

**QUALITY ASSURANCE PROJECT PLAN
FOR
MULHOCKAWAY CREEK STORMWATER
MANAGEMENT AND ASSOCIATED WATERSHED
RESTORATION PLAN
319 (H) RP02-084 FIELD SERVICES**

***Prepared For:
NEW JERSEY WATER SUPPLY AUTHORITY***

***Submitted to:
NEW JERSEY DEPARTMENT OF ENVIRONMENTAL
PROTECTION
DIVISION OF WATERSHED MANAGEMENT***

***November 16, 2005
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1. Project Name: New Jersey Water Supply Authority: Mulhockaway Creek Stormwater Management and Associated Watershed Restoration Plan

2. Applicant Name: New Jersey Water Supply Authority
P.O. Box 5196
Clinton, NJ 08809

3. NJDEP 319 (h) Grants: Mulhockaway Creek NPS Abatement Study; Bethlehem and Union Townships, Hunterdon County, New Jersey
319 (H) Grant Identifier **RP02-084**

4. Sampling Dates: August 2006 through November 2006

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7. Project Description:

The New Jersey Water Supply Authority (NJWSA) is investigating stormwater management measures for existing stormwater problems, including conceptual design of retrofit projects, municipal management of detention basins, ground water recharge opportunities, and monitoring of water quality and quantity in the Mulhockaway Creek Watershed. This nearly 15 square mile watershed drains to the Spruce Run Reservoir, a primary recreation area in New Jersey and source of water for flow augmentation in the South Branch and Main Stem Raritan River, a primary source of drinking water for north central New Jersey. To address impairments and concerns for protecting this vital resource, NJWSA in partnership with two local municipalities (Bethlehem and Union), and the Hunterdon County Soil Conservation District, is developing a regional stormwater management plan for the Mulhockaway Creek watershed under a Section

319(h) nonpoint source pollution mitigation grant. Key elements of the plan focus on inventorying and evaluating the existing stormwater infrastructure, understanding management of these systems and other potential nonpoint source pollutant causing activities, and determining groundwater recharge capacities throughout the watershed. To support this project, NJWSA is prioritizing sites for retrofit and BMP implementations and developing concept plans in support of the municipalities' efforts to comply with the new stormwater rules. The final critical task will be to develop and implement a monitoring program that will identify likely sources of fecal coliform and track these sources so that appropriate management actions can be taken to improve water quality in the Mulhockaway Creek and the Spruce Run Reservoir.

Sampling will be conducted to obtain data with respect to microbiological pollutants (Biological Pathogen Indicators) that may indicate the source of these pollutants including potential septic contamination, wildlife sources (i.e. Canada geese), or agricultural livestock. The purpose of this study is to track down sources of pollutants, and the data are not meant to be used for listing/delisting. Therefore the protocol designed for this study does not address the collection of multiple samples over 30 days as detailed in the NJ Surface Water Quality Standards, but is designed to collect samples under various targeted flow conditions. **Data collected as part of this sampling program will be obtained for the sole purpose of bacterial source track down and will not and should not be used to determine compliance with water quality standards.** The microbiological pollutants chosen for this investigation are fecal coliform and enterococci (a subset of fecal streptococci). These bacteria are present in large numbers in the feces and intestinal tracts of humans and other warm-blooded animals, and can enter water bodies from human and animal waste. The ratio of the fecal coliform to fecal streptococci varies for different animals. Ratios greater than 4.0 indicate human sources, while ratios less than 0.8 indicate animal sources. Ratios between 0.8 and 4.0 are considered inconclusive, or indicate contamination from both human and animal species. Because survival rates of these organisms vary in different environments, this ratio is not always reliable, but can be useful as a preliminary indicator when utilized in conjunction with other procedures to determine pollution sources. Total Suspended Solids (TSS) will be analyzed to determine the relationship between fecal coliform and TSS.

Sampling for this project will obtain data necessary to evaluate targeted pollutants with respect to flow conditions, seasonal variations and pertinent weather conditions. This sampling plan was designed to assess water quality due to impacts including groundwater conditions, erosion and storm water runoff, which could then be examined to determine the effectiveness of BMP installations. In order to incorporate these assessments into an integrated plan, the sampling will be conducted as described below, with monitoring station networks including ambient stream monitoring, dry weather low flow sampling, storm water monitoring, and intensive storm water pollutant source tracking.

Originally, the project scope indicated that total phosphorus, sediment and temperature would be monitored. The 2004 Integrated List, which was generated after the project start, indicated that the Mulhockaway Creek was no longer impaired for total phosphorus and temperature. In addition, no sample in the

AMNET data after May of 2000 had phosphorus concentrations (NWIS parameter code 0665) greater than 0.032 mg/l. Therefore, total phosphorus and temperature were dropped from the monitoring program. Since the intent of the sediment sampling was to aid in the assessment of phosphorus impairment, sediment sampling was also dropped from the monitoring program. The revised work plan submitted to the NJDEP and approved in October of 2005 indicates that monitoring will only be for fecal coliform assessment.

A. Monitoring Network Design and Rationale

Spatial Extent of Study:

The sample stations and boundaries for the study area are shown in Figure 1.

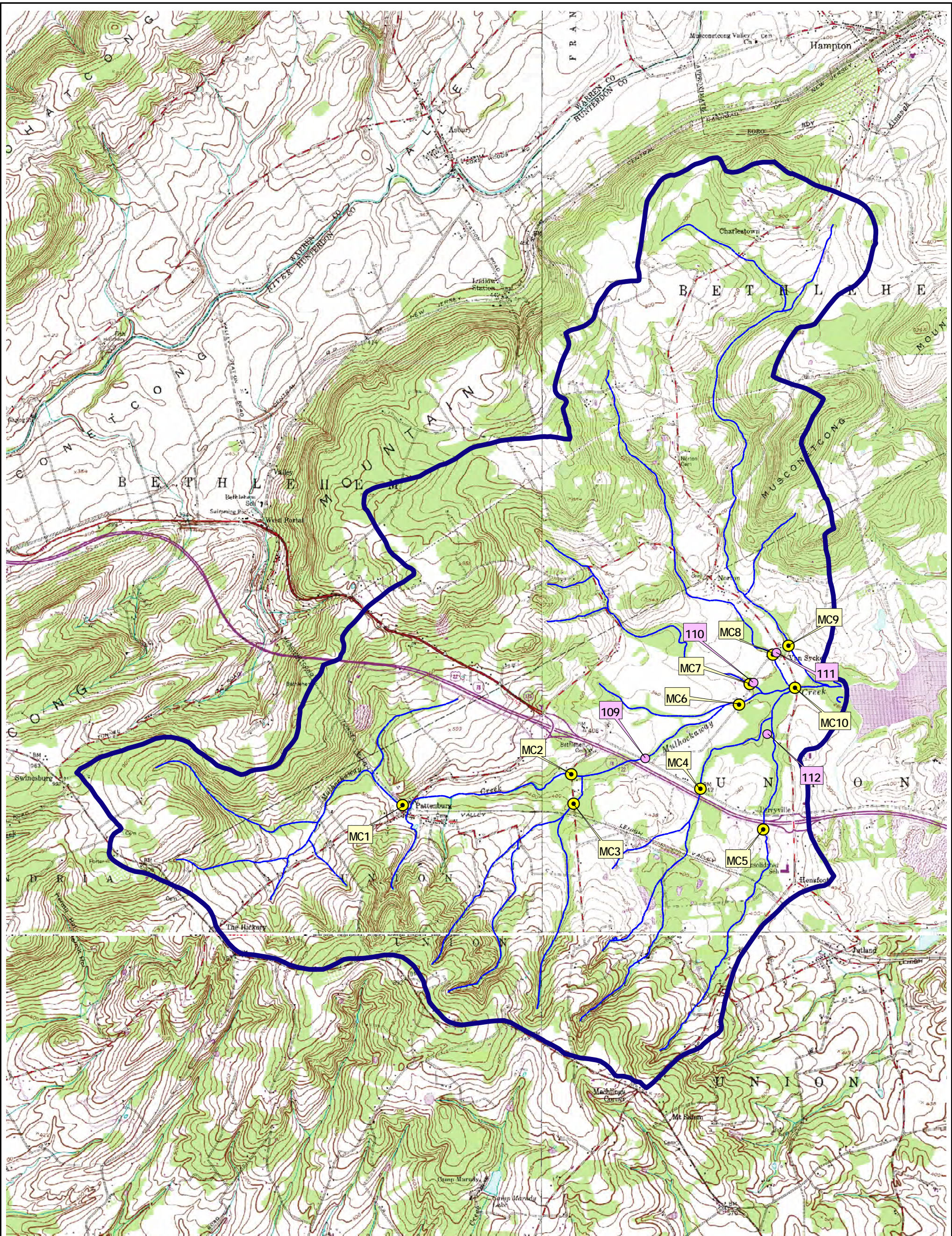


FIGURE 1:
Sampling Locations

NJWSA - MULHOCKAWAY CREEK
REGIONAL STORMWATER
MANAGEMENT PLAN



321 Wall Street
Princeton, NJ 08540
609-924-8821
www.TRComni.com

Mulhockaway Watershed Boundary

NJDEP 2006 Sampling Locations

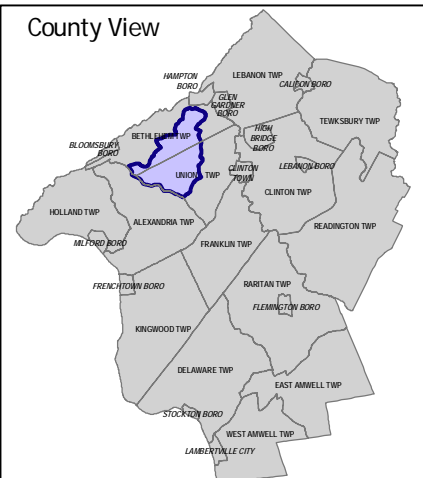
Sampling Locations



3000 0 3000 Feet



County View



Sampling Locations:

The sampling station locations as shown on Figure 1, and listed in Appendix A, will be monitored during this study. All sampling sites will also be located by GPS. The stations are comprised of the following networks (station types):

- Ten (10) ambient sample locations which also serve as low flow and baseline storm water locations;
- Ten (10) low flow locations;
- Ten (10) baseline storm water locations;
- Intensive sampling event (stations to be determined).

Stream sampling stations were selected so that the sources of nonpoint pollutants could be identified. Tributary stations were selected in order to characterize substantial inputs into the Mulhockaway Creek study area. The following list describes the selected sampling stations:

- MC1: Mulhockaway Creek, Route 614 in Pattenburg
- MC2: Mulhockaway Creek, northern crossing on Baptist Church Road
- MC3: Unnamed tributary to Mulhockaway Creek on Baptist Church Road immediately north of Lehigh Valley railroad tracks
- MC4: Unnamed tributary to Mulhockaway Creek, north of Route 78 on Route 173 west of Perryville**
- MC5: Unnamed tributary to Mulhockaway Creek, south of Route 78 on Baptist Church Road in Perryville**
- MC6: Mulhockaway Creek at southern crossing on Van Syckel's Corner Road, west of Route 635
- MC7: Crossing of unnamed tributary to Mulhockaway Creek on Van Syckel's Corner Road, west of Route 635
- MC8: Crossing of unnamed tributary to Mulhockaway Creek on Van Syckel's Corner Road, west of Route 635
- MC9: Crossing of unnamed tributary to Mulhockaway Creek on Van Syckel's Corner Road, east of Route 635
- MC10: Mulhockaway Creek at bridge crossing on Route 635

Stream sampling stations will be marked in the field with a steel post and clearly marked flagging prior to initial sample collection. In addition, a digital photograph and GPS coordinates of each location will be taken, and included as part of the final report. Field personnel will also record any near field conditions and potential upstream sources of non point source pollution. All personnel responsible for sample collection will visit each site as part of their training in sample collection.

Temporal Aspects:

Ambient Events (All Stations):

Ambient sampling at the ten Mulhockaway Creek stations will occur twice per month over a three month period (beginning August 2006 and ending October 2006). Sampling will occur independent of weather conditions, and efforts will be made to collect samples over a range of seasonal and flow conditions. Within the study period a total of six (6) sample collection events will be conducted. The purpose of this sampling is to gather general baseline information for the stream system.

Low-Flow Events (All Stations)

Three low-flow events will be performed. Two of the low-flow events will be performed during the summer period in August, while one event will be performed in September. Low-flow events will be performed when measured flow at USGS station 01396660 does not exceed the stream flows that are exceeded 70% of the time (d70). In addition, this event will be performed only when preceded by at least 72 hours with no more than 0.1 inches of rain. The purpose of this sampling is to determine water quality conditions in the watershed when little or no surface runoff is flowing in the stream. The majority of the water in the stream should consist of base flow, and water quality impacts should primarily be from groundwater or illicit discharges. **Should a spike in bacteria occur during these events, it would potentially indicate failing septics, illicit connections, or poor management of areas with domestic animals. Some sampling sites have been targeted to address this issue and should issues arise, they could be investigated further.**

Baseline Storm Water Events (All Stations)

Two baseline storm water events will be performed during August and September. Over the course of each storm event, a total of three grab samples will be collected. The first sample will be collected at the beginning of the storm (when approximately 0.1 inch of precipitation has been observed) and the remaining two samples will be collected during the storm to characterize the water quality over the hydrograph. Storm water events will be performed during storms predicted to deliver at least 0.5 inches of rain that are preceded by at least 72 hours with no more than 0.1 inches of rain. These two sampling events will be used to determine the water quality impacts of stormwater runoff throughout the watershed. The results of these two events will be used to determine the locations to be sampled in the final intensive stormwater sampling event.

Intensive Storm Water Events (Stations to be Determined)

One intensive storm water event will be performed, preferably in October, weather permitting. Sampling will be performed at a minimum of six stations

of interest. These stations will be selected based on data obtained during the baseline storm events, with the goal of identifying and isolating specific pollutant sources. One event will be performed consisting of three samples per station. The first sample will be collected at the beginning of the storm (when approximately 0.1 inch of precipitation has been observed) and the remaining two samples will be collected during the storm to characterize the water quality over the hydrograph. Storm water events will be performed during storms predicted to deliver at least 0.5 inches of rain that are preceded by at least 72 hours with no more than 0.1 inches of rain. Sampling stations will include locations detailed in the Work Plan and may also incorporate additional locations identified during the Baseline Storm Water Events. The stations will be selected based on data obtained during the baseline storm events, with the goal of identifying and isolating specific pollutant sources.

Spatial Aspects:

In order to minimize sampling interferences due to the disturbance of the stream bottom, sampling at the Mulhockaway Creek stations, during each event, will commence at the downstream station (MC10) and proceed upstream in decreasing station number. The microbiological pollutants will not be composited. All samples for microbiological pollutants will be sampled directly into the sterile sample container at mid depth, mid stream.

Surface water sampling for TSS analysis, will be conducted so that the samples are representative of the cross-section of the stream. At least three subsurface grab samples will be collected mid-depth at equidistant points across the stream. These grab samples will be composited in a larger volume container, from which the desired volume will be transferred to the sample bottles. A dedicated large volume container will be assigned to each sample location. Prior to each sampling event, the large volume containers will be decontaminated using the following procedure: (1) distilled/deionized water rinse, (2) non-phosphate detergent wash, (3) distilled/deionized water rinse, (4) air dry and (5) distilled/deionized water rinse. Sampling will be conducted in accordance with methods specified in the NJDEP Field Sampling Procedures Manual (2005). Photo documentation of suspected loading contributors, when observed, will be performed during each event.

Rationale for Sampling Locations:

In order to obtain sufficient data required to complete this evaluation sample stations were selected at various locations on the Mulhockaway Creek within the spatial extent of the study. These stations were selected in order to characterize substantial inputs into the major stream segments within the study area. In addition, comments from the Mulhockaway Creek stormwater Committee were incorporated into this QAPP.

B. Monitoring Parameters

Laboratory

Fecal Coliform
Enterococci portion of Fecal Streptococcus
Total Suspended Solids (TSS)

Watershed Measurements

Precipitation*
Flow**

* Precipitation will be retrieved from the rain gage established by the New Jersey Water Supply Authority, at Station MC10.

** Flow data will be retrieved from USGS station 01396660 **and calculated per sampling location per sampling event.**

TRC Omni Environmental Corporation, NJDEP certified laboratory #11697, will perform sample collection for all of the sampling events. Monitoring for Biological Pathogen parameters will be performed according to the Sampling Design Matrix Tables in Appendix A. New Jersey Analytical Laboratory (NJAL), NJDEP certified laboratory #11005, will measure all laboratory parameters in accordance with the procedures specified in Appendices B1 and B2, and may assist in the sample collection program.

C. Parameter Table

Samples will be analyzed for all of the laboratory parameters as detailed above. Analysis will be performed in accordance with Table 1B (40 CFR Part 136) of Appendix B1. Also, preservation techniques and holding times will be in accordance with Table II (40 CFR Part 136) of Appendix B2. Any deviations from the test procedures and/or preservation methods and holding times will be noted in the final report from the laboratory.

8. Schedule:

The Quality Assurance Sampling Plan will be submitted to NJDEP by November 30, 2005. Sampling will begin in August 2006.

9. Project Organizations and Responsibility:

State-Based Project Management: (Project Manager) Nick Zripko

Overall Coordination: (Project Officer) Jeremiah Bergstrom

Overall QA: (QA Officer) **Greg Soska**

Sampling QC:	(QA Officer)	Greg Soska
Laboratory QC:	(Manager)	Allen Thomas, NJAL
Laboratory QC:	(QC Officer)	George Latham, NJAL

10. Organizational Chart:

State-Based Project Management: Nick Zripko NJDEP/DWM	
Overall Coordination Project Officer: Jeremiah Bergstrom	
Overall QA QA Officer: Greg Soska	
Sampling QA Officer: Greg Soska	
Laboratory QC (NJAL) Manager: Allen Thomas	Laboratory QC (NJAL) QC Officer: George Latham
Sampling QC/ Sampling Operations: TRC Omni Field Supervisor: Greg Soska	

11. Sampling Procedures:

All sampling procedures will be in conformance with the NJDEP Field Sampling Procedures Manual (2005), USGS NAWQA field sampling protocols, any applicable USEPA guidance, or with prior written approval from NJDEP. Sampling will be conducted in accordance with the methods identified under Section 7 of this quality assurance sampling plan. Samples will be delivered to the laboratory so that holding times of 6 hours for microbiological analysis and 7 days for TSS are met.

12. Chain of Custody Procedures:

Chain of custody procedures will be followed for all samples collected for this study. A sample of a Chain of Custody Form is provided in Appendix D.

A sample is in someone's "custody" if:

- It is in one's actual physical possession.
- It is in one's view, after being in one's physical possession.
- It is in one's physical possession and then locked up so that no one can tamper with it.
- It is kept in a secured area, restricted to authorized personnel only.

13. Calibration Procedures and Preventive Maintenance:

Calibration and preventive maintenance of field equipment (i.e., pH and temperature meters) will be in accordance with the manufacturer's instructions and the Field Sampling Procedures Manual. In addition, calibration and preventive maintenance of laboratory equipment will be in accordance with N.J.A.C. 7:18-1.1 et seq. and 40 CFR Part 136.

14. Documentation, Data Reduction, and Reporting:

Laboratories will supply all quality assurance and quality control (QA/QC) data with the summary of results. All data will be kept on file by the applicant for a minimum of five years, and all data will be included in the quarterly reports to the NJDEP.

15. Quality Assurance and Quality Control:

N.J.A.C. 7:18-1.1 et seq. and 40 CFR Part 136 will be followed for all QA/QC practices, including detection limits, quantitation limits, precision, and accuracy. A table of parameter detection limits, quantitation limits, accuracy, and precision applicable to this study is provided in Appendix C.

16. Performance and Systems Audits:

All NJDEP certified laboratories participate in the Office of Quality Assurance (OQA) Performance Testing Program (PTP), in accordance with NJAC 7:18-2.13, for each category of certification. Laboratories are required to pass the PTP studies in order to maintain certification. The NJDEP Office of Quality Assurance conducts performance audits of each certified laboratory.

The NJDEP Office of Quality Assurance periodically conducts on-site Technical Systems Audits of each certified laboratory. The findings of these audits, together with the PTP results, are used to update each laboratory's certification status.

The NJDEP Office of Quality Assurance periodically conducts a field audit of project sampling operations. The Office of Quality Assurance will be contacted early in the study to schedule a field audit.

17. Data Validation:

Data validation will be performed by TRC Omni and NJAL, and shall include the following:

Method Blank: The method blank cannot show the presence of the parameter of interest above the reported detection limit. Analysis of the batch should not continue until the source of the problem has been corrected.

Laboratory Fortified Blank (LFB): Where appropriate, the LFB must fall within the QC control limits. If the LFB is outside the limits, the following corrective actions should be taken:

- Check data and recovery calculations
- Check reference QC standard
- Reanalyze sample batch

QC Matrix Spike: The matrix spike should fall within the QC control limits established for each methodology. The corrective actions should be as follows:

- Check data and recovery calculations.
- Check whether LFB and reference standard are acceptable.
- If only the matrix spike is not within control limits, check other analytes present for possible sample matrix interference as detailed in the specific method. If the sample matrix is identified as the problem, this may be footnoted. If the matrix spike is consistently outside for a particular parameter, another methodology may have to be considered for sample analysis.
- Check reference QC standard, if one was performed in that batch.
- If the matrix spike is not within control limits, check for presence of that analyte at a high value, which may be greater than the spike amount, causing invalid spike recovery.

Precision evaluated by:

Precision of method is evaluated by control charts, continuously maintained and updated at quarterly intervals. Matrix Spike Duplicates (MSD) must have a relative percent difference (RPD) equal to or lower than the calculated maximum RPD. If reproducibility cannot be achieved and sample matrix interferences are not apparent, batch reanalysis should occur. Calculations, dilutions, etc., should be checked prior to reanalysis.

Accuracy evaluated by:

- Initial and continuing calibrations must be within acceptance criteria.
- LFB acceptance by control limits shall be continuously maintained and updated. LFB result must fall within control limits.

- Recovery control charts must be continuously maintained and updated. All parameters will have upper and lower warning limits (UWL/LWL) set at two standard deviation (SD) units, and upper and lower control limits (UCL/LCL) set at three SD units. Matrix spikes must fall within control limits unless sample value (raw) is four or more times concentration of spike level.

Accuracy and Precision values have been calculated in accordance with the EPA Handbook for Analytical Control in Water and Wastewater Laboratories, June 1972, Sections 6 and 7.

18. Corrective Action:

All NJDEP certified laboratories must have a written corrective action procedure that is adhered to in the event that calibration standards, performance evaluation results, blanks, duplicates, spikes, etc., are out of the acceptable range or control limits. If the acceptable results cannot be obtained for the above-mentioned QA/QC samples during any given day, sample analysis must be repeated for that day with the acceptable QA/QC results. TRC Omni and NJDEP will be notified if there are any deviations from the approved sampling plan.

19. Reports:

A report will be prepared that will present an analysis of the data along with a summary of the conclusions. The report will include all and laboratory data in summary tables, as well as in an electronic database. Data will be assessed and used to evaluate fecal coliform loading issues and sources in the study area. The report will identify BMP measures to control pollutant loading, and recommend monitoring and evaluation techniques for determining the effectiveness of the management measures. The report will detail a plan to set forth a strategy to mitigate impairments from nonpoint sources of fecal coliform and provide recommendations for communities in the region to incorporate these strategies into their Stormwater Management Plans.

APPENDIX A

Sampling Design Matrix Table

Sampling Event	Ambient Events	Low-Flow Events	Baseline Stormwater Events	Intensive Stormwater Events
Sampling Regime	6 events	3 events	2 events	1 event
Total Number of Samples per Station per Event	1 sample	1 sample	3 grab samples	3 grab samples
Sampling Parameters	Fecal Coliform, Enterococci portion of Fecal Streptococcus, Total Suspended Solids (TSS)	Fecal Coliform, Enterococci portion of Fecal Streptococcus, Total Suspended Solids (TSS)	Fecal Coliform, Enterococci portion of Fecal Streptococcus, Total Suspended Solids (TSS)	Fecal Coliform, Enterococci portion of Fecal Streptococcus, Total Suspended Solids (TSS)
Sampling Conditions Goal (weather-permitting)	ambient conditions	stream flow \leq d70	\geq 72 hrs. with \leq 0.1 in. rain; During storm $>$ 0.5 in. rain	\geq 72 hrs. with \leq 0.1 in. rain; During storm $>$ 0.5 in. rain
MC1	6	3	6	TBD
MC2	6	3	6	TBD
MC3	6	3	6	TBD
MC4	6	3	6	TBD
MC5	6	3	6	TBD
MC6	6	3	6	TBD
MC7	6	3	6	TBD
MC8	6	3	6	TBD
MC9	6	3	6	TBD
MC10	6	3	6	TBD
Alternate Locations	No	No	No	TBD

NOTES:
 # - Number in cells indicates total number of samples to be collected per parameter at each sampling location.
 d70 - That stream flow which is exceeded 70% of the time.
 TBD-To Be Determined, based on data from baseline storm events.

APPENDIX B1

List of Approved Test Procedures

**40 CFR Part 136
October 23, 2002**

TABLE IA—LIST OF APPROVED BIOLOGICAL METHODS

Parameter and units	Method ¹	EPA	Standard Methods 18th, 19th, 20th ed.	ASTM	USGS
Bacteria:					
1. Coliform (fecal), number per 100 mL	Most Probable Number (MPN), 5 tube 3 dilution, or Membrane filter (MF) ² single step	p. 132 ³ p. 124 ³	9221C E ⁴ 9222D ⁴		B-0050-85 ⁵
2. Coliform (fecal) in presence of choline, number per 100 mL.	MPN, 5 tube, 3 dilution, or MF, single step ⁶	p. 132 ³ p. 124 ³	9221C E ⁴ 9221D ⁴		
3. Coliform (total), number per 100 mL	MPN, 5 tube, 3 dilution, or MF ² single step or two step	p. 114 ³ p. 108 ³	9221B ⁴ 9222B ⁴		B-0025-85 ⁵
4. Coliform (total), in presence of chlorine, number per 100 mL	MPN, 5 tube, 3 dilution, or MF ² with enrichment	p. 114 ³ p. 111 ³	9221B ⁴ 9222 (B+B.5c) ⁴		
5. Fecal streptococci, number per 100 mL	MPN, 5 tube, 3 dilution MF ² or Plate count	p. 139 ³ p. 136 ³ p. 143 ³	9230B ⁴ 9230C		B-0055-85 ⁵
Aquatic Toxicity:					
6. Toxicity, acute, fresh water organisms, LC50, percent effluent.	Ceriodaphnia dubia acute Daphnia pulex and Daphnia magna acute Fathead minnow, Pimephales promelas, and Bannerfin shiner, Cyprinella leedsii, acute. Rainbow trout, Oncorhynchus mykiss, and brook trout, Salvelinus fontinalis, acute.	⁷ 2002.0 ⁷ 2021.0 ⁷ 2001.0 ⁷ 2019.0			
7. Toxicity, acute, estuarine and marine organisms of the Atlantic Ocean and Gulf of Mexico, LC50, percent effluent.	Mysid, Mysidopsis, bahia, acute Sheepshead minnow, Cyprinodon variegatus, acute. Siverside, Menidia beryllina, Menidia menidia, and Menidia peninsulae, acute.	⁷ 2007.0 ⁷ 2004.0 ⁷ 2006.0			
8. Toxicity, chronic, fresh water organisms, NOEC or IC25, percent effluent.	Fathead minnow, Pimephales promelas, larval survival and growth. Fathead minnow, Pimephales promelas, embryo- larval survival and teratogenicity. Daphnia, Ceriodaphnia dubia, survival and repro- duction. Green alga, Selenastrum capricornutum, growth ...	⁸ 1000.0 ⁸ 1001.0 ⁸ 1002.0 ⁸ 1003.0			
9. Toxicity, chronic, estuarine and marine organisms of the Atlantic Ocean and Gulf of Mexico, NOEC or IC25, percent effluent.	Sheepshead minnow, Cyprinodon variegatus, lar- val survival and growth. Sheepshead minnow, Cyprinodon variegatus, em- bryo-larval survival and teratogenicity. Inland siverside, Menidia beryllina, larval survival and growth. Mysid, Mysidopsis bahia, survival, growth, and fe- cundity. Sea urchin, Arbacia punctulata, fertilization	⁹ 1004.0 ⁹ 1005.0 ⁹ 1006.0 ⁹ 1007.0 ⁹ 1008.0			

Notes to Table IA:

¹The method must be specified when results are reported.

²A 0.45 µm membrane filter (MF) or other pore size certified by the manufacturer to fully retain organisms to be cultivated and to be free of extractables which could interfere with their growth.

³USEPA. 1978. Microbiological Methods for Monitoring the Environment, Water, and Wastes. Environmental Monitoring and Support Laboratory, U.S. Environmental Protection Agency, Cincinnati, Ohio. EPA/600/8-78/017.

⁴APHA. 1998, 1995, 1992. Standard Methods for the Examination of Water and Wastewater. American Public Health Association. 20th, 19th, and 18th Editions. Amer. Publ. Hlth. Assoc., Washington, DC.

⁵USGS. 1989. U.S. Geological Survey Techniques of Water-Resource Investigations, Book 5, Laboratory Analysis, Chapter A4, Methods for Collection and Analysis of Aquatic Biological and Microbiological Samples, U.S. Geological Survey, U.S. Department of the Interior, Reston, Virginia.

⁶Because the MF technique usually yields low and variable recovery from chlorinated wastewaters, the Most Probable Number method will be required to resolve any controversies.

⁷USEPA. October 2002. Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms. Fifth Edition. U.S. Environmental Protection Agency, Office of Water, Washington, D.C. EPA 821-R-02-012.

⁸USEPA. October 2002. Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms. Fourth Edition. U.S. Environmental Protection Agency, Office of Water, Washington, D.C. EPA 821-R-02-013.

⁹USEPA. October 2002. Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Marine and Estuarine Organisms. Third Edition. U.S. Environmental Protection Agency, Office of Water, Washington, D.C. EPA 821-R-02-014.

TABLE IB—LIST OF APPROVED INORGANIC TEST PROCEDURES

Parameter, units and method	Reference (method number or page)				
	EPA ^{1, 35}	Standard Methods [Edition(s)]	ASTM	USGS ²	Other
1. Acidity, as CaCO ₃ , mg/L: Electrometric endpoint or phenolphthalein endpoint.	305.1	2310 B(4a) [18th, 19th, 20th].	D1067-92	I-1020-85 I-2030-85	
2. Alkalinity, as CaCO ₃ , mg/L: Electrometric of Colorimetric titration to pH 4.5, manual or automatic.	310.1	2320 B [18th, 19th, 20th] ...	D1067-92	I-1030-85	973.43 ³
3. Aluminium—Total, ⁴ mg/L; Digestion ⁴ followed by:	310.2.			I-2030-85	
AA direct aspiration ³⁶	202.1	3111 D [18th, 19th]		I-3051-85	
AA furnace	202.2	3113 B [18th, 19th].			
Inductively Coupled Plasma/Atomic Emission Spectrometry (ICP/AES) ³⁶ .	200.7 ⁵	3120 B [18th, 19th, 20th] ...		I-4471-97 ⁵⁰	
Direct Current Plasma (DCP) ³⁶			D4190-94		Note 34.
Colorimetric (Eriochrome cyanine R).		3500-AI B [20th] and 3500-AI D [18th, 19th].			
4. Ammonia (as N), mg/L: Manual, distillation (at pH 9.5) ⁶ followed by.	350.2	4500-NH ₃ B [18th, 19th, 20th].			973.49 ³
Nesslerization	350.2	4500-NH ₃ C [18th]	D1426-98(A)	I-3520-85	973.49 ³
Titration	350.2	4500-NH ₃ C [19th, 20th] and 4500-NH ₃ E [18th].			
Electrode	350.3	4500-NH ₃ D or E [19th, 20th] and 4500-NH ₃ F or G [18th].	D1426-98(B).		
Automated phenate, or	350.1	4500-NH ₃ G [19th, 20th] and 4500-NH ₃ H [18th].		I-4523-85	
Automated electrode					Note 7.

8

§ 136.3

40 CFR Ch. I (7-1-03 Edition)

9

5. Antimony—Total, ⁴ mg/L; Digestion ⁴ followed by:					
AA direct aspiration ³⁶	204.1	3111 B [18th, 19th]			
AA furnace	204.2	3113 B [18th, 19th]			
ICP/AES ³⁶	200.7 ⁵	3120 B [18th, 19th, 20th] ...			
6. Arsenic—Total ⁴ mg/L:					
Digestion ⁴ followed by	206.5				
AA gaseous hydride	206.3	3114 B 4.d [18th, 19th]	D2972-97(B)	I-3062-85	
AA furnace	206.2	3113 B [18th, 19th]	D2972-97(C)	I-4063-98 ⁴⁹	
ICP/AES ³⁶ or	200.7 ⁵	3120 B [18th, 19th, 20th].			
Colorimetric (SDDC)	206.4	3500-As B [20th] and 3500-As C [18th, 19th].	D2972-97(A)	I-3060-85	
7. Barium—Total, ⁴ mg/L; Digestion ⁴ followed by:					
AA direct aspiration ¹⁴	208.1	3111 D [18th, 19th]		I-3084-85	
AA furnace	208.2	3113 B [18th, 19th]	D4382-95		
ICP/AES ¹⁴	200.7 ⁵	3120 B [18th, 19th, 20th] ...			
DCP ¹⁴					Note 34.
8. Beryllium—Total, ⁴ mg/L; Digestion ⁴ followed by:					
AA direct aspiration	210.1	3111 D [18th, 19th]	D3645-93(88)(A)	I-3095-85	
AA furnace	210.2	3113 B [18th, 19th]	D3645-93(88)(B)		
ICP/AES	200.7 ⁵	3120 B [18th, 19th, 20th] ...		I-4471-97 ⁵⁰	
DCP, or			D4190-94		Note 34.
Colorimetric (aluminon)		3500-Be D [18th, 19th]			
9. Biochemical oxygen demand (BOD ₅), mg/L:					
Dissolved Oxygen Depletion	405.1	5210 B [18th, 19th, 20th] ...		I-1578-78 ⁸	973.44, ³ p. 17 ⁹
10. Boron ³⁷ —Total, mg/L:					
Colorimetric (curcumin)	212.3	4500-B B [18th, 19th, 20th]		I-3112-85	
ICP/AES, or	200.7 ⁵	3120 B [18th, 19th, 20th] ...		I-4471-97 ⁵⁰	
DCP			D4190-94		Note 34.
11. Bromide, mg/L:					
Titrimetric	320.1		D1246-95(C)	I-1125-85	p. S44 ¹⁰
12. Cadmium—Total, ⁴ mg/L; Digestion ⁴ followed by:					
AA direct aspiration ³⁶	213.1	3111 B or C [18th, 19th]	D3557-95 (A or B)	I-3135-85 or I-3136-85 ...	974.27, ³ p. 37 ⁹
AA furnace	213.2	3113 B [18th, 19th]	D3557-95(D)	I-4138-89 ⁵¹	
ICP/AES ³⁶	200.7 ⁵	3120 B [18th, 19th, 20th] ...		I-1472-85 or I-4471-97 ⁵⁰	
DCP ³⁶			D4190-94		Note 34.
Voltametry ¹¹ , or			D3557-95(C).		
Colorimetric (Dithizone)		3500-Cd D [18th, 19th].			
13. Calcium—Total, ⁴ mg/L; Digestion ⁴ followed by:					
AA direct aspiration	215.1	3111 B [18th, 19th]	D511-93(B)	I-3152-85	
ICP/AES	200.7 ⁵	3120 B [18th, 19th, 20th] ...		I-4471-97 ⁵⁰	
DCP, or					Note 34.
Titrimetric (EDTA)	215.2	3500-Ca B [20th] and 3500-Ca D [18th, 19th].	D511-93(A).		
14. Carbonaceous biochemical oxygen demand (CBOD ₃), mg/L ¹² :					

TABLE IB—LIST OF APPROVED INORGANIC TEST PROCEDURES—Continued

Parameter, units and method	Reference (method number or page)				
	EPA 1, 35	Standard Methods [Edition(s)]	ASTM	USGS 2	Other
Dissolved Oxygen Depletion with nitrification inhibitor.	.....	5210 B [18th, 19th, 20th].			
15. Chemical oxygen demand (COD), mg/L; Titrimetric or	410.1	5220 C [18th, 19th, 20th] ...	D1252-95(A)	I-3560-85	973.46, ³ p. 17 ⁹
	410.2 .....	.....	.....	I-3562-85	
	410.3 .....	.....	.....	.....
Spectrophotometric, manual or automatic.	410.4	5220 D [18th, 19th, 20th] ...	D1252-95(B)	I-3561-85	Notes 13, 14.
16. Chloride, mg/L: Titrimetric (silver nitrate) or .....	.....	4500-Cl-B [18th, 19th, 20th].	D512-89(B)	I-1183-85	
(Mercuric nitrate)	325.3	4500-Cl-C [18th, 19th, 20th].	D512-89(A)	I-1184-85	973.51 ³
Colorimetric, manual or .....	.....	.....	.....	I-1187-85	
Automated (Ferricyanide)	325.1 or 325.2	4500-Cl-E [18th, 19th, 20th].	.....	I-2187-85	
17. Chlorine—Total residual, mg/L; Titrimetric:					
Amperometric direct	330.1	4500-Cl D [18th, 19th, 20th].	D1253-86(92).		
Iodometric direct	330.3	4500-Cl B [18th, 19th, 20th].			
Back titration ether end-point ¹⁵ or	330.2	4500-Cl C [18th, 19th, 20th].			
DPD-FAS	330.4	4500-Cl F [18th, 19th, 20th].			
Spectrophotometric, DPD	330.5	4500-Cl G [18th, 19th, 20th].			
Or Electrode .....	.....	.....			Note 16.
18. Chromium VI dissolved, mg/L; 0.45 micron filtration followed by: AA chelation-extraction or	218.4	3111 C [18th, 19th]		I-1232-85	
Colorimetric (Diphenylcarbazide) .....	.....	3500-Cr B [20th] and 3500-Cr D [18th, 19th].	D1687-92(A)	I-1230-85	
19. Chromium-Total, ⁴ mg/L; Digestion ⁴ followed by:					
AA direct aspiration ³⁶	218.1	3111 B [18th, 19th]	D1687-92(B)	I-3236-85	974.27 ³
AA chelation-extraction	218.3	3111 C [18th, 19th].			
AA furnace	218.2	3113 B [18th, 19th]	D1687-92(C)	I-3233-93 ⁴⁶ .	
ICP/AES ³⁶	200.7 ⁵	3120 B [18th, 19th, 20th].			
DCP ³⁶ or	D4190-94		Note 34.
Colorimetric (Diphenylcarbazide)	3500-Cr B [20th] and 3500-Cr D [18th, 19th].			

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20. Cobalt—Total, ⁴ mg/L; Digestion ⁴ followed by:					
AA direct aspiration	219.1	3111 B or C [18th, 19th]	D3558-94(A or B)	I-3239-85	p. 37 ⁹
AA furnace	219.2	3113 B [18th, 19th]	D3558-94(C)	I-4243-89 ⁵¹	
ICP/AES	200.7 ⁵	3120 B [18th, 19th, 20th] .....	.....	I-4471-97 ⁵⁰	
DCP .....	.....	.....	D4190-94 .....	.....	Note 34.
21. Color platinum cobalt units or dominant wavelength, hue, luminance purity:					
Colorimetric (ADMI), or (Platinum cobalt), or	110.1	2120 E [18th, 19th, 20th] .....	.....	.....	Note 18.
Spectrophotometric	110.2	2120 B [18th, 19th, 20th] .....	.....	I-1250-85	
.....	110.3	2120 C [18th, 19th, 20th].	.....	.....
22. Copper—Total, ⁴ mg/L; Digestion ⁴ followed by:					
AA direct aspiration ³⁶	220.1	3111 B or C [18th, 19th]	D1688-95(A or B)	I-3270-85 or I-3271-85	974.27 ³ p. 37 ⁹
AA furnace	220.2	3113 B [18th, 19th]	D1688-95(C)	I-4274-89 ⁵¹	
ICP/AES ³⁶	200.7 ⁵	3120 B [18th, 19th, 20th] .....	.....	I-4471-97 ⁵⁰	
DCP ³⁶ or .....	.....	.....	D4190-94 .....	.....	Note 34.
Colorimetric (Neocuproine) or .....	.....	3500-Cu B [20th] and 3500-Cu D [18th, 19th].	.....	.....	Note 19.
(Bicinchoninate) .....	.....	3500-Cu C [20th] and 3500-As B [18th, 19th].	.....	.....
23. Cyanide—Total, mg/L:					
Manual distillation with MgCl ₂ followed by ..	.....	4500-CN C [18th, 19th, 20th].	D2036-98(A)	.....
Titrimetric, or .....	.....	4500-CN D [18th, 19th, 20th].	.....	.....	p. 22 ⁹
Spectrophotometric, manual or ..	335.2 ³¹	4500-CN E [18th, 19th, 20th].	D2036-98(A)	I-3300-85	
Automated ²⁰	335.3 ³¹ .....	.....	.....	I-4302-85	
24. Available Cyanide, mg/L:					
Manual distillation with MgCl ₂ followed by titrimetric or Spectrophotometric.	335.1	4500-CN G [18th, 19th, 20th].	D2036-98(B)	.....
Flow injection and ligand exchange, followed by amperometry.	.....	.....	.....	.....	OIA-1677 ⁴⁴
25. Fluoride—Total, mg/L:					
Manual distillation ⁶ followed by Electrode, manual or	340.2	4500-F B [18th, 19th, 20th] 4500-F C [18th, 19th, 20th]	D1179-93(B)	.....
Automated .....	.....	.....	.....	I-4327-85	
Colorimetric (SPADNS)	340.1	4500-F D [18th, 19th, 20th]	D1179-93(A)	.....
Or Automated complexone	340.3	4500-F E [18th, 19th, 20th]	.....	.....
26. Gold—Total, ⁴ mg/L; Digestion ⁴ followed by:					
AA direct aspiration	231.1	3111 B [18th, 19th] .....	.....	.....	Note 34.
AA furnace, or	231.2 .....	.....	.....	.....
DCP .....	.....	.....	.....	.....

TABLE IB—LIST OF APPROVED INORGANIC TEST PROCEDURES—Continued

Parameter, units and method	Reference (method number or page)				
	EPA 1, 35	Standard Methods [Edition(s)]	ASTM	USGS 2	Other
27. Hardness—Total, as CaCO ₃ , mg/L:					
Automated colorimetric,	130.1				
Titrimetric (EDTA), or Ca plus Mg as their carbonates, by inductively coupled plasma or AA direct aspiration (See Parameters 13 and 33).	130.2	2340 B or C [18th, 19th, 20th].	D1126-86(92)	I-1338-85	973.52B 3
28. Hydrogen ion (pH), pH units:					
Electrometric measurement, or ..	150.1	4500-H ⁺ B [18th, 19th, 20th].	D1293-84 (90)(A or B)	I-1586-85	973.41 3
Automated electrode				I-2587-85	Note 21.
29. Iridium—Total, ⁴ mg/L; Digestion ⁴ followed by:					
AA direct aspiration or	235.1	3111 B [18th, 19th]			
AA furnace	235.2				
30. Iron—Total, ⁴ mg/L; Digestion ⁴ followed by:					
AA direct aspiration ³⁶	236.1	3111 B or C [18th, 19th] ...	D1068-96(A or B)	I-3381-85	974.27 3
AA furnace	236.2	3113 B [18th, 19th]	D1068-96(C)		
ICP/AES ³⁶	200.7 ³	3120 B [18th, 19th, 20th] ...		I-4471-97 ⁵⁰	
DCP ³⁶ or			D4190-94		Note 34.
Colorimetric (Phenanthroline) ...		3500-Fe B [20th] and 3500-Fe D [18th, 19th].	D1068-96(D)		Note 22.
31. Kjeldahl Nitrogen—Total, (as N), mg/L:					
Digestion and distillation followed by.	351.3	4500-N _{org} B or C and 4500-NH ₃ B [18th, 19th, 20th].	D3590-89(A)		
Titration	351.3		D3590-89(A)		973.48 3
Nesslerization	351.3	4500-NH ₃ C [18th]	D3590-89(A)		
Electrode	351.3	4500-NH ₃ C [19th, 20th] and 4500-NH ₃ E [18th].			
Automated phenate colorimetric	351.1			I-4551-78 ⁹	
Semi-automated block digester colorimetric.	351.2		D3590-89(B)	I-4515-91 ⁴⁵ .	
Manual or block digester potentiometric.	351.4		D3590-89(A)		
Block digester, followed by Auto distillation and Titration, or.					Note 39.
Nesslerization, or					Note 40.
Flow injection gas diffusion					Note 41.

32. Lead—Total, ⁴ mg/L; Digestion ⁴ followed by:					
AA direct aspiration ³⁶	239.1	3111 B or C [18th, 19th]	D3559-96(A or B)	I-3399-85	974.27 ³
AA furnace	239.2	3113 B [18th, 19th]	D3559-96(D)	I-4403-89 ⁵¹	
ICP/AES ³⁶	200.7 ⁵	3120 B [18th, 19th, 20th] ...	.....	I-4471-97 ⁵⁰	
DCP ³⁶ .....	.....	.....	D4190-94 .....	.....	Note 34.
Voltametry ¹¹ or .....	.....	.....	D3559-96(C) .....	.....
Colorimetric (Dithizone) .....	.....	3500-Pb B [20th] and 3500-Pb D [18th, 19th].	.....	.....
33. Magnesium—Total, ⁴ mg/L; Digestion ⁴ followed by:					
AA direct aspiration	242.1	3111 B [18th, 19th]	D511-93(B)	I-3447-85	974.27 ³
ICP/AES	200.7 ⁵	3120 B [18th, 19th, 20th] ...	.....	I-4471-97 ⁵⁰	
DCP or .....	.....	.....	.....	.....	Note 34.
Gravimetric .....	.....	3500-Mg D [18th, 19th] ....	.....	.....
34. Manganese—Total, ⁴ mg/L; Digestion ⁴ followed by:					
AA direct aspiration ³⁶	243.1	3111 B [18th, 19th]	D858-95(A or B)	I-3454-85	974.27 ³
AA furnace	243.2	3113 B [18th, 19th]	D858-95(C) .....	.....
ICP/AES ³⁶	200.7 ⁵	3120 B [18th, 19th, 20th] ...	.....	I-4471-97 ⁵⁰	
DCP ³⁶ , or .....	.....	.....	D4190-94 .....	.....	Note 34
Colorimetric (Persulfate), or .....	.....	3500-Mn B [20th] and 3500-Mn D [18th, 19th].	.....	.....	920.203 ³
(Periodate) .....	.....	.....	.....	.....	Note 23.
35. Mercury—Total, ⁴ mg/L:					
Cold vapor, manual or	245.1	3112 B [18th, 19th]	D3223-91	I-3462-85	977.22 ³
Automated	245.2 .....	.....	.....	.....
Oxidation, purge and trap, and cold vapor atomic fluorescence spectrometry (ng/L).	1631E ⁴³	.....	.....	.....
36. Molybdenum—Total ⁴ , mg/L; Digestion ⁴ followed by:					
AA direct aspiration	246.1	3111 D [18th, 19th] .....	.....	I-3490-85	
AA furnace	246.2	3113 B [18th, 19th] .....	.....	I-3492-96 ⁴⁷	
ICP/AES	200.7 ⁵	3120 B [18th, 19th, 20th] ...	.....	I-4471-97 ⁵⁰	
DCP .....	.....	.....	.....	.....	Note 34.
37. Nickel—Total, ⁴ mg/L; Digestion ⁴ followed by:					
AA direct aspiration ³⁶	249.1	3111 B or C [18th, 19th]	D1886-90(A or B)	I-3499-85	
AA furnace	249.2	3113 B [18th, 19th]	D1886-90(C)	I-4503-89 ⁵¹	
ICP/AES ³⁶	200.7 ⁵	3120 B [18th, 19th, 20th] ...	.....	I-4471-97 ⁵⁰	
DCP ³⁶ , or .....	.....	.....	D4190-94 .....	.....	Note 34.
Colorimetric (heptoxime) .....	.....	3500-Ni D [17th].	.....	.....
38. Nitrate (as N), mg/L:					
Colorimetric (Brucine sulfate), or Nitrate-nitrite N minus Nitrite N (See parameters 39 and 40).	352.1 .....	.....	.....	.....	973.50, ³ 419D, ¹⁷ p. 28 ⁹
39. Nitrate-nitrite (as N), mg/L:					

TABLE IB—LIST OF APPROVED INORGANIC TEST PROCEDURES—Continued

Parameter, units and method	Reference (method number or page)				
	EPA 1, 35	Standard Methods [Edition(s)]	ASTM	USGS 2	Other
Cadmium reduction, Manual or ..	353.3	4500-NO ₃ - E [18th, 19th, 20th].	D3867-99(B).		
Automated, or	353.2	4500-NO ₃ - F [18th, 19th, 20th].	D3867-99(A)	I-4545-85.	
Automated hydrazine	353.1	4500-NO ₃ - H [18th, 19th, 20th].			
40. Nitrite (as N), mg/L; Spectrophotometric:					
Manual or	354.1	4500-NO ₂ - B [18th, 19th, 20th].	.....	.....	Note 25.
Automated (Diazotization) .....	.....	.....	.....	I-4540-85.	
41. Oil and grease—Total recoverable, mg/L:					
Gravimetric (extraction)	413.1	5520B [18th, 19th, 20th] ³⁸ .			
Oil and grease and non-polar material, mg/L: Hexane extractable material (HEM): n-Hexane extraction and gravimetry.	1664A ⁴²	5520B [18th, 19th, 20th] ³⁸ .			
Silica gel treated HEM (SGT-HEM): Silica gel treatment and gravimetry.	1664A ⁴² .				
42. Organic carbon—Total (TOC), mg/L:					
Combustion or oxidation	415.1	5310 B, C, or D [18th, 19th, 20th].	D2579-93 (A or B) .....	.....	973.47, ³ p. 14 ²⁴
43. Organic nitrogen (as N), mg/L: Total Kjeldahl N (Parameter 31) minus ammonia N (Parameter 4).					
44. Orthophosphate (as P), mg/L; Ascorbic acid method:					
Automated, or	365.1	4500-P F [18th, 19th, 20th]	.....	I-4601-85	973.56 ³
Manual single reagent	365.2	4500-P E [18th, 19th, 20th]	D515-88(A) .....	.....	973.55 ³
Manual two reagent	365.3.				
45. Osmium—Total ⁴ , mg/L; Digestion ⁴ followed by:					
AA direct aspiration, or	252.1	3111 D [18th, 19th].			
AA furnace	252.2.				
46. Oxygen, dissolved, mg/L: Winkler (Azide modification), or Electrode	360.2	4500-O C [18th, 19th, 20th]	D888-92(A)	I-1575-78 ⁸	973.45B ³
	360.1	4500-O G [18th, 19th, 20th].	D888-92(B)	I-1576-78 ⁸ .	

47. Palladium—Total, ⁴ mg/L; Digestion ⁴ followed by:					
AA direct aspiration, or	253.1	3111 B [18th, 19th]			p. S27 ¹⁰
AA furnace	253.2				p. S28 ¹⁰
DCP					Note 34.
48. Phenols, mg/L:					
Manual distillation ²⁶	420.1				Note 27.
Followed by:					
Colorimetric (4AAP) manual, or.	420.1				Note 27.
Automated ¹⁹	420.2.				
49. Phosphorus (elemental), mg/L:					
Gas-liquid chromatography					Note 28.
50. Phosphorus—Total, mg/L:					
Persulfate digestion followed by	365.2	4500-P B, 5 [18th, 19th, 20th].			973.55 ³
Manual or	365.2 or 365.3	4500-P E [18th, 19th, 20th]	D515-88(A)		
Automated ascorbic acid reduction.	365.1	4500-P F [18th, 19th, 20th]		I-4600-85	973.56 ³
Semi-automated block digester	365.4		D515-88(B)	I-4610-91 ⁴⁸ .	
51. Platinum—Total, ⁴ mg/L: Digestion ⁴ followed by:					
AA direct aspiration	255.1	3111 B [18th, 19th].			
AA furnace	255.2.				
DCP					Note 34
52. Potassium—Total, ⁴ mg/L: Digestion ⁴ followed by:					
AA direct aspiration	258.1	3111 B [18th, 19th]		I-3630-85	973.53 ³
ICP/AES	200.7 ⁶	3120 B [18th, 19th, 20th].			
Flame photometric, or		3500-K B [20th] and 3500-K D [18th, 19th].			
Colorimetric					317 B ¹⁷
53. Residue—Total, mg/L:					
Gravimetric, 103-105°	160.3	2540 B [18th, 19th, 20th]		I-3750-85.	
54. Residue—filterable, mg/L:					
Gravimetric, 180°	160.1	2540 C [18th, 19th, 20th]		I-1750-85.	
55. Residue—nonfilterable (TSS), mg/L:					
Gravimetric, 103-105° post washing of residue.	160.2	2540 D [18th, 19th, 20th]		I-3765-85.	
56. Residue—settleable, mg/L: Volumetric, (Imhoff cone), or gravimetric.	160.5	2540 F [18th, 19th, 20th].			
57. Residue—Volatile, mg/L: Gravimetric, 550°	160.4			I-3753-85.	
58. Rhodium—Total, ⁴ mg/L; Digestion ⁴ followed by:					
AA direct aspiration, or	265.1	3111 B [18th, 19th].			
AA furnace	265.2.				

APPENDIX B2

**Required Containers, Preservation Techniques, and
Holding Times**

**40 CFR Part 136
July 1, 2003**

§ 136.3

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Systems Laboratory, the Regional Administrator may grant a variance applicable to the specific charge to the applicant. A decision to approve or deny a variance will be made within 90 days of receipt of the application by the Regional Administrator.

TABLE II—REQUIRED CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES

Parameter No./name	Container ¹	Preservation ^{2,3}	Maximum holding time ⁴
Table IA—Bacteria Tests:			
1-4 Coliform, fecal and total	P, G	Cool, 4°C, 0.008% Na ₂ S ₂ O ₃ ⁵	6 hours.
5 Fecal streptococci	P, G	Cool, 4°C, 0.008% Na ₂ S ₂ O ₃ ⁵	6 hours.
Table IA—Aquatic Toxicity Tests:			
6-10 Toxicity, acute and chronic	P, G	Cool, 4 °C ¹⁶	36 hours.
Table IB—Inorganic Tests:			
1. Acidity	P, G	Cool, 4°C	14 days.
2. Alkalinity	P, G	.....do	Do.
4. Ammonia	P, G	Cool, 4°C, H ₂ SO ₄ to pH<2	28 days.
9. Biochemical oxygen demand	P, G	Cool, 4°C	48 hours.
10. Boron	P, PTFE, or Quartz.	HNO ₃ TO pH<2	6 months.
11. Bromide	P, G	None required	28 days.
14. Biochemical oxygen demand, carbonaceous	P, G	Cool, 4°C	48 hours.
15. Chemical oxygen demand	P, G	Cool, 4°C, H ₂ SO ₄ to pH<2	28 days.
16. Chloride	P, G	None required	Do.
17. Chlorine, total residual	P, G	.....do	Analyze immediately.
21. Color	P, G	Cool, 4°C	48 hours.
23-24. Cyanide, total and amenable to chlorination.	P, G	Cool, 4°C, NaOH to pH>12, 0.6g ascorbic acid ⁵ .	14 days. ⁶
25. Fluoride	P	None required	28 days.
27. Hardness	P, G	HNO ₃ to pH<2, H ₂ SO ₄ to pH<2	6 months.
28. Hydrogen ion (pH)	P, G	None required	Analyze immediately.
31, 43. Kjeldahl and organic nitrogen	P, G	Cool, 4°C, H ₂ SO ₄ to pH<2	28 days.
Metals: ⁷			
18. Chromium VI ⁷	P, G	Cool, 4 °C	24 hours.
35. Mercury ¹⁷	P, G	HNO ₃ to pH<2	28 days.
3, 5-8, 12,13, 19, 20, 22, 26, 29, 30, 32-34, 36, 37, 45, 47, 51, 52, 58-60, 62, 63, 70-72, 74, 75. Metals except boron, chromium VI and mercury ⁷ .	P, G	do	6 months.
38. Nitrate	P, G	Cool, 4°C	48 hours.
39. Nitrate-nitrite	P, G	Cool, 4°C, H ₂ SO ₄ to pH<2	28 days.
40. Nitrite	P, G	Cool, 4°C	48 hours.
41. Oil and grease	G	Cool to 4°C, HCl or H ₂ SO ₄ to pH<2.	28 days.
42. Organic Carbon	P, G	Cool to 4 °C HCl or H ₂ SO ₄ or H ₃ PO ₄ , to pH<2.	28 days.
44. Orthophosphate	P, G	Filter immediately, Cool, 4°C	48 hours.
46. Oxygen, Dissolved Probe	G Bottle and top.	None required	Analyze immediately.
47. Winkler	.....do	Fix on site and store in dark	8 hours.
48. Phenols	G only	Cool, 4°C, H ₂ SO ₄ to pH<2	28 days.
49. Phosphorus (elemental)	G	Cool, 4°C	48 hours.
50. Phosphorus, total	P, G	Cool, 4°C, H ₂ SO ₄ to pH<2	28 days.
53. Residue, total	P, G	Cool, 4°C	7 days.
54. Residue, Filterable	P, G	do	7 days.
55. Residue, Nonfilterable (TSS)	P, G	.....do	7 days.
56. Residue, Settleable	P, G	.....do	48 hours.
57. Residue, volatile	P, G	.....do	7 days.
61. Silica	P, PTFE, or Quartz.	Cool, 4 °C	28 days.
64. Specific conductance	P, G	.....do	Do.
65. Sulfate	P, G	.....do	Do.
66. Sulfide	P, G	Cool, 4°C add zinc acetate plus sodium hydroxide to pH>9.	7 days.
67. Sulfite	P, G	None required	Analyze immediately.
68. Surfactants	P, G	Cool, 4°C	48 hours.
69. Temperature	P, G	None required	Analyze.
73. Turbidity	P, G	Cool, 4°C	48 hours.
Table IC—Organic Tests ⁸			
13, 18-20, 22, 24-28, 34-37, 39-43, 45-47, 56, 76, 104, 105, 108-111, 113. Purgeable Halocarbons.	G, Teflon-lined septum.	Cool, 4 °C, 0.008% Na ₂ S ₂ O ₃ ⁵ .	14 days.

47. Palladium—Total, ⁴ mg/L; Digestion ⁴ followed by:					
AA direct aspiration, or	253.1	3111 B [18th, 19th]			p. S27 ¹⁰
AA furnace	253.2				p. S28 ¹⁰
DCP					Note 34.
48. Phenols, mg/L:					
Manual distillation ²⁶	420.1				Note 27.
Followed by:					
Colorimetric (4AAP) manual, or.	420.1				Note 27.
Automated ¹⁹	420.2.				
49. Phosphorus (elemental), mg/L:					
Gas-liquid chromatography					Note 28.
50. Phosphorus—Total, mg/L:					
Persulfate digestion followed by	365.2	4500-P B, 5 [18th, 19th, 20th].			973.55 ³
Manual or	365.2 or 365.3	4500-P E [18th, 19th, 20th]	D515-88(A)		
Automated ascorbic acid reduction.	365.1	4500-P F [18th, 19th, 20th]		I-4600-85	973.56 ³
Semi-automated block digester	365.4		D515-88(B)	I-4610-91 ⁴⁸ .	
51. Platinum—Total, ⁴ mg/L: Digestion ⁴ followed by:					
AA direct aspiration	255.1	3111 B [18th, 19th].			
AA furnace	255.2.				
DCP					Note 34
52. Potassium—Total, ⁴ mg/L: Digestion ⁴ followed by:					
AA direct aspiration	258.1	3111 B [18th, 19th]		I-3630-85	973.53 ³
ICP/AES	200.7 ⁶	3120 B [18th, 19th, 20th].			
Flame photometric, or		3500-K B [20th] and 3500-K D [18th, 19th].			
Colorimetric					317 B ¹⁷
53. Residue—Total, mg/L:					
Gravimetric, 103-105°	160.3	2540 B [18th, 19th, 20th]		I-3750-85.	
54. Residue—filterable, mg/L:					
Gravimetric, 180°	160.1	2540 C [18th, 19th, 20th]		I-1750-85.	
55. Residue—nonfilterable (TSS), mg/L:					
Gravimetric, 103-105° post washing of residue.	160.2	2540 D [18th, 19th, 20th]		I-3765-85.	
56. Residue—settleable, mg/L: Volumetric, (Imhoff cone), or gravimetric.	160.5	2540 F [18th, 19th, 20th].			
57. Residue—Volatile, mg/L: Gravimetric, 550°	160.4			I-3753-85.	
58. Rhodium—Total, ⁴ mg/L; Digestion ⁴ followed by:					
AA direct aspiration, or	265.1	3111 B [18th, 19th].			
AA furnace	265.2.				

APPENDIX C

Parameter Detection Limits, Quantitation Limits, Accuracy, and Precision

**Parameter Detection Limits, Quantitation Limits, and Precision
 (Laboratory Measurements)**

Parameter:	Fecal Streptococcus (colonies/100ml)	Fecal Coliform (colonies/100ml)
Method Number: Standard Methods 18th Edition (SM)	9230C	9222D
Method Detection Limit	1	1
Project Detection Limit	2	2
Quantitation Limit	2	2
Precision (mean % RPD)	23.9	27.7
Precision Protocol (maximum allowable RPD)	39.4	38.3

RPD - Relative % Difference
 Laboratory: NJAL (NJDEP #11005)

**Parameter Detection Limits, Quantitation Limits, and Precision
(Laboratory Measurements)**

Parameter:	Total Suspended Solids (mg/L)
EPA Method Number:	160.2
Method Detection Limit	0.5
Project Detection Limit	1
Quantitation Limit	1
Precision (mean % RPD)	10.32
Precision Protocol (maximum allowable RPD)	30.1

RPD - Relative % Difference
Laboratory: NJAL (NJDEP #11005)

APPENDIX D

Chain of Custody Form

Chain of Custody Form

NEW JERSEY ANALYTICAL LABORATORY											
Client: TRC Omni		Phone: (609) 924-8821			Sampling Method:			Project No. 6089		Page of	
Project: Mulhockaway Creek Watershed		Sample Technician (Print/Sign):						Report and Invoice to: Greg Soska			
Laboratory ID No.	Sample ID/Location	DATE		TIME		Sample Matrix	ANALYSIS				
						Aqueous	pH = (S.U.);		Temperature = °C		
		DATE		TIME		Sample Matrix	Number Bottles	Volume Bottles	Preservative	ANALYSIS	Comments:
Relinquished by: (signature)						Date:		Time:		Received by: (signature)	
Relinquished by: (signature)						Date:		Time:		Received by: (signature)	
New Jersey Analytical Laboratory						Method of Shipment		All bottles received for Laboratory (NJAL) by: (Signature)			
1590 Reed Road Suite 102A						Phone: 609-737-3477					
Pennington, New Jersey 08534						Fax: 609-737-3052					