

10 SURFACE WATER

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10.1 PECONIC RIVER WATER QUALITY SURVEILLANCE

DQO START DATE	January 1, 2003
IMPLEMENTATION DATE	January 1, 2025
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SUMMARY OF PROPOSED CHANGES

No changes are proposed for calendar year 2025.

DESCRIPTION AND TECHNICAL BASIS

The headwaters of the Peconic River, a New York State-designated Scenic River that discharges to the Peconic Estuary, begin west of the Laboratory site. The Peconic River enters the site at the northwest corner, traverses through the Relativistic Heavy Ion Collider (RHIC) area, then flows in an east-southeasterly direction and exits the site along the southeast boundary. With the exception of the RHIC and Sewage Treatment Plant (STP), there has been nominal development along the Peconic River corridor on site.

At Brookhaven National Lab (BNL), the Peconic River is an intermittent stream, with flow occurring predominantly via groundwater discharge in the spring and fall (i.e., a “gaining” stream) and completely drying up during dry periods (i.e., a “losing” stream). During very wet periods, continuous flow can occur across the entire BNL site. Several areas of low topography and areas with near surface silts and clays accumulate water during the dryer seasons. The redirection of treated effluent from the Peconic River to groundwater recharge has no impact on continuous stream flow during wet periods.

Until 2014, treated effluent from the STP was discharged to the Peconic River. In October 2014, treated effluent from the STP was diverted from the Peconic River to nearby groundwater re-charge basins. With the removal of contributions from the STP, surface runoff and groundwater comprise the only other contributed sources of water to the Peconic River. Potential contaminants that could enter the river include sediment, oil, and grease from surface runoff.

Investigation of the Peconic River conducted under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) program indicates that historical releases of radiological materials, PCBs, pesticides, and inorganics have resulted in their accumulation within the Peconic River sediments (ITC, 1998). Re-suspension of sediments due to scouring can result in the migration of these contaminants off site. Most of the contaminants were removed under the CERCLA program in 2004-2005, again in 2011, and a final removal in 2017. Sediments were removed from select areas stretching from the former STP Outfall to the County Parklands east of BNL. Monitoring to measure the effect of these removal actions on fish and sediments were conducted under the Flora/Fauna sampling program through 2015.

DRIVERS FOR MONITORING BEING CONDUCTED UNDER THIS PROGRAM

- Compliance
- Support compliance
- X Surveillance
- Restoration

Although surface water quality monitoring is not required by BNL’s State Pollutant Discharge Elimination System (SPDES) permit, monitoring is performed in accordance with DOE Order 436.1A (2023), *Departmental Sustainability*, which requires that DOE sites maintain an Environmental Management System (EMS), and DOE Order 458.1, Admin Chg. 4 (2020), *Radiation Protection of the Public and Environment*, which requires that DOE sites maintain surveillance monitoring for determining radiological impacts to the public and environment. An extensive environmental monitoring program is one component of the Laboratory’s EMS, and it specifies requirements for conducting general surveillance monitoring to:

- Verify compliance with federal, state, and local regulations;
- Determine compliance with commitments made in Environmental Impact Statements, Environmental Assessments, or other official documents;
- Identify potential environmental problems; and
- Detect, characterize, and report unplanned releases.

Additionally, BNL’s EMS requires that monitoring be conducted to measure the effects, if any, of DOE activities on and off site, establish baselines of environmental quality, and characterize and define trends in the physical, chemical, and biological conditions of environmental media. The New York State Department of Environmental Conservation (NYSDEC) has established ambient water quality standards for the Peconic River and other local water bodies. These standards have been codified under Parts 700-706 of Title 6 of the NYCRR (6 NYCRR Parts 700-706).

DATA QUALITY OBJECTIVE ANALYSIS

Step 1: State the Problem

While greatly reduced, Laboratory operations have the potential to impact the Peconic River and its environment through nonpoint-source spills and potential operational upsets at RHIC. Impacts include contamination of surface water and associated freshwater ecosystems, including associated aquatic and terrestrial flora and fauna that rely on these water systems for survival and river sediments.

Step 2: Identify the Decision

The desired decisions for the surface water monitoring program are:

- Are BNL operations causing the Peconic River segments on site and immediately downstream of the Laboratory to exceed ambient water quality standards?
- Are BNL’s efforts to continually improve its environmental management program improving the water quality of the Peconic River?
- Are BNL operations contributing to any river use restrictions?
- Are engineered and operational controls effective in preventing the activation of the Peconic River water that flows via culverts beneath the RHIC ring?

Step 3: Identify Inputs to the Decision

Inputs necessary to support the decisions in Step 2 include:

- Analytical data (and trends) for the Peconic River both upstream and downstream of the former STP discharge
- Analytical data (and trends) for control locations (e.g., Carmans River)
- Historical analyses of process discharges and the STP effluent
- Sampling team field logs and records
- Sampling team instrumentation calibration and maintenance records
- Environmental Monitoring Standard Operating Procedures (SOPs)
- Review of analytical results by project managers in accordance with Environmental Protection Division (EPD) data review procedures to ensure data are of acceptable quality
- Documentation of the sampling and analysis program
- Collection and analysis of samples performed according to regulatory agency standards or guidelines
- New York State ambient water quality standards
- River flow data

Step 4: Define the Study Boundaries

The study area incorporates all BNL operations that contribute surface water runoff to the Peconic River or indirect discharge (via base flow). With discharges from the STP no longer occurring, the Peconic River will be sampled at four locations on site: stations HY, HV, HM-S, and HQ (see Figure 10-1 on Page 10.1-7). Two of the on-site stations are located upstream of the former STP discharge point, and the remaining two stations are downstream. This distribution of sampling will allow for detection of impacts from off-site events (Station HY), potential impacts from RHIC (Station HV), impacts from the east-central portion of BNL (Station HM-S), and final monitoring at the site boundary (Station HQ). Obtaining samples from any or all these locations will be dependent on available flow. The Carmans River, located southwest of the site, is sampled at station HH to determine background or ambient conditions. Samples are collected and analyzed for radiological parameters (gross alpha, gross beta, and tritium activity, as well as strontium-90 [Sr-90] and other gamma-emitting radionuclides), nonradiological parameters (e.g., metals, volatile organic compounds [VOCs], and water quality parameters).

Water samples have historically been collected on a quarterly basis for most locations with samples collected several times weekly at points directly downstream from the STP discharge. Review of past analytical data shows the quality of the Peconic River to be very consistent with most VOCs and semi-volatile organic compounds (SVOCs), and radionuclides being nondetectable. Inorganics are detected throughout the Peconic and Carmans River. To assess the physical state of inorganic contaminants, filtered and unfiltered samples are collected, and the analytical data compared. Evaluation of the data shows that many of the inorganic detections are due to suspension of sediments. Radiological analyses have shown significant decreases in concentration and nuclide detection. For example, tritium is detected typically just above detection limits once or twice yearly, while gamma activity has not been detected for several years.

Historical data show no significant variations in water quality throughout the Peconic River system. Drastic changes in concentrations are unexpected, especially since the STP is no longer discharging to the Peconic River. The focus of the surface water-monitoring program is continuing to assess the long-term, cumulative impact of BNL discharges on surface waters. Because cumulative effects are the focus of this monitoring/decision process, quarterly to annual decisions are appropriate and will be dependent on flow conditions.

Step 5: Develop the Decision Rule

Decision 1

Are BNL operations causing the Peconic River segments on the BNL Site and immediately downstream of the Laboratory to exceed ambient water quality standards and historical levels?

Analytical data collected from the Peconic River are compared to New York State ambient water quality standards and historical and control points analyses.

If this comparison yields an excursion of an ambient water quality standard or a significant deviation from historical data that may be attributable to BNL, **then** implement the *Event/Issues Management* Subject Area, as appropriate, to determine the source of the contaminant and collect additional samples to better define the extent (i.e., duration and magnitude) of the discharge. **If** the comparison shows the data to be consistently below regulatory limits or standards or within historical levels, **then** routine monitoring and reporting is continued.

Decision 2

Are BNL's efforts to continually improve its environmental management program improving the water quality of the Peconic River?

Analytical data collected from the Peconic River are evaluated and compared with historical trends and with data collected from the off-site control location to determine the impact of BNL discharges on the environment.

If contaminant trends for stations HM-S and HQ show improving or stable trends in Peconic River quality and can be correlated with Laboratory actions, **then** BNL will claim credit under the Laboratory's EMS. **If** the evaluation shows declining water quality that may be attributable to BNL, **then** implement the *Event/Issues Management* Subject Area, as appropriate, to determine the cause of the decline.

Decision 3

Are BNL operations contributing to any river use restrictions?

There are no fish advisories issued that are specific to the Peconic River. A general advisory has been issued statewide to protect against eating fish that have not been tested or that may contain unidentified contaminants. The Laboratory will keep apprised of specific health advisories and will maintain data for water and fish, dependent on flow and availability of fish, to determine if BNL is contributing to any future issued advisory. All data is shared routinely with NYSDEC and the New York State Department of Health (NYSDOH), and the Laboratory continually strives to reduce the impact of its discharges by implementing waste minimization and pollution prevention practices and by imposing strict effluent limitations on pollutant sources.

If NYSDOH issues a health advisory for the Peconic River, **then** implement the *Event/Issues Management* Subject Area, as appropriate, and work with the issuing authority to determine if the Laboratory is contributing to the advisory and what steps could be taken to reduce the impact.

Decision 4

Are engineered and operational controls effective in preventing the activation of the Peconic River water that flows via a culvert and/or groundwater beneath the RHIC ring?

Concentrations of radionuclides (e.g., tritium) collected at stations HY and HV are compared to determine if activation is resulting from RHIC operations.

If tritium concentrations at station HV are significantly greater than those measured at HY, **then** implement the *Event/Issues Management* Subject Area, as appropriate, to investigate whether this is an impact from RHIC and determine the cause. Also, see the Data Quality Objective (DQO) for groundwater monitoring at RHIC in Chapter 7.

Step 6: Specify Acceptable Error Tolerances

The Laboratory has monitored the surface waters of the Peconic River and Carmans River routinely for many years and documents the results in BNL's annual Site Environmental Report (SER). The risks of not detecting an impact are erosion in stakeholder confidence and possible cleanup costs. Although BNL has a history of impacting the river, recent improvements in wastewater management, remediation of Peconic River sediments, and removal of the STP discharge from the Peconic River have significantly reduced the potential for future impact.

The most obvious potential error associated with decisions regarding the quality of the Peconic River is in the monitoring program, sample design, and implementation. Potential errors include failure to collect a representative sample, failure of a sample collection device, and impacts to sampling collection schedules due to flow conditions of the river. Monitoring of the Peconic River is limited to semi-annual analysis for most locations; consequently, loss of a single sample could have a detrimental impact on the ability to characterize the Peconic (especially with intermittent flow conditions) and Carmans River. However, diligence on the part of BNL's Sampling Team reduces the potential loss of samples.

Seasonal flow of the Peconic River also impacts the ability to collect samples and characterize water quality (e.g., during extended drought, flows may be absent for one or more quarterly sampling periods and may result in lack of sampling in any given year). Awareness of river flow conditions enables the Sampling Team to maximize the collection of samples when possible. Sample collection devices are checked prior to use to ensure they are operating properly. Upon sample collection, the sample is inspected to determine if the volume is appropriate for the period of sample collection and that the sample looks representative (e.g., color, settleable solids, etc.).

Deviations are noted in a field log and notebooks. Should a sample device fail during a sample collection period or if the sample volume is inappropriate for the collection period, samples are either collected on a subsequent day or a grab sample is taken. The field log is appropriately annotated to document the failure of the sample collection device and describe the action taken.

Analytical errors could have a greater impact on monitoring. Because the sample is consumed in analysis, if an error is made during the analysis, complete loss of a sample is possible. If the error is not discovered soon enough, the loss could be unrecoverable. To prevent such an occurrence, additional sample volume is collected to allow for repeat analyses. Deviations in analytical methods are not expected to impact the results. Data are reviewed upon receipt to determine usability.

Step 7: Optimize the Design

The surface water monitoring program, as required by DOE orders and the Laboratory's EMS, focuses on determining impacts of BNL operations on the environment. With discharges from the STP no longer occurring, the Peconic River will be sampled at four locations on site (stations HY, HV, HM-S, and HQ). Sampling for metals, anions, and VOCs analyses at monitoring station HQ will continue on a quarterly basis (filtered/unfiltered) and is dependent on flow. Samples will be collected at HY, HV, and HM-S semi-annually depending on available flow (filtered/unfiltered).

Except for an occasional low-level detection of tritium, radionuclides in the Peconic River have not been detected for several years. Therefore, sample collection frequency for gross alpha/beta, tritium, gamma, and strontium-90 will continue to be quarterly at monitoring station HQ and semi-annual for the remaining Peconic River stations. Continued review of radiological data shows no impacts from Laboratory operations; consequently, the sampling locations and frequency are justified.

Table 10.1 Surface Water Monitoring Program

Sampling Location	Sample Type	Analysis/Frequency
HQ	24-hr composite	Anions, gross alpha, gross beta, tritium, and metals (filtered/unfiltered); sampled and analyzed quarterly.
HQ	24-hr composite	Gamma and Sr-90 analysis; samples are from individual 24-hour composites and analyzed quarterly.
HQ	Grab sample	VOCs (EPA 624); sampled and analyzed quarterly.
HM-S, HY, HH	Grab sample	Anions, VOCs (EPA 624), metals (filtered/unfiltered), gross alpha, gross beta, tritium, gamma, and Sr-90 analysis; sampled and analyzed semi-annually.
HV	Grab sample	Gross alpha, gross beta, tritium, and gamma analysis; sampled and analyzed semi-annually.
HM-N and HM-S	Grab sample	Flow chart exchanged and pH measurement taken weekly.
HQ	Grab sample	Gross alpha, gross beta, and tritium; quarterly for NYSDOH analysis (used for comparison in the SER).

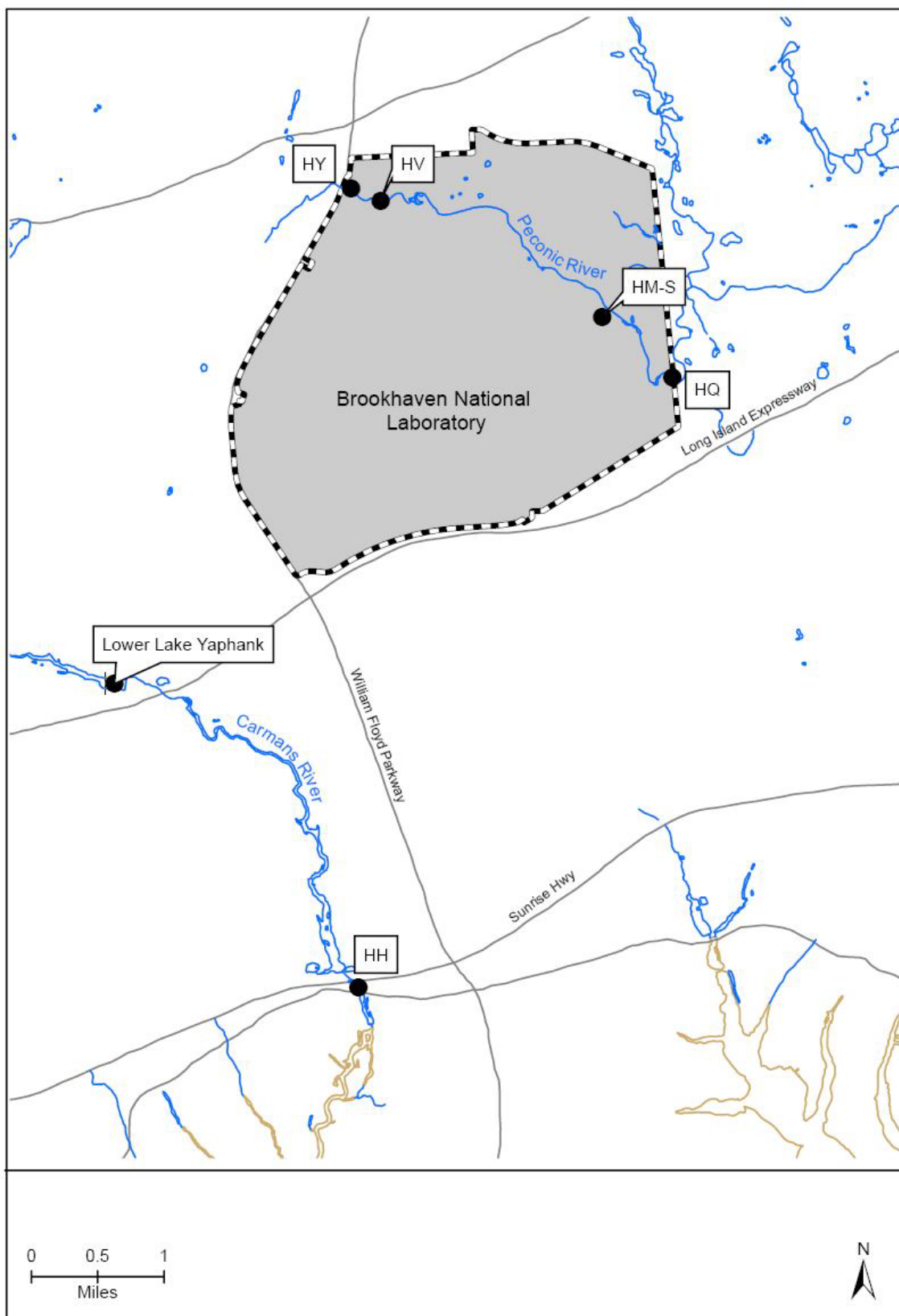


Figure 10.1. Sampling Stations for Surface Water and Fish

See Appendix B for the monitoring program for this DQO.

REFERENCES

IT Corporation, 1998. *Operable Unit V Remedial Investigation Report Volume I or V*. International Technology Corporation, May 27, 1998.

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