpink Creek near Clarksville, NJ | USGS Continuous |
| 01464000 | Assunpink Creek @ Trenton, NJ | USGS Continuous |
| 01463500 | Delaware R. at Trenton, NJ | USGS Continuous** |

** denotes availability of current data on worldwide web at <http://waterdata.usgs.gov/nwis-w/>

Table C2: DRBC Flow Monitoring - Develop Flow Rating Curves for Loadings (10 Creeks)

| | | |
|--|------|---------------|
| Pidcock Creek at Bowmans Hill Wildflower Preserve, Bucks Co, PA | DRBC | Instantaneous |
| Wickecheoke Creek at Rt 29 near Prahls Mill, Hunterdon Co, NJ | DRBC | Instantaneous |
| Lokatong Creek at Rosemont-Raven Rock Rd, Hunterdon Co, NJ | DRBC | Instantaneous |
| Paunacussing Creek near Rt 32, Bucks Co, PA | DRBC | Instantaneous |
| Tinicum Creek near Rt 32, Bucks Co, PA | DRBC | Instantaneous |
| Tohickon Creek above Rt 32, Bucks Co, PA (relate to upstr USGS gage) | DRBC | Instantaneous |
| Nishisakawick Creek, Hunterdon Co, NJ | DRBC | Instantaneous |
| Cooks Creek above Red Bridge Rd, Bucks Co, PA | DRBC | Instantaneous |
| Pohatcong Creek above River Rd, Warren Co, NJ | DRBC | Instantaneous |
| Bushkill Creek above Rt 611, Northampton Co, PA | DRBC | Instantaneous |

Table C3: Delaware River Water Chemistry Monitoring Sites

| Delaware River Bridge | River Mile | Site # (composite, NJ side, PA side) |
|--|------------|--------------------------------------|
| Calhoun Street Bridge | 134.34 | DRBCNJPAC01, DRBCNJ0001, DRBCPA0001 |
| Washington Crossing Bridge | 141.80 | DRBCNJPAC02, DRBCNJ0004, DRBCPA0006 |
| Lambertville/New Hope Bridge | 148.70 | DRBCNJPAC11, DRBCNJ0009, DRBCPA0010 |
| Stockton Bridge (not monitored 2001) | 151.90 | DRBCNJPAC03, DRBCNJ0011, DRBCPA0012 |
| Raven Rock/Lumberville Foot Bridge, Bulls Isl. | 155.40 | DRBCNJPAC04, DRBCNJ0014, DRBCPA0013 |

Table C3 continued

| Delaware River Bridge | River Mile | Site # (composite, NJ side, PA side) |
|---|-------------------|---|
| Frenchtown/Uhlerstown Bridge (closed 2001) | 164.30 | DRBCNJPAC05, DRBCNJ0021, DRBCPA0018 |
| Milford/Upper Black Eddy Bridge | 167.70 | DRBCNJPAC06, DRBCNJ0024, DRBCPA0019 |
| Riegelsville Bridge | 174.80 | DRBCNJPAC07, DRBCNJ0026, DRBCPA0023 |
| Easton/Phillipsburg Bridge, Northampton St. | 183.80 | DRBCNJPAC08, DRBCNJ0029, DRBCPA0027 |
| Belvidere/Riverton Bridge | 197.80 | DRBCNJPAC09, DRBCNJ0034, DRBCPA0033 |
| Columbia/Portland Foot Bridge | 207.40 | DRBCNJPAC10, DRBCNJ0037, DRBCPA0036 |

Table C4: Tributary Water Chemistry Monitoring Sites

| Tributary | Mile | Reason for Selection 2001 | Site No. |
|-----------------------|-------------|---|-----------------|
| Pidcock Cr, PA | 146.3 | Good quality, potential reference site | DRBCPA0008 |
| Wickecheoke Cr, NJ | 152.5 | W&S, TM, development | DRBCNJ0012 |
| Lokatong Cr, NJ | 154.0 | W&S, TM, development | DRBCNJ0013 |
| Paunacussing Cr, PA | 155.6 | W&S, HQ, watershed group | DRBCPA0016 |
| Tohickon Cr, PA 157.0 | W&S | EV, regulated, major tributary | DRBCPA0015 |
| Tinicum Cr, PA | 161.6 | W&S, EV | DRBCPA0017 |
| Nishisakawick Cr, NJ | 164.1 | ASW | DRBCNJ0020 |
| Cooks Cr, PA | 173.7 | W&S, EV, infrequent samples, watershed group | DRBCPA0021 |
| Musconetcong R., NJ | 174.6 | ASW, TM, major tributary, watershed group | DRBCNJ0025 |
| Pohatcong Cr, NJ | 177.4 | TP, reservoir effects, development, watershed group | DRBCNJ0027 |
| Lehigh River, PA | 183.66 | WQN, regulated, major tributary, watershed groups | DRBCPA0026 |
| Bushkill Cr, PA | 184.1 | EV (pt), known problems, watershed group | DRBCPA0028 |
| Pequest River, NJ | 197.8 | ASW, TM, major tributary, watershed group | DRBCNJ0032 |
| Paulins Kill, NJ | 207.0 | W&S, TM, ASW, major tributary | DRBCNJ0036 |

Table C5: Lower Delaware Monitoring Program Sampled Parameters and Procedures

| Parameter | Standard Methods Procedure | Equipment | Min – Max | Accuracy(±) |
|--|--|-------------------------|--------------------|---------------------|
| COLLECTED AND ANALYZED BY DRBC: | | | | |
| Flow Discharge | See TABLE 2 for locations | Pygmy meter | 0.07-3.00 fps | |
| Gage Height | N/A | Surveyor’s Tape | N/A | 0.01 ft |
| Air temperature | 2550 – thermometric | Thermometer | -10-110 °C | 1 °C |
| Water temperature | 2550 – thermometric | Thermometer | -10-110 °C | 1 °C |
| | | Probe (DO meter) | -5-45 °C | 0.7 °C |
| | | Probe (cond. meter) | -2-50 °C | 0.6 °C |
| Dissolved oxygen | 4500-O C. - azide modification of Winkler titration method | Pre-prepared Hach kit | 0-20 mg/l | 20-60 µg/l |
| | 4500-O G. – membrane electrode | YSI Meter | 0-20 mg/l | 1% of scale |
| Specific conductance | 2510 B. Laboratory Method (platinum electrode cond. cell) | YSI Meter | 0-19,999 µmhos /cm | 2 µmhos/cm |
| PH | 4500-H+ | Oakton pH Testr 2 | 4-10 units | 0.25 units |
| PH | 4500-H+ | IQ 120 pH meter | 2-12 pH | ±0.1 units |
| COLLECTED BY DRBC: Contract with NJ Analytical Labs for analyses (LRL is Lower Reporting Limit) | | | | |
| Hardness (Total) | EPA 130 | 1 mg/l CaCO3 LRL | 7 d hold time | ±1 mg/l |
| Chloride | EPA 325.3 | 1 mg/l LRL | 7 d hold time | ±1 mg/l |
| Alkalinity, Total | EPA 310 | 1 mg/l CaCO3 LRL | 24 hr hold time | ±1 mg/l |
| Turbidity (NTU) | EPA 180.1 | 5 NTU LRL | 24 hr hold time | ±1 units |
| Enterococcus | 9230 C. mE agar enterococci MF | >0 /100ml LRL | 6 hr hold time | NA |
| Fecal coliform | 9222 D. m-FC media (MF) | >0 /100ml LRL | 6 hr hold time | NA |
| Nitrate+Nitrite | EPA 353.2, 353.3 | 0.05 mg/l as N LRL | 7 d hold time | 0.05 mg/l |
| Chlorophyll a | SM 10200 H. | 0.001 mg/m3 LRL | 24 hr hold time | 0.001 mg/m3 |
| Ammonia N | EPA 350 | 0.1 mg/l NH3 as N LRL | 7 d hold time | 0.1 mg/l NH3 as N |
| Total Phosphorus | EPA 365.1 | 0.005 mg/l PO4 as P LRL | 7 d hold time | 0.005 mg/l PO4 as P |
| Total Kjeldahl Nitrogen | EPA 351.2 | 0.1 mg/l TKN LRL | 7 d hold time | 0.1 mg/l TKN |
| Orthophosphate P | EPA 365.1 | 0.005 mg/l PO4 as P LRL | 24 hr hold time | 0.005 mg/l PO4 as P |
| Total Suspended Solids | EPA 160.2 | 4 mg/l LRL | 24 hr hold time | 4 mg/l |

W&S=Wild and Scenic, TM=Trout Maintenance, HQ = High Quality Waters, EV = Exceptional Value Waters, ASW = Ambient Surface Water Network (NJDEP)

Table C6: Sites Not Monitored in 2001, Established for Definition of Existing Water Quality

| Tributary | Mile | Reason for Exclusion 2001 | Site No. |
|---------------------|--------|---|------------|
| Assunpink Creek, NJ | 133.8 | Lack of funds, NJDEP monitors (303D listed) | DRBCNJ1338 |
| Buck/Brock Cr, PA | 138.0 | Lack of funds, not major tributary | DRBCPA0002 |
| Jacobs Cr, NJ | 140.5 | Lack of funds, not major tributary | DRBCNJ0003 |
| Aquetong Cr, PA | 148.5 | Lack of funds, not major tributary (PA HQ stream) | DRBCPA0009 |
| Alexaukin Creek, NJ | 149.5 | Lack of funds | DRBCNJ0010 |
| Hakihokake Cr, NJ | 167.2 | Lack of funds, not major tributary (NJ TM waters) | DRBCNJ0023 |
| Fry's Run, PA | 176.6 | Lack of funds, not major tributary (PA HQ stream) | DRBCPA0024 |
| Lopatcong Cr, NJ | 182.0 | Lack of funds, not major tributary (NJ TP waters) | DRBCNJ0028 |
| Martins Cr, PA | 190.58 | Lack of funds, not major tributary | DRBCPA0031 |
| Buckhorn Cr, NJ | 192.9 | Lack of funds, not major tributary (NJ TP waters) | DRBCNJ0030 |

Quality Assurance and Control

The QA Objectives of the Lower Delaware Monitoring Program are:

- To accurately describe the water quality and related biological conditions in the study area. The water quality parameters should be sufficient to:
 1. Define and assess existing water quality and quantity
 2. Evaluate the quality of the waters within the Lower Delaware River region;
 3. Categorize tributaries and river locations as point source or non-point source impacted;
 4. Rank tributaries and river locations for water quality management actions including follow-up monitoring and intensive surveys by state enforcement agencies;
 5. Identify whether water quality meets or exceeds standards related to designated uses; and,
 6. Ascertain relative water quality impact on the biological resources of the study area.

Quality Assurance Practices and Procedures

Attainment of quality assurance objectives is achieved by maintaining a running check of precision and accuracy of analyses throughout the sampling program. Before the start of the program, the quality assurance officer and program manager conducted a laboratory audit. During the monitoring season, field sampling protocol audits are conducted monthly. Instrument variations are controlled by calibration of equipment and use of standard solutions. Comparability of data sets is determined by examining data using the Student t-test. All problems are immediately reported to both the program manager and the quality assurance officer, a report is prepared in the form of a DRBC memorandum, and resolution is sought before continuation of the task.

Reports and Forms

The program staff is required to maintain a log of activities. Notebooks and common computer files accessible to all study participants are used to record observations (weather, etc.), to describe sampling station locations, and to present results. Several data record/analyses sheets were developed or adopted from the SRMP and other agencies for recording results. These are used routinely for water quality, flow, habitat, macroinvertebrate, and stream channel condition studies (See Exhibits 2,3 and 4). QA reporting forms have been developed for use by staff for QA recording activities. All forms contained in the Rapid Bioassessment Protocols (Barbour et. al 1999) and USGS NAWQA Protocols (Cuffney et. al 1993; Fitzpatrick et. al 1998) are copied directly from those documents for field use.

Sample Custody

All samples will be logged according to chain of custody procedures. The program manager is responsible for record-keeping, including preparation of sample labels, laboratory logging procedures and maintenance of reports as described above. In cases where a laboratory is contracted for analyses, field personnel follow the contract laboratory's sample custody procedures

Performance and System Audits

Before the initiation of the sampling season, the manager prepares the program by checking all equipment, making repairs, and by purchasing equipment and chemicals. The QA Officer performs an audit of the contract laboratory prior to commencement of the program. The program manager and/or the QA officer observe field and lab procedures, checking data including quality control checks and other activities related to program administration.

The program manager and/or the QA officer will conduct field audits to evaluate sampling technique, sample handling, and preservation to insure representative results. Personnel safety measures are highlighted, and all relevant personnel are required to read and understand the DRBC Field Safety Manual. The laboratory audits review analytical, sample preparation, and data reporting procedures. Also, laboratory cleanliness and safety are

emphasized. DRBC's laboratory must comply with the New Jersey Right-to-Know Act, and all chemical materials must be properly stored and labeled.

Quality Assurance Records to Management

The Project Manager reports to the Quality Assurance Officer for inspection and application of performance and system audits. Reports will present the results of internal and external quality checks, corrective actions taken, and analytical results. The reporting procedures will consist of the submittal of logbooks.